

QUESTION BANK

MCA

SEMESTER III

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QUESTION BANK

COMPUTER GRAPHICS

MCA 203

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COMPUTER GRAPHICS – MCA 203
MCA III

UNIT - I

I Test Your Skills

(a) State Whether the Following Statements are True or False:

- 1 Smallest size object that can be displayed on a monitor is called picture element.
- 2 Each screen point is referred to as pixel.
- 3 Translation transformation is used to move the object in the X and Y directions of the 2-D space
- 4 The shear transformation makes the object to slant either in X direction or Y direction and is called X-shear and y shear respectively
- 5 Scaling and shearing transformation can be combined using homogenous coordinate system.
- 6 To perform a sequence of transformation such as translation followed by rotation and scaling, we need to follow a non-sequential process.
- 7 A translation moves an object to a different position on the screen.
- 8 In rotation, we rotate the object at particular angle θ (theta) from its origin.
- 9 Mathematically scaling can be represented as $X' = X \cdot S_X$ and $Y' = Y \cdot S_Y$
- 10 Reflection is rotating an object by 180°
- 11 Composite transformation can be achieved by concatenation of transformation matrices to obtain a combined transformation matrix.
- 12 The basis of the DDA method is to take unit steps along one coordinate and compute the corresponding values along the other coordinate.
- 13 Bresenham's circle algorithm is not derived from the midpoint circle algorithm.
- 14 Big advantage of the Bresenham's circle algorithm is that it uses only integer calculations
- 15 One of the most common and important tasks in computer graphics is to transform the coordinates (position, orientation, and size) of either objects within the graphical scene or the camera that is viewing the scene.

Ans. (1)(T), (2)(T), (3)(T), (4)(F), (5)(T), (6)(F), (7)(T), (8)(T), (9)(T), (10)(F), 11(T), 12(T), 13(F), 14(T), 15(T)

II Test Your Skills:

(a) Multiple Choice Questions:

- 1 DDA stands for
 - (a) Digital Decision Analysis
 - (b) Decision Divide Analysis
 - (c) Digital Differential Analysis
 - (d) Digital Differential Analyzer

- 2 DDA algorithm used for the
- (a) Draw a rectangle
 - (b) Draw a circle
 - (c) Draw a polygon
 - (d) Draw a line
- 3 Region filling is the process of _____ a definite area of region.
- (a) Coloring in
 - (b) Preparing
 - (c) Selecting
 - (d) Removing
- 4 Boundary fill and flood fill algorithm begins with a
- (a) Fruit
 - (b) Leaf
 - (c) Picture
 - (d) Seed
- 5 Select the methods of character generation.
- (a) Strike method
 - (b) Stroke method
 - (c) BIT map
 - (d) Digital method
- 6 To determine the points inside the polygon this test is used
- (a) Inside test
 - (b) Side by side test
 - (c) Over test
 - (d) Outside test
- 7 To modify the graphics in coded numbers _____ is used.
- (a) Transport
 - (b) Transfer
 - (c) Transformation
 - (d) Relation
- 8 To increase or reduce the size _____ is used.
- (a) Rotation
 - (b) Translation
 - (c) Scaling
 - (d) Reflection
- 9 To rotate the object which transformation is used.
- (a) Scaling
 - (b) Rotation
 - (c) Reflection
 - (d) Translation

- 10 To move the image or object from one position to another.
- (a) Scaling
 - (b) Rotation
 - (c) Translation
 - (d) Skewing
- 11 When two or more transformation are carried out together then it is called.
- (a) Concluding transformation
 - (b) Composite transformation
- 12 Which of the following is measured in screen coordinates.
- (a) Object model
 - (b) Image model
 - (c) Object space
 - (d) Image space
- 13 If the line is entirely within the window then both points will have out-codes.
- (a) 0100
 - (b) 0000
 - (c) 1111
 - (d) 1010
- 14 Cohen-Sutherland algorithm used for
- (a) Polygon clipping
 - (b) Graph colouring
 - (c) Line clipping
 - (d) 3D modeling
- 15 Sutherland-Hodgeman algorithm used for
- (a) Polygon clipping
 - (b) Graphical representation
 - (c) 3D modeling
 - (d) None
- 16 Interactive computer graphics uses various kind of input devices such as
- (a) Mouse
 - (b) Graphic tablet
 - (c) Joystick
 - (d) All of these
- 17 Input function are used for
- (a) Control the data flow from these interactive devices
 - (b) Process the data flow from these interactive devices
 - (c) Both a & b
 - (d) None of these

- 18 If the line connecting two interior points of the polygon lies completely inside the polygon, is said to be _____.
- (a) Convex
 - (b) Pixel
 - (c) Concave
 - (d) bitmap
- 19 In Bresenham's line generation algorithm, the initial value of the decision parameter as $p_0 = \underline{\hspace{2cm}}$, where slope MOD $(m) < 1$.
- (a) $2\Delta y - \Delta x$
 - (b) $2\Delta y - 2\Delta x$
 - (c) $\Delta x - \Delta y$
 - (d) None of the above
- 20 If a line whose end point is (10, 12) and start point is (20, 20), then slope $m = ?$
- (a) 1.2
 - (b) 0.8
 - (c) -0.4
 - (d) None of the above
- 21 Which is not an interactive device?
- (a) Keyboard
 - (b) Mouse
 - (c) CRT Monitor
 - (d) None of the above
- 22 The Cartesian slope-intercept equation for a straight line is _____.
- (a) $y = m(a+b+c)$
 - (b) $y = m.x + b$
 - (c) $y = 2\Delta x - m$
 - (d) None of the above
- 23 A polygon having vertices P_1, P_2, \dots, P_n is said to be _____ oriented if a tour of the vertices in the given order produces an anticlockwise loop.
- (a) Positive
 - (b) Negative
 - (c) Register
 - (d) None of the above
- 24 Most of our drawing algorithm use-
- (a) Incremental Method
 - (b) Decrement Method
 - (c) Multiplier Method
 - (d) None
- 25 In our computer we follow
- (a) Left handed coordinate system
 - (b) Right handed coordinate system
 - (c) Cartesian Coordinate system
 - (d) None

- 26 The process of burning ON of the pixel of line segment is:
- (a) Rasterization
 - (b) Factorization
 - (c) Randomization
 - (d) None
- 27 The process of distortion of information due to low frequency sampling or under sampling is
- (a) Aliasing
 - (b) Anti-aliasing
 - (c) Sampling
 - (d) None
- 28 The distance between the actual line location and nearest pixel is called
- (a) Raster
 - (b) Error Team
 - (c) Line
 - (d) None
- 29 The process of combining pixels of available colors is called-
- (a) Dithering
 - (b) Pixel Phasing
 - (c) Filtering
 - (d) None
- 30 An array of weights of subpixels are called as-
- (a) pixel array
 - (b) pixels
 - (c) pixel-weighted mask
 - (d) None
- 31 In CRT, the electron intensity is adjusted using
- (a) Accelerating anode
 - (b) Control grid
 - (c) Electron gun
 - (d) Focusing anode
- 32 Lower persistence phosphorus is used in
- (a) Animation
 - (b) Simple object
 - (c) Complex object
 - (d) All of these
- 33 The shortest distance between any two dots of the same color is called
- (a) Resolution
 - (b) Dot Pitch
 - (c) Pixel Depth
 - (d) ppi

- 34 Identify the odd one out from the following
- (a) Frame Buffer
 - (b) Pixmap
 - (c) Display program
 - (d) Refresh Buffer
- 35 The purpose of refreshing a CRT is
- (a) To avoid flickering
 - (b) To maintain steady picture
 - (c) To avoid fading of pixels
 - (d) All of the above
- 36 The transformation in which an object is moved in a minimum distance path from one position to another is called
- (a) Rotation
 - (b) Replacement
 - (c) Translation
 - (d) Scaling
- 37 The translation distances (dx, dy) is called as
- (a) Translation vector
 - (b) Shift vector
 - (c) Both a and b
 - (d) Neither a nor b
- 38 The transformation in which an object is moved from one position to another in circular path around a specified pivot point is called
- (a) Rotation
 - (b) Shearing
 - (c) Translation
 - (d) Scaling
- 39 A circle, if scaled only in one direction becomes a ?
- (a) Hyperbola
 - (b) Ellipse
 - (c) Parabola
 - (d) remains a circle
- 40 (2,4) is a point on a circle that has center at the origin. Which of the following points are also on circle ?
- (a) (2,-4)
 - (b) (-2,4)
 - (c) (-4,-2)
 - (d) All of above
- 41 The shortest distance between any two dots of the same color is called
- (a) Resolution
 - (b) Dot Pitch
 - (c) Pixel Depth
 - (d) ppi

- 42 DVST stands for
- (a) Digital View Storing Table
 - (b) Direct Visual Storage Tube
 - (c) Direct View Storage Tube
 - (c) Digital View Storage Tube
- 43 The transformation in which the size of an object can be modified in x-direction ,y-direction and z-direction
- (a) Translation
 - (b) Scaling
 - (c) Rotation
 - (d) All of these
- 44 What are the components of Interactive computer graphics
- (a) A digital memory or frame buffer
 - (b) A television monitor
 - (c) An interface or display controller
 - (d) All of these
- 45 The center of display screen is computed as
- (a) X_{max}, y_{max}
 - (b) $X_{max}/2, y_{max}/2$
 - (c) $X_{max}/3, y_{max}/3$
 - (d) None of these
- 46 The image can be transmitted to the display point by_____
- (a) Line
 - (b) Segment
 - (c) Point
 - (d) None of these
- 47 The transformation in which an object is moved from one position to another in circular path around a specified pivot point is called
- (a) Translation
 - (b) Scaling
 - (c) Rotation
 - (d) Reflection
- 48 The selection and separation of a part of text or image for further operation are called
- (a) Translation
 - (b) Shear
 - (c) Reflection
 - (d) Clipping

- 49 The graphics method in which one object is transformed into another object are called
 (a) Clipping
 (b) Morphing
 (c) Reflection
 (d) Shear
- 50 A many sided figure is termed as
 (a) Square
 (b) Polygon
 (c) Rectangle
 (d) None

Ans. (1)(d), (2)(d), (3)(a), (4)(d), (5)(b and c), (6)(a), (7)(c), (8)(c), (9)(b), (10)(c), (11)(b), (12)(b), (13)(b), (14)(c), (15)(a), (16)(d), (17)(c), (18)(a), (19)(a), (20)(b), 21(c), (22)(b), (23)(a), (24)(a), (25)(a), (26)(a), (27)(b), (28)(b), (29)(a), (30)(c), (31)(b), (32)(a), (33)(b), (34)(b), (35)(d), (36)(c), (37)(c), (38)(a), (39)(b), (40)(d), (41)(d), (42)(c), (43)(b), (44)(d), (45)(b), (46)(c), (47)(c), (48)(d), (49)(b), (50)(b)

(b) Fill in the Blanks:

- 1 The _____ is accomplished by reversing the x, y coordinates.
 2 _____ is the process of “coloring in” a definite image area of region.
 3 This is a recursive algorithm that begins with a starting pixel, called a _____, inside the region.
 4 Variations can be made to limit the number of _____ by structuring the order in which neighboring pixels are processed.
 5 This way the number of recursive calls at any particular time is merely N when the current line is N scan lines away from the _____.
 6 The Flood fill algorithm also begins with a _____ inside the region.
 7 Some conversion is essentially a systematic approach to mapping objects that are defined in _____ to their discrete approximation.
 8 A common example of aliasing effects in the _____ we can see when scan-converting a primitive such as a line or a circle.
 9 A _____ appears dimmer than a horizontal or vertical line.
 10 The _____ problem occurs when an object is not aligned with, or does not fit into, the pixel grid properly.
 11 Graphics having coded numbers can be modified by certain operations called _____.
 12 _____ change the size and properties of the displayed image.
 13 The image would not change, as anything multiplied by _____ would remain the same.
 14 Anti-clockwise rotation is always referred to as _____ rotation.
 15 Moving the image (object) at some other position on the screen is call _____.
 16 The method for selecting and enlarging portions of a drawing is called _____.
 17 The technique for not showing that part of the drawing which one is not interested in is called _____.
 18 The _____-- is said to reside in object space and this model represents the object using physical units of length.

- 19 To image a box and would only display what is enclosed in the box and such a box is called _____.
- 20 We would like to image a box on the screen and have the image confined to that box. Such box in the screen space called a _____.
- 21 In _____ we examine each line of the displayed. If it is _____ nothing is drawn.
- 22 Cohen-Sutherland algorithm makes clever use of _____ to perform the test efficiently.
- 23 If the line is entirely within the window then both end points will have out-codes _____.
- 24 First we compute _____ for the end-points (P_1 and P_2) of the segment.
- 25 A polygon is called _____ if the line joining any two exterior points of a polygon lies completely inside the polygon.
- 26 The interactive computer graphics involves _____ way communication b/w computer and the user
- 27 Interactive computer graphics enables a user to customize the graphics in _____

Ans. (1)(reflection), (2)(Region filling), (3)(Seed), (4)(recursive calls), (5)(Initial seed), (6)(seed), (7)(continuous space), (8)(Staircase or jagged appear), (9)(slanted line), (10)(Picker fence), (11)(transformation), (12)(Scaling), (13)(Unit matrix), (14)(counter clockwise), (15)(translation), (16)(windowing), (17)(Clipping), (18)(Object model), (18)(Object model), (19)(window), (20)(Viewport), (21)(Clipping, Inside, Outside), (22)(Inside, outside), (23)(Bit operations), (24)(0000), (25)(Out-codes), (26)(two), (27)(his own way)

II Short Answer Type Questions:

- 1 What do you understand by 2D Transformation? Give matrices for scaling, translation and rotation.
- 2 Explain the translation matrix.
- 3 Explain scaling transformation in detail.
- 4 Explain rotation transformation in detail.
- 5 Explain how the rotation about an arbitrary point is obtained.
- 6 What do you mean by inverse of scaling transformation? Explain in details.
- 7 What is the resolution of an image?
- 8 What is Windowing and Clipping?
- 9 What do you mean by clipping? Explain it in detail.
- 10 What is viewing transformation?
- 11 What is Windowing and Clipping?
- 12 What do you mean by clipping? Explain it in detail.
- 13 What is viewing transformation?
- 14 What do you understand by clipping?
- 15 Bresenham's line drawing algorithm uses integer arithmetic. What is the justification for this approach?
- 16 Why are homogeneous coordinates used for transformation computations in Computer Graphics?
- 17 Differentiate between view port and window.
- 18 Explain the method of generating a raster image.

- 19 What are the basic attributes of graphics storage systems used to evaluate competing storage systems?
- 20 What are the basic attributes of graphics storage systems used to evaluate competing storage systems?
- 21 What is scan conversion?
- 22 How can we scan convert a line. Discuss?
- 23 How can we scan convert a circle. Discuss?
- 24 Write Bresenham's algorithm for scan conversion of a Circle.
- 25 Draw a circle with radius 10 and centre coordinates (25,20) using Bresenham's circle drawing algorithm.
- 26 Differentiate between 2D Rotation and 3D Rotation.
- 27 Discuss the concept of Boundary-Fill. How it is different from Flood-fill.
- 28 Define clipping. How polygon clipping is performed with Sutherland Hodgeman polygon clipping algorithm? Illustrate with suitable example.
- 29 List five applications of Computer Graphics.
- 30 Explain the way a LCD screen functions. How the color is shown on the screen?
- 31 Explain the architecture of raster display system with peripheral display processor?
- 32 What all functionalities can display processor provide?

III Long Answer Type Questions:

- 1 The endpoints of a given line are (0,0) and (6,18). Compute each value of y as x steps from 0 to 6 and plot the results.
- 2 What steps are required to plot a line whose slope is between 0° and 45° using the slope-intercept equation?
- 3 What steps are required to plot a line whose slope is between 0° and 45° using Bresenham's method?
- 4 What steps are required to generate a circle using the polynomial method?
- 5 What steps are required to scan-convert a circle using Bresenham's algorithm's?
- 6 (a) Find the matrix that represents rotation of an object by 30° about the
 - i. origin.
 - (b) What are the new coordinates of the point P(2, -4) after the rotation?
- 7 Write the general form of the matrix for rotation about a point P(h,k).
- 8 Perform a 45° rotation of triangle A(0,0), B(1,1), C(5,2) (a) about the origin and (b) about P(-1, -1).
- 9 Write the general form of a scaling matrix with respect to a fixed point P(h,k).
- 10 Magnify the triangle with vertices A(0,0), B(1,1), and C(5,2) to twice its size while keeping C(5,2) fixed.
- 11 Describe the transformation M_L which reflects an object about a line L.
- 12 Find the form of the matrix for reflection about a line L with slope m and y intercept (0,b).
- 13 Reflect the diamond-shaped polygon whose vertices are A(-1,0), B(0, -2), C(1,0), and D(0,2) about (a) the horizontal line y=-2, (b) the vertical line x=2, and (c) the line y=x+2.
- 14 The matrix $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ defines a transformation called a simultaneous shearing or shearing for short.
- 15 The special case when b=0 is called shearing in the x direction. When a=0, we have shearing in the y direction. Illustrate the effect of these shearing transformations on the square A(0,0), B(1,0), C(1,1), and D(0,1) when a= 2 and b = 3.

- 16 Show that the order in which transformations are performed is important by the transformation of triangle A(1,0), B(0,1), C(1,1), by (a) rotating 45° about the origin and then translating in the direction of vector I, and (b) translating and then rotating.
- 17 Find the normalization transformation that maps a window whose lower left corner is at (1,1) and upper right corner is at (3,5) onto (a) a viewport that is the entire normalized device screen and (b) a viewport that has lower left corner at (0,0) and upper right corner (1/2, 1/2).
- 18 Find the complete viewing transformation that maps a window in world coordinates with x extent 1 to 10 and y extent 1 to 10 onto a viewport with x extent 1/4 to 3/4 and y extent 0 to 1/2 in normalized device space, and then maps a workstation window with x extent 1/4 to 1/2 and y extent 1/4 to 1/2 in the normalized device space into a workstation viewport with x extent 1 to 10 and y extent 1 to 10 on the physical display device.
- 19 Find a normalization transformation from the window whose lower left corner is at (0,0) and upper right corner is at (4,3) onto the normalized device screen so that aspect ratios are preserved.
- 20 Derive a composite matrix which maps a rectangular window into a rectangular viewport using the basic geometric transformation in 2-D(i.e. using translation and scaling)
- 21 Find out the transformation matrix which reflects points above the line, $3x+4y = 5$.
- 22 Derive a composite matrix which maps a rectangular window into a rectangular viewport using the basic geometric transformation in 2-D(i.e. using translation and scaling)
- 23 Answer the following questions:
 - (a) Persistence
 - (b) Resolution
 - (c) Aspect ratio
 - (d) Interlacing
 - (e) Coordinate transformation
 - (f) Window to view port mapping
- 24 Prove that any two successive rotations about a given rotation axis is commutative.
- 25 Find the normalization transformation that maps a window with lower left corner at(1,1) and upper right corner at (3,4)onto a viewport that is the entire normalized device screen.
- 26 Solve and write the matrix for reflection about line $Y=X$.
- 27 Explain the relevance of computer graphics in Information Technology.
- 28 How the size of frame buffer pixel and resolution are related to each other?
- 29 Give some operations performed by the video controller. Explain all the forms in which output of a video controller can be seen.

UNIT - II

(a) State Whether the Following Statements are True or False:

- 1 We can write the coefficient matrix as $C = M.G$
- 2 There are only two types of splines namely β splines and uniform B splines.
- 3 Hermite curves are defined by two endpoints and two end points tangent vectors.
- 4 Splines are defined by 5 control point.
- 5 Bezier curves are similar to Hermite curves.
- 6 We can obtain the blending function by expanding the product $T.M_H$.
- 7 Bezier curves were named after Pierre Bezier.

- 8 Curve segments whose polynomial coefficients depend on just a few control points is called local control.
- 9 The parameter value at the joint point of two curve segments is called knot value.
- 10 In case of uniform B-splines knots are placed at irregular interval.
- 11 One problem with wireframe models is ambiguity.
- 12 Lack of local control in some surface patches creates problems with continuity.
- 13 Four points are needed to define a Bezier curve.
- 14 One advantage to solid modelers is that they can model non-manifold objects.
- 15 The Boolean intersection of two solids which do not overlap creates a null object.

Ans. (1)(T), (2)(F), (3)(T), (4)(F), (5)(F), (6)(T), (7)(T), (8)(T), (9)(T), (10)(F), 11(T), 12(T), 13(T), 14(F), 15(T)

(b) Multiple Choice Questions:

- 1 We need to represent curves & surfaces when
 - (a) We want to model existing objects
 - (b) While modeling from scratch
 - (c) Both a & b
 - (d) None of the above

- 2 The representations for surface modeling include.
 - (a) Polygon mesh
 - (b) Parametric surfaces
 - (c) Quadric surfaces
 - (d) All of the above

- 3 Quadric surfaces are defined by equation
 - (a) $f(x,y,z) = 0$
 - (b) $f(x) = 0$
 - (c) $f(y) = 0$
 - (d) $f(z) = 0$

- 4 In explicit representation each polygon is represented by list of
 - (a) Vertex coordinates
 - (b) Edge coordinates
 - (c) Vertex and Edge both
 - (d) None of the above

- 5 In pointers to vertex list
 - (a) Each vertex is stored once
 - (b) Each vertex is stored twice
 - (c) Vertex is not stored
 - (d) Edges are stored

- 6 In case of explicit functions the functions are equal to
(a) $y = f(x)$
(b) $z = g(x)$
(c) None of the above
(d) Both a & b
- 7 The value of x, y, z in case of parametric representation of curves is
(a) $x(t)$
(b) $y(t)$
(c) $z(t)$
(d) All of the above
- 8 The parameter t ranges from
(a) 1 to 0
(b) 0 to 1
(c) 0 to ∞
(d) ∞ to 0
- 9 If two curve segments join together the curve has
(a) G^1 continuity
(b) G^0 continuity
(c) G^2 continuity
(d) G^3 continuity
- 10 If tangent vectors of two cubic curve segments are equal the curve has
(a) C^1 continuity
(b) C^0 continuity
(c) C^2 continuity
(d) None of the above
- 11 The center of display screen is computed as
(a) X_{\max}, y_{\max}
(b) $X_{\max}/2, y_{\max}/2$
(c) $X_{\max}/3, y_{\max}/3$
(d) None of these
- 12 A joystick is a
(a) Graphics input device
(b) Graphics output device
(c) Both a & b
(d) None of these
- 13 A Bezier curve is a polynomial of degree _____ the no of control points used
(a) One more than
(b) One less than
(c) Two less than
(d) None of these

- 14 A three dimensional object can also be represented using_____
- (a) Method
 - (b) Equation
 - (c) Point
 - (d) None of these
- 15 A three dimensional graphics has
- (a) Two axes
 - (b) Three axes
 - (c) Both a & b
 - (d) None of these
- 16 An_____ can be considered as an extension of spherical surface
- (a) Bezier
 - (b) Ellipsoid
 - (c) Shearing
 - (d) None of these
- 17 Sp line curve can be either
- (a) Bezier sp line
 - (b) B sp line
 - (c) Both a & b
 - (d) None of these
- 18 Bezier sp line always passes through
- (a) First and second control point
 - (b) Does not pass from First and second control point
 - (c) Both a & b
 - (d) None of these
- 19 The Bezier curve obtained from the four control points is called a
- (a) Square Bezier curve
 - (b) Cubic Bezier curve
 - (c) Hectare Bezier curve
 - (d) Rectangle Bezier curve
- 20 The shape of a Bezier curve primarily depends upon the
- (a) Position of control points
 - (b) Distance of control points
 - (c) Position of control panel
 - (d) None of these
- 21 The no of control points in a Bezier curve ensures the
- (a) Jaggies of curve
 - (b) Smoothness of curve
 - (c) Straightness of curve
 - (d) None of these

- 22 More the control points of a Bezier curve,_____ quality of the curve
(a) Higher
(b) Lower
(c) Bad
(d) None of these
- 23 _____ is one of the function that is used to specify a single plane surface
(a) Meta-ball model
(b) Fill area
(c) Reflection
(d) None of these
24. Meta-ball is used to describe
(a) Simplest object
(b) Complex object
(c) Composite object
(d) None of these
- 25 Super quadrics is a class of object that contain
(a) Data
(b) Codes
(c) Both a & b
(d) None of these
- 26 When two molecules move apart, which effect on molecular shapes
(a) Stretching
(b) Snapping
(c) Contracting
(d) All of these
- 27 An object's _____ determine its orientation relative to the light sources. For each vertex, OpenGL uses the assigned normal to determine how much light that particular vertex receives from each light source.
(a) Unit
(b) Normal
(c) Double
(d) None
- 28 Bezier curve is tangent to the lines connecting _____.
(a) First two points
(b) Last two points
(c) First two points and last two point
(d) None of the given

29. A parametric curve is one whose defining equations are given in terms of a -----, common, independent variable called the parametric variable.
- (a) Triple
 - (b) Double
 - (c) Single
 - (d) None of the given
30. To ensure a smooth transition from one section of a piecewise _____ to the next, we can impose various continuity conditions at the connection points
- (a) non parametric curve
 - (b) parametric curve
 - (c) polygon vector
 - (d) None of these
31. How many data elements for each region in quad-tree data structure
- (a) 2
 - (b) 4
 - (c) 8
 - (d) 6
32. How many data elements for each region in octree data structure
- (a) 2
 - (b) 4
 - (c) 6
 - (d) 8
33. refer to the shapes created by union, intersection and difference of given shapes
- (a) Wire frame model
 - (b) Composite transformation
 - (c) Constructive solid geometry methods
 - (d) None
34. The center of display screen is computed as
- (a) X_{max}, y_{max}
 - (b) $X_{max}/2, y_{max}/2$
 - (c) $X_{max}/3, y_{max}/3$
 - (d) None of these
35. The operation that is used for repositioning the object is called
- (a) Rubber band method
 - (b) Gravity method
 - (c) Dragging
 - (d) None

36. Which method are used to construct and position the straight lines, arcs and circles etc.
- Rubber band method
 - Gravity method
 - Dragging
 - None of these
37. Identify the methods for Constructive Solid Geometry operations
- Ray casting
 - Ray tracing
 - Beam penetration
 - Ray sorting
38. solid representation takes advantage of spatial coherence to reduce the storage representations.
- Sweep representation
 - Octree
 - Polygon surfaces
 - CSG
39. is a data element to store the pixels within an octant having same color
- Voxel
 - Void
 - Tex
 - Flag
40. Empty regions of the space are represented by type.....
- int
 - void
 - null
 - empty
41. In a clipping algorithm of Cohen & Sutherland using region codes, a line is already clipped if the ?
- codes of the end point are same
 - logical AND of the end point code is not 0000
 - logical OR of the end points code is 0000
 - logical AND of the end point code is 0000
 - A and B
42. The subcategories of orthographic projection are ?
- cavalier, cabinet, isometric
 - cavalier, cabinet
 - isometric, dimetric, trimetric
 - isometric, cavalier, trimetric

- 43 Which are used to achieve the predetermined orientations and alignments of the objects
- (a) Constraints
 - (b) Grid
 - (c) Gravity field
 - (d) None of these
- 44 A Bezier curve is a polynomial of degree _____ the no of control points used
- (a) One more than
 - (b) One less than
 - (c) Two less than
 - (d) None of these
- 45 Which of the following curve is an Sp-line approximation method
- (a) Bezier
 - (b) Ellipsoid
 - (c) Shearing
 - (d) None of these
- 46 We translate a two-dimensional point by adding
- (a) Translation distances
 - (b) Translation difference
 - (c) X and Y
 - (d) Only a
- 47 B-splines can be used for which of the following
- (a) Curve-fitting and numerical differentiation of experimental data.
 - (b) approximation
 - (c) numerical transformation
 - (d) none of the above
- 48 A B-spline of order n is a piecewise polynomial function of degree _____ in a variable x
- (a) (a)less than n
 - (b) greater than n
 - (c) (c)equal to n
 - (d) (d)none of these
- 49) if a knot vector of $m + 1$ knots and $n + 1$ control points are given, the degree of the B-spline curve is $p =$
- (a) $m+n - 1$
 - (b) $m-n-1$
 - (c) $m+n+1$
 - (d) $n-m+1$

- 50 Second order parametric continuity (C^2 continuity) means that both _____ and _____ parametric derivatives of the two curves are same at the intersection
- second and third
 - first and second
 - second and third
 - third and fourth

Ans. (1)(c), (2)(d), (3)(a), (4)(a), (5)(a), (6)(d), (7)(d), (8)(b), (9)(b), (10)(a), (11)(b), (12)(a), (13)(b), (14)(b), (15)(b), (16)(b), (17)(c), (18)(c), (19)(b), (20)(a), (21)(b), (22)(a), (23)(b), (24)(c), (25)(c), (26)(d), (27)(b), (28)(c), (29)(c), (30)(d), (31)(c), (32)(d), (33)(c), (34)(b), (35)(c), (36)(c), (37)(a), (38)(b), (39)(a), (40)(b), (41)(e), (42)(c), (43)(a), (44)(b), (45)(a), (46)(d), (47)(a), (48)(a), (49)(b), (50)(b)

(c) Fill in the Blanks:

- _____ is a set of connected polygonally bounded planer surfaces.
- _____ curves define points on a 3D curve by using three polynomials in parameter t.
- Polygon mesh is a collection of _____, _____ and _____.
- _____ and _____ are the criteria used for evaluating different representations.
- Polygon is represented in the form of pointers to edge list in case of _____ representation.
- The plane equation is given by _____.
- _____ give too little flexibility in controlling the shape of curve.
- A curve segment $Q(t)$ is defined by $Q(t) = \underline{\hspace{2cm}}$
- In the equation $Q(t) = T.C$, C stands for _____
- We can obtain the parametric tangent of a curve by taking its _____.

Ans. (1)(polygon mesh), (2)(parametric polynomial), (3)(edges, vertices and polygons), (4)(space and time), (5)(pointers to an edge list), (6)($Ax + By + Cz + D = 0$), (7)(lower degree polynomial), (8)($[x(t) \ y(t) \ z(t)]$), (9)(coefficient matrix), (10)(first derivative)

II Short Answer Type Questions:

- Describe B-splines and their applications in detail.
- Determine Bezier Curve with four control points. Discuss the importance of Bemstein Polynomial.
- Describe Bezier Function? Explain it's properties of Bezier Curves.
- What is C^0 , C^1 & C^2 continuity?
- Why do we need homogeneous co-ordinate system in case of transformation?
- How B-Spline curves differ from Hermite Curve.
- What do you mean by homogeneous co-ordinate? Give example.
- State the difference between parametric and geometric continuity.
- Why do we use parametric rep. of curve.
- Derive the basics matrix for cubic Bezier Curve. Give also the corresponding Bernstein Polynomial.
- What are the conditions for smoothly joining the two Bezier Curve Segments?
- What do you mean by knot values in B Spline. Define the various types of knot vectors & give the effect of such knot vectors on the shape of curve.

- 13 Explain Bezier Surface.
- 14 Draw a Bezier Curve with respect to control points $p(1,3)$, $q(2,4)$, $r(5,5)$, $s(7,3)$ and draw its convex hull.
- 15 What is the use of approximated curve in Computer Graphics?
- 16 What are Bezier and b-spline curves different from non-periodic B-spline curves?
- 17 How are periodic B-spline curves different from non-periodic B-spline curves?
- 18 Define B-Spline and Bezier Curves?
- 19 List the properties of Bezier curves
- 20 Write short notes on Bezier curves
- 21 Explain briefly about splines
- 22 Explain the following curve approximation methods (a) Bezier Curves (b) B-spline curves
- 23 Determine the Bezier blending functions for five control points. Plot each function and label the maximum and minimum values
- 24 Consider a cubic B-spline curve with control points $(-1,-1)$, $(-1,1)$, $(1,1)$ and $(1,1)$. What are the midpoint of the curve segment? What are the midpoints of the curve segment?
- 25 State the condition for smoothly joining curve segments.

III Long Answer Type Questions:

- 1 What is the advantage of parametric form of curve with respect to the explicit form of curve in CG?
- 2 Prove that the blending function of open uniform B-Splines is equal to that of Bezier Curve for $d=n+1$ (where no. of control point = $n+1$ and degree = $d-1$)
- 3 Find out the effect of multiple control point in B-spline using example.
- 4 Derive the basis matrix for Hermite Curve.
- 5 Derive the basis matrix for Bezier Curve. Also derive Bernstein Polynomial.
- 6 How many view planes (at the origin) produce isometric projections of an object?
- 7 Represent a cube by using an explicit vertex list.
- 8 Represent a cube by using polygon listing.
- 9 Show that the n th-degree b-spline basis functions $B_{i,n}(x)$ satisfy $B_{i,n}(x) = 0$ if $x < t_i$ or $x > t_{i+n+1}$
- 10 Let $P_0(0,0)$, $P_1(1,2)$, $P_2(2,1)$, $P_3(3,-1)$, $P_4(4,10)$, and $P_5(5,5)$ be given data points. If interpolation based on cubic B-splines is used to find a curve interpolating these data points, find a knot set t_0, \dots, t_9 that can be used to define the cubic B-splines.
- 11 Show that the knot set used in constructing the Bezier-b-spline approximation to a guiding polyline guarantees that the endpoints of the spline coincide with the endpoints of the guiding polyline.
- 12 Derive the Bresenham's circle algorithm. Generate the intermediate points of a circle whose centre is at $(0, 0)$ and two given points on the circumference are $(0, 10)$, and $(\sqrt{10}, \sqrt{10})$ i.e., intermediate points in the second quadrant.
- 13 Let $P_0(0, 0)$, $P_1(1,2)$, $P_2(2,1)$, $P_3(3,1)$, $P_4(4, 10)$ and $P_5(5, 5)$ be given data points. If interpolation based on B-splines is used to find a curve interpolating these data points, Find a knot set t_0, \dots, t_9 that can be used to Define B-splines (cubic B-splines).
- 14 What do you understand by Bezier Curve and Surfaces? How are these used and useful? Explain their properties and continuity conditions.

- 15 Define Knot vector and explain the concept used to define a Bezier curve. Compute coefficients of Bezier curve in interval [1,3].
- 16 Prove that the open uniform B-spline curve for $n=2$, $k=5$ is the cubic Bezier curve.
- 17 Four control points $P_0(a,b)$, $P_1(3,6)$, $P_2(5,5)$ and $P_3(8,c)$ are on a uniform quadratic B-spline. Determine the values of a, b and c if the curve starts from the point $(1,4)$ and terminates with the slope (-0.5) .
- 18 Explain the effect of multiple control points at the same location?
- 19 List four types of curve generation. Describe B-spline method for curve generation?

UNIT - III

I Test Your Skills:

(a) State Whether the Following Statements are True or False:

- 1 The domain of representation should be large enough to allow a useful set of physical objects to be represented.
- 2 We call a representation if it can be used to encode any given solid in more than one way.
- 3 Boundary points are those points whose distance from the object and its complement is non zero.
- 4 A closed set comprises of all its boundary points.
- 5 We can define regularization by following equation

$$A \text{ op } B = \text{closure}(\text{interior}(A \text{ op } B))$$
- 6 Rotational sweeps are defined by rotating an area about an axis.
- 7 B-reps do not support solid whose boundaries are 3 manifold.
- 8 Spatial occupancy enumeration is a special case of cell decomposition.
- 9 Octrees are derived from quadtrees.
- 10 In CSG simple primitives are combined by means of Boolean Set operators.
- 11 In 3D rotation, we have to specify the angle of rotation along with the axis of rotation.
- 12 Scaling can be achieved by multiplying the original coordinates of the object with the scaling factor to get the desired result.
- 13 Usually 3×3 or 4×4 matrices are used for transformation.
- 14 Line clipping is the process of removing lines or portions of lines inside an area of interest.
- 15 The Cohen Sutherland algorithm divides a two-dimensional space into 12 regions (or a three-dimensional space into 24 regions)

Ans. (1)(T), (2)(F), (3)(F), (4)(T), (5)(T), (6)(T), (7)(F), (8)(T), (9)(T), (10)(F), 11(T), 12(T), 13(T), 14(F), 15(F)

(b) Multiple Choice Questions:

- 1 How many basic method of projection
 - (a) Four
 - (b) Two
 - (c) More than three
 - (d) One

- 2 Lines of projection coverage at a single point called
- Centre of attraction
 - Centre of projection
 - Line of projection
 - None
- 3 Select the perspective anomalies from the following:
- Perspective foreshortening
 - Perspective increasing
 - Centre of projection
 - Vanishing point
- 4 Difference between parallel and perspective projection lies in the
- Centre of attraction
 - Centre of projection
 - Line of control
 - None
- 5 The operation that is used for repositioned the object are called
- Rubber band method
 - Gravity field
 - Dragging
 - None of these
- 6 Which method are used to construct and position the straight lines, arcs and circles, etc
- Rubber band method
 - Gravity field
 - Dragging
 - None of these
- 7 Which are used to connect a line to already drawn line
- Rubber band method
 - Gravity field
 - Dragging
 - None of these
- 8 The rubber band is also applicable to_____ objects
- Scale
 - Vector
 - Scalar
 - None of these
- 9 Which technique depends on viewer ability to reconstruct the scene from Multiple projections.
- Parallel projection
 - Perspective Projection
 - Intensity Rate
 - None

- 10 Which of the following does NOT figure into the Field of View of a pinhole camera?
- (a) The direction of projection
 - (b) The distance from the center of projection to the projection plane
 - (c) The size of the projection plane
 - (d) None
- 11 This projection technique has the direction of projection perpendicular to the viewing plane, but the viewing direction is NOT perpendicular to one of the principle faces.
- (a) Orthographic Parallel Projection
 - (b) Axonometric Parallel Projection
 - (c) Oblique Parallel Projection
 - (d) None
- 12 This projection technique does NOT have the direction of projection perpendicular to the viewing plane.
- (a) Orthographic Parallel Projection
 - (b) Axonometric Parallel Projection
 - (c) Oblique Parallel Projection
 - (d) None
- 13 This projection technique has the direction of projection perpendicular to the viewing plane, and the viewing direction is perpendicular to one of the principle faces.
- (a) Orthographic Parallel Projection
 - (b) Axonometric Parallel Projection
 - (c) Oblique Parallel Projection
- 14 When transforming a random Axis-Aligned Bounding Box defined by the points $(near_x, near_y, near_z)$ and (far_x, far_y, far_z) to the standard orthographic viewing box, which affine transforms are used?
- (a) shear and translation
 - (b) rotation and scale
 - (c) scale and shear
 - (d) translation and scale
- 15 The purpose of the front and back clipping planes in OpenGL. Which of the following was NOT a purpose for using clipping planes?
- (a) division by zero
 - (b) objects behind the center of projection mapping onto the projection plane
 - (c) avoiding the problems of infinite viewing volume size

- 16 Oblique projection with an angle of 45 to the horizontal plane is called as:
(a) Cabinet projection
(b) Isometric projection
(c) Cavalier projection
(d) None
- 17 The transformation in which an object is moved in a minimum distance path from one position to another is called
(a) Rotation
(b) Replacement
(c) Translation
(d) Scaling
- 18 The transformation in which an object is moved from one position to another in circular path around a specified pivot point is called
(a) Rotation
(b) Translation
(c) Scaling
(d) None
- 19 A circle, if scaled only in one direction becomes a ?
(a) Ellipse
(b) Parabola
(c) Hyperbola
(d) None
- 20 The object refers to the 3D representation through linear, circular or some other representation are called
(a) Quadric surface
(b) Sweep representation
(c) Torus
(d) None of these
- 21 A quad-tree is a data structure which is used for graphical representation of.....
(a) 2D digital picture or object
(b) 3D picture or object
(c) Both a & b
(d) None of these
- 22 How many data elements for each region in quad-tree data structure
(a) 2
(b) 4
(c) 8
(d) 6

- 23 refer to the shapes created by union, intersection and difference of given shapes
- (a) Wire frame model
 - (b) Composite transformation
 - (c) Constructive solid geometry methods
 - (d) None
- 24 An octree is a data structure which is used for alternative representation of
- (a) 2D digital picture or object
 - (b) 3D picture or object
 - (c) Both a & b
 - (d) None of these
- 25 The text clipping strategy to reject an entire character string that overlaps a clip window is called.....
- (a) All-or-none character clipping
 - (b) All-or-none string clipping
 - (c) Curve clipping
 - (d) both a & b
- 26 A transformation that slants the shape of an object is called
- (a) Reflection
 - (b) Shear
 - (c) Distortion
 - (d) Scaling
- 27 A method used to test lines for total clipping is equivalent to the
- (a) logical XOR
 - (b) logical OR
 - (c) logical AND
 - (d) both a & b
- 28 The phenomenon of having a continuous glow of a beam on the screen even after it is removed is called as?
- (a) Fluorescence
 - (b) Persistence
 - (c) Phosphorescence
 - (d) Incandescence
- 29 The region against which an object is clipped is called a
- (a) Clip window
 - (b) Boundary
 - (c) Enclosing rectangle
 - (d) Clip square

- 30 Identify line clipping algorithms from the following
- (a) Cohen- Sutherland algorithm
 - (b) Liang-Barsky clipping
 - (c) Nicholl-Lee-Nicholl clipping
 - (d) All of the above
- 31 The process of mapping a world window in world coordinate system to viewport are called
- (a) Transformation viewing
 - (b) Viewport
 - (c) Clipping window
 - (d) Screen coordinate system
32. The process of extracting a portion of a database or a picture inside or outside a specified region are called
- (a) Transformation
 - (b) Projection
 - (c) Clipping
 - (d) Mapping
33. The rectangle portion of the interface window that defines where the image will actually appear are called
- (a) Transformation viewing
 - (b) View port
 - (c) Clipping window
 - (d) Screen coordinate system
34. The phenomenon of having a continuous glow of a beam on the screen even after it is removed is called as ?
- (a) Fluorescence
 - (b) Persistence
 - (c) Phosphorescence
 - (d) Incandescence
- 35 Coordinates of window are knows as
- (a) Screen coordinates
 - (b) World coordinates
 - (c) Device coordinates
 - (d) Cartesian coordinates
36. Coordinates of viewport are known as
- (a) World coordinates
 - (b) Polar coordinates
 - (c) Screen coordinates
 - (d) Cartesian coordinates

37. The region against which an object is clipped is called a
- (a) Clip window
 - (b) Boundary
 - (c) Enclosing rectangle
 - (d) Clip square
38. identifies the picture portions that are exterior to the clip window
- (a) Interior clipping
 - (b) Exterior clipping
 - (c) Extraction
 - (d) None of the above
39. Identify line clipping algorithms from the following
- (a) Cohen- Sutherland algorithm
 - (b) Liang-Barsky clipping
 - (c) Nicholl-Lee-Nicholl clipping
 - (d) All of the above
40. The region code of a point within the window is
- (a) 1111
 - (b) 0000
 - (c) 1000
 - (d) 0001
41. A line with endpoints codes as 0000 and 0100 is
- (a) Partially invisible
 - (b) Completely visible
 - (c) Completely invisible
 - (d) Trivially invisible
42. If the object uses the golden mean in its distances from the viewer, its perspective will have a golden mean proportion to the
- (a) front corner
 - (b) back corner
 - (c) height
 - (d) height*mean
43. Find the odd one out
- (a) World Coordinate System
 - (b) Screen Coordinate System
 - (c) World Window
 - (d) Interface Window
 - (e) None of these

- 44 Which of the following is the equation involved in window to viewport mapping (symbols have their usual meanings)
- (a) $xv = s_x xw + tx, yv = s_y yw + ty$
 - (b) $xv = s_x xw - tx, yv = s_y yw - ty$
 - (c) $xv + s_x xw = tx, yv + s_y yw = ty$
 - (d) $xv = s_x xw * tx, yv = s_y yw * ty$
- 45 Sutherland - Hodgman Polygon Clipping algorithm goes around the edges of the window, clipping the polygon, it encounters ____ types of edges.
- (a) one
 - (b) two
 - (c) three
 - (d) four
- 46 Parallel projection discards _____ and parallel lines from each vertex on the object are extended until they intersect the view plane.
- (a) x-coordinate
 - (b) z-coordinate
 - (c) y-coordinate
 - (d) xyz coordinate
- 47 – Cavalier and Cabinet projections are
- (a) Orthographic Projection
 - (b) Perspective Projection
 - (c) Isometric Projection
 - (d) oblique projections
- 48 In BRep (boundary representation) A solid is *represented* as a collection of _____ surface elements, the *boundary* between solid and non-solid.
- (a) connected
 - (b) disconnected
 - (c) parallel
 - (d) perpendicular
- 49 The main topological items in boundary representation are:
- (a) faces, edges and vertices.
 - (b) faces, graphs, edges
 - (c) edges, graphs, points
 - (d) faces, edges, points
- 50 which of the following are simple shapes as described by constructive solid geometry
- (a) cuboids,
 - (b) cylinders,
 - (c) prisms,
 - (d) pyramids
 - (e) all of the above

Ans. (1)(b), (2)(b), (3)(a), (4)(b)(5)(c)(6) (a)(7) (b)(8)(a), 9(a), (10)(a), (11)(b), (12)(c), (13)(a), (14)(d), (15)(c), (16)(c), (17)(c), (18)(a), (19)(a), (20)(b), (21)(a), (22)(b), (23)(c), (24)(b), (25)(b), (26)(b), (27)(c), (28)(c), (29)(a), (30)(d), (31)(a), (32)(c), (33)(b), (34)(c), (35)(b), (36)(c), (37)(a), (38)(b), (39)(d), (40)(b), (41)(a), (42)(b), (43)(e), (44)(a), (45)(d), (46)(b), (47)(d), (48)(a), (49)(a), (50)(e)

(c) Fill in the Blanks:

- 1 _____ representation is said to be complete.
- 2 _____ representations allow an object to be represented without approximation.
- 3 _____ of a set is defined as the closure of set's interior points.
- 4 Primitive Instancing is a _____ technique.
- 5 The Euler's formula is _____.
- 6 The difference between parallel and perspective projection lies in the _____ between the _____ to the projection plane.
- 7 In a _____, the farther away from an object is from the viewer, the smaller it appears.
- 8 Lines of projection coverage at a single point called _____.
- 9 There could be maximum of _____ vanishing points along the three orthogonal axes.
- 10 The _____ is the projection of the vertex.
- 11 Difference between _____ and perspective projection lies in the _____ of projection.

Ans. (1)(Unambiguous), (2)(accurate), (3)(Regularization), (4)(Solid modeling), (5)($V-E+F=2$), (6)Distance, center of projection), (7)(Perspective projection), (8)(Centre of projection), (9)(3), (10)(Point of intersection), (11)(Parallel, center)

II Short Answer Type Questions:

- 1 Explain the difference between perspective and parallel projection.
- 2 What are the perspective anomalies?
- 3 Explain parallel projection.
- 4 Explain perspective projection.
- 5 What do you mean by vanishing point?
- 6 Explain the octree& quad tree representation of solid objects
- 7 What is perspective foreshortening?
- 8 What is center of projection?
- 9 Write short notes on projections
- 10 How are regularized Boolean set operators different from ordinary operators? Explain.

- 11 Give a list of the properties that are desirable for representing a solid.
- 12 What are the various types of sweeps available?
- 13 Give the generalization for Euler's formula.
- 14 Define and discuss Octrees.
- 15 What is CSG?
- 16 Use the Cohen Sutherland algorithm to clip line P1(70,20) and P2(100,10) against a window lower left hand corner (50,10) and the upper right hand corner (80,40).
- 17 Write down the steps required for window to viewport transformation?

III Long Answer Type Questions:

- 1 Find the perspective projection onto the view plane $z=d$ where the center of projection is the origin (0,0,0)
- 2 Describe the (a) one principal vanishing point perspective (b) two principal vanishing point (c) three principal vanishing point perspective.
- 3 What are the principal vanishing points for standard perspective transformation
- 4 Find the general form of an oblique projection onto the xy plane
- 5 Find the transformation for (a) cavalier with $\Theta = 45$ degree and (b) cabinet projection with $\Theta = 30$ degree. (c) Draw the projection of the unit cube for each transformation.
- 6 Derive the equations of parallel projection onto the xy plane in the direction of projection $V = aI + bJ + cK$.
- 7 Discuss in detail various solid modeling techniques.
- 8 Discuss Primitive Instancing in detail
- 9 Discuss B-reps in detail.
- 10 Discuss spatial partitioning representation.
- 11 What do you mean by Projection? Discuss principal vanishing points for the standard perspective transformation.
- 12 Differentiate between Orthographic and Oblique Parallel projections.
- 13 Describe spatial occupancy enumeration method for spatial partitioning representation of solids. What are the advantages of octrees?
- 14 Describe the different operations in constructive solid geometry methods?

UNIT - IV

I Test Your Skills:

(a) State Whether the Following Statements are True or False:

- 1 Specular Reflection can be observed on any shiny surface.
- 2 In Phong's model, rapid fall off is approximated by $\cos^n \alpha$, where n is material 's specular reflection exponent.
- 3 The value of specular reflection coefficient ranges from 0 to ∞ .
- 4 Depth cueing is provided to simulated atmospheric attenuation.
- 5 Illumination equation for simple model is $I = Ki$.

- 6 the product of multiple reflections if light from many surfaces present in environment is diffuse light.
- 7 Dull surfaces exhibit diffuse reflection.
- 8 Diffuse reflection is also known as lambertian reflection.
- 9 Diffuse illumination equation is given by

$$I = I_a K_a + I_p^k d (N \cdot L)$$
- 10 Object's diffuse color can be represented by one value of O_d for each component.
- 11 Shading is used in drawing for depicting levels of darkness on paper by applying media more densely or with a darker shade for darker areas, and less densely or with a lighter shade for lighter areas.
- 12 Shading is independent on the lighting used.
- 13 An ambient light source represents a fixed-intensity and fixed-color light source that affects all objects in the scene equally.
- 14 Hidden surface determination is the process used to determine which surfaces and parts of surfaces are not visible from a certain viewpoint.
- 15 The hidden surface removal algorithm used in Quake 1 is Sorted Active Edge List

Ans. (1)(T), (2)(T), (3)(F), (4)(T), (5)(T), (6)(F), (7)(T), (8)(T), (9)(F), (10)(T), 11(T), 12(F), 13(T), 14(T), 15(T)

(b) Multiple Choice questions:

- 1 Hidden surface problem relies on a device called
 - (a) Z-buffer
 - (b) X-buffer
 - (c) Y-factor
 - (d) None

- 2 The division displayed on screen into row and columns is known as
- (a) Rubber band method
 - (b) Gravity field
 - (c) Dragging
 - (d) Grid
- 3 The function of a plotter is like a
- (a) Monitor
 - (b) Projector
 - (c) Printer
 - (d) None of these
- 4 A plotter is capable of
- (a) Printing a map
 - (b) Printing a similar images
 - (c) Both a & b
 - (d) None of these
- 5 _____ ink is used in laserprinter
- (a) Wet
 - (b) Dry
 - (c) Both a & b
 - (d) None of these
- 6 The cabinet in laser printer in which the ink is filled is called
- (a) Cartage
 - (b) Toner
 - (c) Both a & b
 - (d) None of these
- 7 An inkjet printer places _____ of ink onto paper to print an image
- (a) Small droplets
 - (b) large droplets
 - (c) Both a & b
 - (d) None of these
- 8 The size of these dot in inkjet printer usually lies between
- (a) 50 to60 microns in diameter
 - (b) 20 to30 microns in diameter
 - (c) 30 to40 microns in diameter
 - (d) 10 to20 microns in diameter
- 9 The speed of printing in inkjet printer is
- (a) Fast
 - (b) Slow
 - (c) Not fast nor slow

- (d) None of these
- 10 The inkjet printer is mostly common due to their
- (a) Low cost
 - (b) Performance
 - (c) Both a & b
 - (d) None of these
- 11 The main property of_____ is that their shape is irregular
- (a) Fractals
 - (b) Quad-tree
 - (c) Rendering
 - (d) None
- 12 Which type of quad tree is specifically used to store lines rather than points
- (a) Point quad tree
 - (b) Edge quad tree
 - (c) Curves quad tree
 - (d) Areas quad tree
- 13 The painter algorithm are also called
- (a) Depth sort algorithm
 - (b) Priority algorithm
 - (c) Both a & b
 - (d) None of these
- 14 The painter algorithm are based on the property of
- (a) Polygon
 - (b) Frame buffer
 - (c) Depth buffer
 - (d) None of these
- 15 The dynamic effect of an image is called
- (a) Video
 - (b) Animation
 - (c) Super sampling
 - (d) None of these
- 16 The method which is based on the principle of comparing objects and parts of objects to each other to find which are visible and which are hidden are called
- (a) Object-space method
 - (b) image-space method

- (c) Both a & b
 - (d) None of these
- 17 The method which is based on the principle of checking the visibility point at each pixel position on the projection plane are called
- (a) Object-space method
 - (b) image-space method
 - (c) Both a & b
 - (d) None of these
- 18 The types of hidden surface removal algorithm are
- (a) Depth comparison, Z-buffer, back-face removal
 - (b) Scan line algorithm, priority algorithm
 - (c) BSP method, area subdivision method
 - (d) All of these
- 19 Which surface algorithm is based on perspective depth?
- (a) Depth comparison
 - (b) Z-buffer or depth-buffer algorithm
 - (c) subdivision method
 - (d) back-face removal
- 20 In which year Z- buffer algorithm are described?
- (a) 1995
 - (b) 1974
 - (c) 1945
 - (d) 1981
- 21 Z -buffer algorithm are
- (a) Simplest algorithm
 - (b) Complex algorithm
 - (c) Largest algorithm
 - (d) None of these
- 22 Which is a tree type of data structure in which every internal node has at most four children?
- (a) Point quad tree
 - (b) Edge quad tree
 - (c) Quad tree
 - (d) None of these
- 23 The surfaces that is blocked or hidden from view in a 3D scene are known as
- (a) Hidden surface
 - (b) Frame buffer

- (c) Quad tree
 - (d) None of these
- 24 The problem of hidden surface are
- (a) Removal of hidden surface
 - (b) Identification of hidden surface
 - (c) Both a & b
 - (d) None of these
- 25 Why we need removal of hidden surface
- (a) for displaying realistic view
 - (b) for determining the closest visible surface
 - (c) Both a & b
 - (d) None of these
- 26 How many types of hidden surface algorithm are
- (a) 1
 - (b) 2
 - (c) 3
 - (d) 4
- 27 The algorithm of hidden surface is
- (a) Object-space method
 - (b) image-space method
 - (c) Both a & b
 - (d) None of these
- 28 The method which is based on the principle of comparing objects and parts of objects to each other to find which are visible and which are hidden are called
- (a) Object-space method
 - (b) image-space method
 - (c) Both a & b
 - (d) None of these
- 29 The method which is based on the principle of checking the visibility point at each pixel position on the projection plane are called
- (a) Object-space method
 - (b) image-space method
 - (c) Both a & b
 - (d) None of these

- 30 The types of hidden surface removal algorithm are
- (a) Depth comparison, Z-buffer, back-face removal
 - (b) Scan line algorithm, priority algorithm
 - (c) BSP method, area subdivision method
 - (d) All of these
- 31 Hue of color is related to ?
- (a) Luminance
 - (b) Saturation
 - (c) Incandescence
 - (d) Wavelength
- 32 The phenomenon of having a continuous glow of a beam on the screen even after it is removed is called as ?
- (a) Fluorescence
 - (b) Persistence
 - (c) Phosphorescence
 - (d) Incandescence
- 33 All the hidden surface algorithms employ image space approach except ?
- (a) Back face removal
 - (b) Depth buffer method
 - (c) Scan line method
 - (d) Depth sort method
- 34 Which of the following statement is true ?
- (a) Request, sample and event are the three basic modes of input
 - (b) Keyboard is a device ideally suited for use in sample mode
 - (c) A mouse is typically a device for inputting an absolute position on the screen
 - (d) Special graphics hardware support is essential for providing menu-driven user interface to an application
- 35 Choose the incorrect statement from the following about the basic ray tracing technique used in image synthesis ?
- (a) In this technique rays are cast from the eye point through every pixel on the screen
 - (b) In this technique, viewing transformation are not supplied to the scene prior to rendering
 - (c) This technique removes hidden surfaces.
 - (d) In this technique rays are cast from the light source to the object in the scene
- 36 The refresh rate below which a picture flickers is ?
- (a) 25
 - (b) 30
 - (c) 35
 - (d) 60

- 37 If all the pixels within an octant have the same color, it is referred to as
- Heterogeneous octant
 - Homogeneous octant
 - Simultaneous octant
 - Similar octant
- 38 A structure is created using the function
- initstructure()
 - startstructure()
 - openstructure()
 - none
- 39 is the reference portion value of each structure element.
- element pointer
 - index
 - attribute
 - attribute index
- 40 can be produced by interpolating shading patterns across the polygon surfaces to eliminate or reduce the presence of polygon edge boundaries.
- Rasterizing
 - Rendering
 - Smoothing
 - None
- 41 If the light is propagating in a material with a ____ index of refraction than the material whose surface it strikes, then total internal reflection may occur if the angle of incidence is ____ than a certain critical angle
- higher, greater
 - lower, lesser
 - highet,lesser
 - lower, greater
- 42 The equation occurring in finding the reflected vector is
- $L' = 2(N \cdot L)N - L$
 - $L' = 2(N \cdot L)N + L$
 - $L' = 2(N \cdot L)N * L$
 - $L' = 2(N \cdot L)N / L$
- 43 Curves can be broadly classified into three categories – which are
- explicit, implicit, and parametric curves.
 - explicit, implicit, and nonparametric curves.
 - explicit, bezier, and parametric curves.
 - implicit, cubic and parametric curves

- 44 $x^2 + y^2 - R^2 = 0$ is the equation of a
 (i) line
 (ii) circle
 (iii) parabola
 (iv) ellipse
- 45 Approximating curve passes as close as possible while maintaining _____degrees of freedom
 (a) maximum
 (b) minimum
 (c) zero
 (d) five
- 46 Who developed the phong shading model
 (a) Dui Tuang Phong
 (b) Bui Tuong Phong
 (c) Cohen-sutherland
 (d) none of these
- 47 k_a the ambient diffuse coefficient of reflection always has a value
 (a) >1
 (b) between 0 and 1
 (c) >0
 (d) <0
- 48 If we assume a uniform intensity of ambient light, I_a , then the intensity of the diffuse reflection at any point on the surface: $I =$ _____where k_a =the ambient diffuse coefficient of reflection
 (a) k_a/I_a
 (b) $k_a * I_a$,
 (c) k_a-I_a
 (d) k_a+I_a
- 49) which of the following is not a hidden surface removal algorithm
 (a) Z-buffering
 (b) Binary space partitioning
 (c) Warnock algorithm
 (d) Sutherland cohen
- 50 The _____ is a geometric representation of the volume visible to the _____
 (a) viewing frustum ,virtual camera.
 (b) virtual camera, viewing frustum ,
 (c) viewing cone, virtual camera
 (d) virtual camera, viewing cone

Ans (1)(a), (2)(d), (3)(c), (4)(c), (5)(b), (6)(c), (7)(a), (8)(a), (9)(b), (10)(c), (11)(a), (12)(b), (13)(c), (14)(b), (15)(b), (16)(a), (17)(b), (18)(d), (19)(b), (20)(b), (21)(a), (22)(c), (23)(a), (24)(c), (25)(c), (26)(b), (27)(c), (28)(a), (29)(b), (30)(d), (31)(d), (32)(c), (33)(a), (34)(a), (35)(d), (36)(a), (37)(b), (38)(c), (39)(a), (40)(b), (41)(a), (42)(a), (43)(a), (44)(b), (45)(b), (46)(b), (47)(b), (48)(b), (49)(d), (50)(a)

(c) Fill in the Blanks:

- 1 The blocked or hidden surfaces must be removed in order to render a realistic screen image. The identification and removal of these surfaces is called the _____ problem.
- 2 The _____ of two vectors is a third vector with the length equal to the product of length of the two vectors times the sine of the angle between them.
- 3 Large amount of _____ is need for Z buffer.

Ans. (1)(Hidden Surface), (2)(Cross Product), (3)(Memory)

II Short Answer Type Questions:

- 1 How are back faces detected and why need to remove them?
- 2 Implement Z buffer algorithm using 'C'.
- 3 What do you understand by Quadratic and Oct tree?
- 4 What is Z-buffer algorithm for removing hidden faces?
- 5 What are the merits and demerits of various techniques for hidden surface removal?
- 6 Compare the techniques of Phong and Gourard shading.
- 7 Why need of hidden-surface algorithms? How does the Z-buffer algorithm determine which surface are hidden?
- 8 Explain the Z-Buffer algorithm for hidden surface removal.
- 9 Discuss Mach Band Effect.
- 10 Explain the advantages and disadvantages of Z-Buffer Algorithm
- 11 Explain the depth sort algorithm for hidden surface removal.
- 12 Define atmospheric attenuation
- 13 How can we calculate the value for reflection vector?
- 14 Explain the binary space partition tree visible surface Algorithm and write a pseudo code for building a BSP tree.
- 15 Explain the scan line algorithm for hidden surface removal.
- 16 Explain any one area subdivision algorithm for visible surface Detection.
- 17 Write a pseudocode for Weiler-Atherton algorithm.
- 18 Give the important steps involved in Weiler-Atherton Algorithm visible surface algorithm.
- 19 Explain A-Buffer visible surface algorithm.
- 20 Describe floating horizon algorithm.
- 21 Describe the back-face removal algorithm.
- 22 Define point light source.
- 23 Give the illumination equation for ambient light

- 24 Define specular reflection.
- 25 Derive the illumination equation by adding the value of object's diffuse colour.
- 26 Differentiate between Octree and BSP tree method of representing solid objects with suitable examples.
- 27 What do you understand by hidden surface removal? Discuss Painter's algorithm for Hidden Surface problem.
- 28 Explain with the example Area Subdivision Method?
- 29 Differentiate between Phong and Gourard projection and derive their projection matrix?

III Long Answer Type Questions:

- 1 Given points $P_1(1,2,0)$, $P_2(3,6,20)$, and $P_3(2,4,6)$ and a viewpoint $C(0,0,-10)$, determine which points obscure the others when viewed from C .
- 2 Construct the perspective to parallel transform T_p which produces an object whose parallel projection onto the xy plane yields the same image as the perspective projection of the original object onto the normalized view plane $z = c'z/(c'z + b)$ with respect to the origin as the center of projection.
- 3 Show that the normalized perspective to parallel transform NT_p preserves the relationships of the original perspective transformation while transforming the normalized perspective view volume into the unit cube.
- 4 What are hidden-surface algorithms needed?
- 5 What two steps are required to determine whether any given points $P_1(x_1, y_1, z_1)$ obscure another point $P_2(x_2, y_2, z_2)$?
- 6 Why is it easier to locate hidden surfaces when parallel projection is used?
- 7 Using a 2×2 pixel display, show how the Z-buffer algorithm would determine the color of each pixel for the given objects Z and B .
- 8 What is the maximum number of objects that can be presented by using the Z-buffer algorithm?
- 9 How does the basic scan-line method determine which surfaces are hidden?
- 10 How does edge coherence help to reduce computational effort?
- 11 Show how the calculation of the intersection of an edge with a scan line can be made incremental as opposed to absolute.
- 12 How does area coherence reduce computational effort?
- 13 How is spatial coherence determined?
- 14 Draw two polygons such that their extents intersect but the polygons themselves don't intersect.
- 15 Discuss in detail various illumination models.
- 16 What is the underlying concept of the painter's or the priority algorithm?
- 17 What difficulties are encountered in implementing the painter's algorithm?
- 18 If polygon Q has the same depth value as polygon P , which polygon has priority, that is, which is painted first?
- 19 What are the basic concepts underlying the subdivision algorithm?
- 20 Explain the Phong illumination model.
- 21 How can we use the special structure of a convex polyhedron to identify its hidden faces for a general parallel or perspective projection?

- 22 How many the properties of parallel projection be used to simplify hidden-surface calculations for any form of projection?
- 23 Derive the illumination equation after adding value for atmospheric attenuation.
- 24 What happens when two polygons have the same z value and the Z-buffer algorithm is used?
- 25 How would the Z-buffer algorithm be altered to allow figures to be superimposed on a surface?
- 26 Explain Gouraud shading model. Also state the difference between phong and gouraud shading models.
- 27 Discuss in detail various shading models.
- 28 How can the amount of computation required by the scan-line method be reduced?
- 29 How is the depth of a polygon determined by the painter's algorithm?
- 30 How does the subdivision algorithm exploit are coherence?
- 31 Discuss the scan-line algorithm for the removal of hidden lines from a scene of 3D graphics display.
- 32 Why do we need to eliminate the hidden surfaces?
- 33 What are the different types of hidden surface elimination method?
- 34 What steps are required to shade an object using Phong shading method of polygon rendering? How it overcomes the drawbacks of Gouraud Shading Method?
- 35 Explain the relevance of surface rendering in computer graphics?
- 36 Explain the concept of Ray Tracing?
- 37 Explain Scan Line method?

QUESTION BANK

DATA COMMUNICATION AND NETWORKING

MCA 207

QUESTION BANK
DATA COMMUNICATION AND NETWORKING - MCA 207
MCA - III

UNIT - I

I Test Your Skills:

(a) State Whether the Following Statements are True or False:

- 1 A dedicated connection is required in a packet switched network.
- 2 ANSI stands for American National Standards Institute.
- 3 EIA and ANSI are not related to each other.
- 4 Analog signal is a non-continuous waveform.
- 5 Frequency is directly proportional to time.
- 6 The bandwidth of a signal is the difference between its highest and lowest frequencies.
- 7 Standards are irrelevant to data communication.
- 8 Protocols govern a set of rules for data communication.
- 9 Forums are generally set up by user group.
- 10 Amplitude is the same as the frequency of a signal.
- 11 Telephone lines can be used for both voice and data communication.
- 12 ARPANET was the first computer network.
- 13 ICMP and IGMP are auxiliary protocols that help TCP in its delivery and routing tasks.
- 14 UDP is connection less protocol.
- 15 Wavelength is given by propagation speed (speed of light) divided by frequency.

Ans. (1)(F), (2)(T), (3)(F), (4)(F), (5)(F), (6)(T), (7)(F), (8)(T), (9)(T), (10)(F), (11)(T), (12)(T), (13)(F), (14)(T), (15)(T)

(b) Multiple Choice Questions:

- 1 Rules that govern a communication exchange are
 - (a) Media
 - (b) Criteria
 - (c) Protocol
 - (d) All of above

- 2 Performance of data communications depend on
 - (a) No. of users
 - (b) Transmission media
 - (c) H/w and S/w
 - (d) All of above

- 3 The information to be communicated in a data communication system is
- (a) Medium
 - (b) Protocol
 - (c) Message
 - (d) Transmission
- 4 In a network with 25 computers, which topology would require most extensive calling
- (a) Mesh
 - (b) Star
 - (c) Bus
 - (d) Ring
- 5 In a network with 25 computers, which topology would require most extensive calling
- (a) Mesh
 - (b) Star
 - (c) Bus
 - (d) Ring
- 6 Which topology features a point to point line configuration
- (a) Mesh
 - (b) Star
 - (c) Ring
 - (d) All of above
- 7 A cable break in which topology stops all transmission
- (a) Mesh
 - (b) Bus
 - (c) Star
 - (d) Primary
- 8 The OSI model consist of
- (a) 3 layers
 - (b) 5 layers
 - (c) 7 layers
 - (d) 8 layers
- 9 Dialog control is the function of which layer
- (a) Transport
 - (b) Session
 - (c) Presentation
 - (d) Application

10. Data unit is called a frame in
- (a) Physical layer
 - (b) Network layer
 - (c) Presentation layer
 - (d) Data link layer
11. Communication between a computer and a keyboard involves _____ transmission.
- (a) simplex
 - (b) half-duplex
 - (c) full-duplex
 - (d) automatic
12. A television broadcast is an example of _____ transmission.
- (a) simplex
 - (b) half-duplex
 - (c) full-duplex
 - (d) automatic
13. A _____ connection provides a dedicated link between two devices.
- (a) point-to-point
 - (b) multipoint
 - (c) primary
 - (d) secondary
14. In a _____ connection, more than two devices can share a single link.
- (a) point-to-point
 - (b) multipoint
 - (c) primary
 - (d) secondary
15. In _____ transmission, the channel capacity is shared by both communicating devices at all times.
- (a) simplex
 - (b) half-duplex
 - (c) full-duplex
 - (d) half-simplex
16. In the original ARPANET, _____ were directly connected together.
- (a) IMPs
 - (b) host computers
 - (c) networks
 - (d) routers

17. This was the first network.
- (a) CSNET
 - (b) NSFNET
 - (c) ANSNET
 - (d) ARPANET
18. Which organization has authority over interstate and international commerce in the communications field?
- (a) ITU-T
 - (b) IEEE
 - (c) FCC
 - (d) ISOC
19. _____ are special-interest groups that quickly test, evaluate, and standardize new technologies.
- (a) Forums
 - (b) Regulatory agencies
 - (c) Standards organizations
 - (d) All of the above
20. Which agency developed standards for physical connection interfaces and electronic signaling specifications?
- (a) EIA
 - (b) ITU-T
 - (c) ANSI
 - (d) ISO
21. _____ is the protocol suite for the current Internet.
- (a) TCP/IP
 - (b) NCP
 - (c) UNIX
 - (d) ACM
22. _____ refers to the structure or format of the data, meaning the order in which they are presented.
- (a) Semantics
 - (b) Syntax
 - (c) Timing
 - (d) All of the above

23. _____ defines how a particular pattern to be interpreted, and what action is to be taken based on that interpretation.
- (a) Semantics
 - (b) Syntax
 - (c) Timing
 - (d) None of the above
24. _____ refers to two characteristics: when data should be sent and how fast it can be sent.
- (a) Semantics
 - (b) Syntax
 - (c) Timing
 - (d) none of the above
25. The _____ layer is responsible for the delivery of a message from one process to another.
- (a) physical
 - (b) transport
 - (c) network
 - (d) none of the above
26. The Internetworking Protocol (IP) is a _____ protocol.
- (a) reliable
 - (b) connection-oriented
 - (c) both a and b
 - (d) none of the above
27. _____ is a process-to-process protocol that adds only port addresses, checksum error control, and length information to the data from the upper layer.
- (a) TCP
 - (b) UDP
 - (c) IP
 - (d) none of the above
28. _____ provides full transport layer services to applications.
- (a) TCP
 - (b) UDP
 - (c) ARP
 - (d) none of the above
29. The _____ address, also known as the link address, is the address of a node as defined by its LAN or WAN.
- (a) port
 - (b) physical
 - (c) logical
 - (d) none of the above

30. Ethernet uses a _____ physical address that is imprinted on the network interface card (NIC).
- (a) 32-bit
 - (b) 64-bit
 - (c) 6-byte
 - (d) none of the above
31. Which layer links the network support layers and user support layers
- (a) session layer
 - (b) data link layer
 - (c) transport layer
 - (d) network layer
32. Which address is used in an internet employing the TCP/IP protocols?
- (a) physical address and logical address
 - (b) port address
 - (c) specific address
 - (d) all of the mentioned
33. Which address identifies a process on a host?
- (a) physical address
 - (b) logical address
 - (c) port address
 - (d) specific address
34. Transmission data rate is decided by
- (a) network layer
 - (b) physical layer
 - (c) data link layer
 - (d) transport layer
35. Physical layer provides
- (a) mechanical specifications of electrical connectors and cables
 - (b) electrical specification of transmission line signal level
 - (c) specification for IR over optical fiber
 - (d) all of the mentioned
36. The physical layer translates logical communication requests from the _____ into hardware specific operations.
- (a) data link layer
 - (b) network layer
 - (c) transport layer
 - (d) application layer

37. A single channel is shared by multiple signals by
- (a) analog modulation
 - (b) digital modulation
 - (c) multiplexing
 - (d) none of the mentioned
38. Wireless transmission can be done via
- (a) radio waves
 - (b) microwaves
 - (c) infrared
 - (d) all of the mentioned
39. In asynchronous serial communication the physical layer provides
- (a) start and stop signaling
 - (b) flow control
 - (c) both (a) and (b)
 - (d) none of the mentioned
40. The physical layer is responsible for
- (a) line coding
 - (b) channel coding
 - (c) modulation
 - (d) all of the mentioned
41. Attenuation means
- (a) loss of energy
 - (b) change in form or shape of a signal
 - (c) crosstalk
 - (d) difference in frequency
42. If r is the number of data elements carried per signal element, N is the data rate, and S is the signal rate, then
- (a) $S = N \times r$
 - (b) $S = N/r$
 - (c) $N = S \times r \times r$
 - (d) None of the above
43. NRZ L and NRZ I differ in
- (a) synchronization
 - (b) transition
 - (c) Both a and b
 - (d) None

44. Analog to digital conversion can be done using
- (a) PCM
 - (b) DM
 - (c) Both a and b
 - (d) Neither a nor b
45. The frequency of the modulated signal is constant for the duration of one signal element, but changes for the next signal element if the data element changes. Both peak amplitude and phase remain constant for all signal elements. This is
- (a) PSK
 - (b) FSK
 - (c) ASK
 - (d) None of the above
46. QAM combines
- (a) ASK and FSK
 - (b) FSK and PSK
 - (c) ASK and PSK
 - (d) None of the above
47. Differential Manchester and multi line transmission (MLT-3) schemes differ in
- (a) Number of transition rules to encode binary data
 - (b) Self synchronization
 - (c) Both a and b
 - (d) None of the above
48. OSI model defines an open system as
- (a) a set of protocols that allows any two different systems to communicate
 - (b) a set of rules for open access
 - (c) a standard
 - (d) None of the above
49. 1 TeraHertz =
- (a) 1000000 Hz
 - (b) 1000000000 Hz
 - (c) 1000000000000 Hz
 - (d) None of the above
50. Shannon capacity formula for noisy channel is
- (a) $C = B \log (\text{SNR})$
 - (b) $C = B \log (1/\text{SNR})$
 - (c) $C = B \log (1 + \text{SNR})$
 - (d) None of the above

Ans. (1)(c), (2)(d), (3)(c), (4)(b), (5)(a), (6)(d), (7)(b), (8)(c), (9)(b), (10)(d), (11)(a), (12)(a), (13)(a), (14)(b), (15)(c), (16)(a), (17)(d), (18)(c), (19)(a), (20)(a), (21)(a), (22)(b), (23)(a), (24)(c), (25)(b), (26)(d), (27)(b), (28)(a), (29)(b), (30)(c), (31)(c), (32)(d), (33)(c), (34)(b), (35)(d), (36)(a), (37)(c), (38)(d), (39)(c), (40)(d), (41)(a), (42)(b), (43)(c), (44)(c), (45)(b), (46)(c), (47)(c), (48)(a), (49)(c), (50)(c)

(b) Fill in the Blanks:

- 1 The layer is a closest to the transmission medium.
- 2 Decryption and encryption of data are the responsibility of _____ layer.
- 3 The _____ layer can use the trailer of the frame for error detection.
- 4 The physical layer is concerned with the transmission of _____ over the physical medium.
- 5 _____ cable consists of an inner copper core and a second conducting outer sheath.
- 6 In fiber, the signal source is _____ waves.
- 7 Unipolar, polar and bipolar are types of _____ encoding.
- 8 _____ is the number of bits per second.
- 9 _____, _____ and _____ are types of digital to analog conversion.
- 10 _____ is the number of signal units per second.

Ans. (1)(Physical), (2)(Presentation), (3)(Data Link), (4)(Bits), (5)(Co-axial), (6)(Light), (7)(Digital to digital), (8)(Bit-rate), (9)(ASK, FSK & PSK), (10)(Baud Rate)

II Short Answer Type Questions:

- 1 Identify the components of data communication.
- 2 What are the various forms of data?
- 3 Define the three transmission modes.
- 4 Name the five basic network topologies.
- 5 Distinguish between a peer-to-peer relationship and a primary secondary relationship.
- 6 Give the formula that finds the number of cable links necessary for a mesh network topology.
- 7 For each type of network topology, discuss the implication of single cable fault.
- 8 List two advantages of layering principle in computer networks.
- 9 Which OSI layers are the network support layers?
- 10 Which OSI layers are the uses support layers?
- 11 What is a peer-to-peer process?
- 12 What are the concerns of data link layer?
- 13 What are the responsibilities of transport layer?
- 14 What is digital to digital encoding?
- 15 Name the two major categories of transmission media.
- 16 What are the design factors for transmission media?
- 17 Name the advantages of optical fiber over twisted pair and co-axial cable.
- 18 Discuss the mode for propagating light along optical channels
- 19 Name three types of transmission impairment.

- 20 Define point to point and Multi point.
- 21 List some uses of computer networks.
- 22 A sine wave has a frequency of 6 Hz. What is its period?
- 23 A data stream is made of 10 0's. Encode this stream using following encoding scheme (a) Polar NRZ-L (b) RZ.
- 24 A data stream is made up of alternating 0's and 1's (starting with 0). Represent using following (a) Manchester; (b) Differential Manchester
- 25 If a signal is sample 8000 times per second, what is the interval between each sample.
- 26 Calculate the maximum bit rate for a channel having bandwidth 3100 HZ and S/N ratio of 20 Gb.
- 27 A system sends a signal that can assume 8 different voltage levels. It sends 400 of these signals per second. What are the level and list rates.
- 28 Explain the concept of handoffs in Mobile telephone system.
- 29 Explain PSTN.
- 30 Explain in detail about the types of topologies
- 31 What are two reasons for using layered protocols
- 32 What is the principle difference between connectionless and connection oriented communication
- 33 List two advantages and two disadvantages of having international standards for network protocol
- 34 Differentiate between microwave and radiowave.
- 35 Differentiate between multimode and monomode in Fibre optics.
- 36 How QAM is related to ASK and PSK?
- 37 What is sampling theorem?
- 38 Compare guided media with that of unguided media.
- 39 Differentiate between a low pass filter and a band pass filter
- 40 Explain different modes of transmission in an optical fiber.
- 41 Define QAM and draw the constellation diagram for 32 QAM.

III Long Answer Type Questions:

- 1 What is the difference between a protocol and a service interface? Explain in terms of a ISO seven layer model
- 2 Explain Guided and Unguided Media.
- 3 Explain the OSI Model.
- 4 Perform a comparative study between the ISO-OSI model and TCP/IP reference model.
- 5 Differentiate between LAN, MAN and WAN.
- 6 Using B8ZS, encode the bit stream 1000000000100. Assume polarity of the first 1 is positive.
- 7 Using HDB3 encode 1000000000100. Assume that the number of 1's so far is odd and the first 1 is positive.
- 8 The bit rate of a signal is 3000. If each signal element carries six bits, what is the band rate?
- 9 An analog signal carries 4 bits in each signal element. If 1000 signal elements are sent per second, find the bits rate and the bit rate.

- 10 Distinguish between circuit switching, message switching and packet switching.
- 11 Explain the OSI reference model of computer networks with focus on the main protocols at each layer
- 12 What is the essential difference between message switching and packet switching
- 13 Encode the following data into digital signals 11001010. Use NRZ-L, NRZ-----1, bipolar-AMI, Manchester and Differential manchesters formats
- 14 Describe AM, FM, and PM.
- 15 What are the functions performed by the Presentation Layer? Briefly discuss them.
- 16 With reference to ISO-OSI Reference model, briefly explain the function of the following devices:-(i) Repeater (ii) Bridge (iii) Router (iv) Gateway
- 17 What is Pulse Code Modulation (PCM)? Explain.
- 18 Convert the following digital data into digital signals using NRZ-I, Manchester and Differential Manchester encoding techniques: 11001101.
- 19 How is 2G mobile communication different from 3G mobile communication?
- 20 Explain multiplexing and its types with focus on its application in the Mobile telephone system.
- 21 Differentiate between OSI and TCP/IP reference models in terms of architecture.
- 22 Describe different types of communication satellites.
- 23 Encode the following bits into a digital signal using bipolar AMI and HDB3 encoding schemes : 1100100001101

UNIT - II

I Test Your Skills:

(a) State Whether the Following Statements are True or False:

- 1 Go Back N window size at receiver end is atmost $2^{(M-1)}$.
- 2 ALOHA lets stations sense the channel before sending the packets.
- 3 WiFi uses CSMA/CA for medium access.
- 4 Stop and Wait protocol is a simple flow control protocol.
- 5 CSMA is a collision free protocol.
- 6 Checksum is an effective error correction technique.
- 7 A good generator polynomial should not be a factor of $x+1$.
- 8 To detect upto s errors, the minimum hamming distance of a block code must be $s+1$.
- 9 A burst error means change in a bit or two in the data word.
- 10 ALOHA uses persistence strategies to send data over an idle channel.
- 11 A secondary station can send data to primary in POLL/SELECT without asking primary.
- 12 Gigabit Ethernet runs at speeds as high as 10 Gbps.
- 13 Standard Ethernet runs at 100 Mbps speed.
- 14 The address fields in Ethernet frame header are 32 bits long each.
- 15 Ethernet 10Base2 implementation uses twisted pair cables.

Ans. (1)(F), (2)(F), (3)(T), (4)(T), (5)(F), (6)(F), (7)(F), (8)(T), (9)(F), (10)(F), (11)(F), (12)(F), (13)(F), (14)(F), (15)(F)

(b) Multiple Choice Questions:

- 1 In sliding window, if the window size is 63, what is the range of sequence numbers?
 - (a) 0 to 63
 - (b) 0 to 64
 - (c) 1 to 63
 - (d) 1 to 64

- 2 Regulation of the rate of transmission of data frames is known as
 - (a) Line discipline
 - (b) Data rate control
 - (c) Flow control
 - (d) Switch control

- 3 When a primary device wants to send data to a secondary device, it needs to first send _____ frame.
 - (a) ACK
 - (b) Poll
 - (c) SEL
 - (d) ENQ

- 4 Flow control is needed to prevent
 - (a) Bit errors
 - (b) Overflow of sender buffer
 - (c) Overflow of receiver buffer
 - (d) Collision

- 5 A timer is set when _____ is sent.
 - (a) Packet
 - (b) ACK
 - (c) NAK
 - (d) All

6. In a Go-Back-N ARQ, if the window size is 63, what is the range of sequence numbers?
 - (a) 0 to 63
 - (b) 0 to 64
 - (c) 1 to 63
 - (d) 1 to 64

7. In Go-Back-N ARQ, if frames 4, 5, and 6 are received successfully, the receiver may send an ACK _____ to the sender.
 - (a) 5
 - (b) 6
 - (c) 7
 - (d) any of the above

8. ARQ stands for _____.
- (a) Automatic repeat quantization
 - (b) Automatic repeat request
 - (c) Automatic retransmission request
 - (d) Acknowledge repeat request
9. For Stop-and-Wait ARQ, for 10 data packets sent, _____ acknowledgments are needed.
- (a) exactly 10
 - (b) less than 10
 - (c) more than 10
 - (d) none of the above
10. HDLC is an acronym for _____.
- (a) High-duplex line communication
 - (b) High-level data link control
 - (c) Half-duplex digital link combination
 - (d) Host double-level circuit
11. Data link control deals with the design and procedures for _____ communication.
- (a) node-to-node
 - (b) host-to-host
 - (c) process-to-process
 - (d) none of the above
12. _____ in the data link layer separates a message from one source to a destination, or from other messages going from other sources to other destinations.
- (a) Digitizing
 - (b) Controlling
 - (c) Framing
 - (d) none of the above
13. In _____ framing, there is no need for defining the boundaries of frames.
- (a) fixed-size
 - (b) variable-size
 - (c) standard
 - (d) none of the above
14. In _____ framing, we need a delimiter (flag) to define the boundary of two frames.
- (a) fixed-size
 - (b) variable-size
 - (c) standard
 - (d) none of the above

15. _____ framing uses two categories of protocols: character-oriented and bit-oriented.
- (a) Fixed-size
 - (b) Variable-size
 - (c) Standard
 - (d) None of the above
16. In a _____ protocol, the data section of a frame is a sequence of characters.
- (a) bit-oriented
 - (b) character-oriented
 - (c) either (a) or (b)
 - (d) none of the above
17. In a _____ protocol, the data section of a frame is a sequence of bits.
- (a) byte-oriented
 - (b) bit-oriented
 - (c) either (a) or (b)
 - (d) none of the above
18. In _____ protocols, we use _____.
- (a) character-oriented; byte stuffing
 - (b) character-oriented; bit stuffing
 - (c) bit-oriented; character stuffing
 - (d) none of the above
19. Byte stuffing means adding a special byte to the data section of the frame when there is a character with the same pattern as the _____.
- (a) header
 - (b) trailer
 - (c) flag
 - (d) none of the above
20. In _____ protocols, we use _____.
- (a) byte-oriented; bit stuffing
 - (b) character-oriented; bit stuffing
 - (c) bit-oriented; bit stuffing
 - (d) none of the above
21. Bit stuffing means adding an extra 0 to the data section of the frame when there is a sequence of bits with the same pattern as the _____.
- (a) Header
 - (b) Trailer
 - (c) Flag
 - (d) None of the above

22. _____ control refers to a set of procedures used to restrict the amount of data that the sender can send before waiting for acknowledgment.
- (a) Flow
 - (b) Error
 - (c) Transmission
 - (d) None of the above
23. _____ control refers to methods of error detection and correction.
- (a) Flow
 - (b) Error
 - (c) Transmission
 - (d) None of the above
24. In a linear block code, the _____ of any two valid codewords creates another valid codeword
- (a) XORing
 - (b) ORing
 - (c) ANDing
 - (d) none of the above
25. A simple parity-check code can detect _____ errors.
- (a) an even-number of
 - (b) two
 - (c) no errors
 - (d) an odd-number of
26. _____ codes are special linear block codes with one extra property. If a codeword is rotated, the result is another codeword.
- (a) Non-linear
 - (b) Convolution
 - (c) Cyclic
 - (d) none of the above
27. The _____ of errors is more difficult than the _____.
- (a) correction; detection
 - (b) detection; correction
 - (c) creation; correction
 - (d) creation; detection
28. In modulo-11 arithmetic, we use only the integers in the range _____, inclusive.
- (a) 1 to 10
 - (b) 1 to 11
 - (c) 0 to 10
 - (d) none of the above

29. In modulo-2 arithmetic, we use only _____.
- (a) 1 and 2
 - (b) 0 and 2
 - (c) 0 and 1
 - (d) none of the above
30. Adding 1 and 1 in modulo-2 arithmetic results in _____.
- (a) 1
 - (b) 2
 - (c) 0
 - (d) none of the above
31. Which one of the following task is not done by data link layer?
- (a) framing
 - (b) error control
 - (c) flow control
 - (d) channel coding
32. Which sublayer of the data link layer performs data link functions that depend upon the type of medium?
- (a) logical link control sublayer
 - (b) media access control sublayer
 - (c) network interface control sublayer
 - (d) none of the above
33. Header of a frame generally contains
- (a) synchronization bytes
 - (b) addresses
 - (c) frame identifier
 - (d) all of the above
34. When 2 or more bits in a data unit has been changed during the transmission, the error is called
- (a) random error
 - (b) burst error
 - (c) inverted error
 - (d) none
35. CRC stands for
- (a) cyclic redundancy check
 - (b) code repeat check
 - (c) code redundancy check
 - (d) cyclic repeat check

36. Which one of the following is a data link protocol?
- (a) Ethernet
 - (b) point to point protocol
 - (c) HDLC
 - (d) all of the above
37. The technique of temporarily delaying outgoing acknowledgements so that they can be hooked onto the next outgoing data frame is called
- (a) piggybacking
 - (b) cyclic redundancy check
 - (c) fletcher's checksum
 - (d) none of the mentioned
38. The data link layer takes the packets from _____ and encapsulates them into frames for transmission.
- (a) network layer
 - (b) physical layer
 - (c) transport layer
 - (d) application layer
39. The maximum size of payload field in Ethernet frame is
- (a) 1000 bytes
 - (b) 1200 bytes
 - (c) 1300 bytes
 - (d) 1500 bytes
40. What is inter-frame gap?
- (a) idle time between frames
 - (b) idle time between frame bits
 - (c) idle time between packets
 - (d) none of the above
41. Error detection at the data link level is achieved by
- (a) Bit Stuffing
 - (b) Cyclic Redundancy Code
 - (c) Hamming Code
 - (d) Equalization
42. "BAUD" rate means
- (a) The number of bits transmitted per unit time.
 - (b) The number of bytes transmitted per unit time.
 - (c) The rate at which the signal changes.
 - (d) None of the above
43. Start and stop bits are used in serial communication for
- (a) Error detection
 - (b) Error correction

- (c) Synchronization
 - (d) Slowing down the communication
44. Unmodulated signal coming from a transmitter is known as
- (a) Carrier signal
 - (b) Baseband signal
 - (c) Primary signal
 - (d) None of these
45. Maximum data rate of a channel for a noiseless 3-kHz binary channel is
- (a) 3000bps
 - (b) 6000 bps
 - (c) 1500 bps
 - (d) None of these
46. The _____ measures the number of lost or garbled messages as a fraction of the total sent in the sampling period.
- (a) Residual Error Rate.
 - (b) Transfer Failure Probability.
 - (c) Connection release failure probability.
 - (d) Connection establish.
47. In session layer, during data transfer, the data stream responsible for the "control" purpose (i.e control of the session layer itself) is
- (a) Regular Data
 - (b) Typed data
 - (c) Capability Data
 - (d) Expedited Data
48. Which of the following is not a field in the Ethernet Message packet?
- (a) Type
 - (b) Data
 - (c) Pin-code
 - (d) Address
49. The Network topology that supports bi-directional links between each possible node is
- (a) Ring
 - (b) Star
 - (c) Tree
 - (d) Mesh
50. Which network has connectivity range up to 10 meters?
- (a) LAN
 - (b) PAN
 - (c) MAN
 - (d) WAN

Ans. (1)(a), (2)(b), (3)(d), (4)(c), (5)(a), (6)(a), (7)(c), (8)(b), (9)(a), (10)(b), (11)(a), (12)(c), (13)(a), (14)(b), (15)(b), (16)(b), (17)(b), (18)(a), (19)(c), (20)(c), (21)(c), (22)(a), (23)(b), (24)(a), (25)(d), (26)(c), (27)(a), (28)(c), (29)(c), (30)(c), (31)(d), (32)(b), (33)(d), (34)(b), (35)(a), (36)(d), (37)(a), (38)(a), (39)(d), (40)(a), (41)(b), (42)(c), (43)(c), (44)(b), (45)(b), (46)(a), (47)(c), (48)(c), (49)(d), (50)(b)

(c) Fill in the Blanks:

- 1 _____ decides the sole of a device on a network.
- 2 In go back n ARQ, if frames 4, 5 & 6 are received successfully, the receiver may send an ACK _____ to sender.
- 3 In stop and wait ARQ if data has an error the receiver sends a _____ frame.
- 4 ARQ stands for _____.
- 5 For stop and wait flow control, for n data packets sent, _____ acknowledgments are needed.
- 6 Errors detection is usually done in _____ layer.
- 7 In CRC there is no error if the remainder at the receiver is _____.
- 8 At CRC generator, _____ are added to the data unit before division.
- 9 At CRC generator, _____ are added to the data unit after division process.
- 10 At the CRC checker, _____ means that the data unit is damaged.

Ans. (1)(Line Discipline), (2)(7), (3)(NAK), (4)(Automotive Repeat Request), (5)(n), (6)(Data Link), (7)(Zero), (8)(0's), (9)(CRC Remainder), (10)(A strong of 0's)

II Short Answer Type Questions:

- 1 State the various design issues for the data link layer.
- 2 What are different framing methods?
- 3 What is byte stuffing?
- 4 Explain character stuffing.
- 5 What is piggybacking?
- 6 Explain the stop and wait protocol.
- 7 Explain the go back n protocol.
- 8 Draw and explain the frame structure of HDLC.
- 9 Explain the role of minimum distance in error correction and detection.
- 10 Write the function of Media Access Control Sublayer?
- 11 Write the functions of Logical Link Control (LLC) sublayer.
- 12 Explain the components of Bluetooth.
- 13 Compare a piconet and scatternet
- 14 What are the benefits of using Wireless networks?
- 15 Compare 1 persistent CSMA and P persistent CSMA.
- 16 What are the channelization techniques?
- 17 Explain the frame format of Ethernet.

- 18 What is Binary and Potential Back off algorithm?
- 19 Compare Pure Aloha & Slotted Aloha.
- 20 Define collision?
- 21 Define sliding window.
- 22 Explain CSMA/CD.
- 23 Which encoding scheme is used in Ethernet?
- 24 Explain in brief FDDI.
- 25 Describe the three HDLC station types.
- 26 How do the three HDLC frame type differ from one another.
- 27 What is the mechanism of stop and wait flow control.
- 28 What is the mechanism of sliding window flow control?
- 29 What is the mechanism of stop and wait ARQ error control.
- 30 In stop and wait flow control, discuss the handling of (a) Damaged Frame; (b) Lost Frame.
- 31 Define simple parity check code.
- 32 Define hamming distance.
- 33 Explain Vertical Redundancy Check (VRC) method.
- 34 Briefly discuss the LRC method.
- 35 How does a single bit error differ from Burst Error
- 36 Discuss the Hamming Code Method.
- 37 Explain the concept of window size in sliding window protocol.
- 38 What are the two sub layers of Data Link layer and define its functionalities.
- 39 Draw the frame format of Ethernet.
- 40 List out the Ethernet types.
- 41 Differentiate between static and dynamic channel allocation
- 42 If a binary signal is sent over a 3-khz channel whose signal to noise ratio is 20db. What is the key maximum achievable data rate?
- 43 Why can't wireless LANs use CSMA/CD?
- 44 What are collision free media access protocols?
- 45 What are the implementations of Fast Ethernet?
- 46 What is autonegotiation?
- 47 Differentiate between GoBackN and Selective Repeat sliding window protocols.
- 48 Why do we need flow control?
- 49 Differentiate between ALOHA and Slotted ALOHA.
- 50 What is channel allocation problem?

III Long Answer Type Questions:

- 1 Define CRC. Explain CRC generator & CRC checks in detail with one example
- 2 Explain in detail about error correction using Hamming code
- 3 A sliding window protocol uses a window of size 15. How many bits are needed to define the sequence number?
- 4 Find the LRC for the following block of data 10011001 01101111.
- 5 Find the binary equivalent of $x^8 + x^3 + x + 1$.
- 6 Given a 10-bit sequence 1010011110 and a divisor of 1011, find the CRC.

- 7 Discuss limitations of Stop and Wait Protocol.
- 8 (a) Given a 10 bit sequence 1010011110 and a divisor of 1011 find the CRC. Check the answer
- (b) Bit stuff the following data
- i) 0001111110111110011110011111001
- ii) 0001111111111111111111111111111111111110011111001
- 9 What is the level of reliability provided by the simple parity scheme in error detection
- 10 What is IEEE 802.3? What are the types of Ethernet? Discuss.
- 11 A bit stream 10011101 is transmitted using the standard CRC method. This generator polynomial $x^3 + 1$ is used. Show the actual bits transmitted. Suppose the third bit from the left is inverted during transmission. Show that this error is detected at the receiver's end.
- 12 Datalink protocols almost always put the CRC in a trailer rather than in a header. Why
- 13 Explain the following data link protocols a) HDLC b) PPP
- 14 Compare and contrast Single slave with that of multi slave communication in Bluetooth.
- 15 How the lost acknowledgement and lost frame are handled by the sender in Go-back-N ARQ technique? Explain with example.
- 16 Given a 10 bit sequence 1001101101 and a divisor is 1011, find the CRC. Also check your result.
- 17 What is frequency division multiple access (FDMA)? How is it different from time division multiple access (TDMA)?
- 18 How can we determine that in a message, how many errors can be corrected and how many detected based on Hamming Distance?
- 19 What is a two-dimensional parity check? Calculate the redundancy bits for the following data using the Hamming Code: 1100101011.
- 20 Differentiate between Selective Repeat and Go Back N sliding window protocol.
- 21 How are collisions avoided in a wireless network?
- 22 Describe a collision free protocol.
- 23 Draw the structure of an Ethernet frame.

UNIT - III

I Test Your Skills:

(a) State Whether the Following Statements are True or False:

- 1 Network layer performs error detection.
- 2 Flooding is a dynamic routing mechanism.
- 3 OSPF is based on distance vector routing.
- 4 Congestion control between hosts is achieved by network layer.
- 5 IPv6 is denoted in dotted decimal representation.
- 6 IPv4 headers are fixed sized 10 byte headers.
- 7 Connecting devices meant for routing of packets are hubs.
- 8 Intra domain routing protocols are classified into distance vector and link state routing.
- 9 Link state routing protocols suffer from two node instability problem.
- 10 Network layer protocols perform media access control.
- 11 RSVP protocol is a class based quality control protocol.

- 12 Token bucket mechanism is better than leaky bucket mechanism in case of bursty traffic conditions.
- 13 Router buffers are unlimited in size.
- 14 RIP protocol defines infinity as 16.
- 15 Load shedding is the last resort to avoid congestion.

Ans. (1)(F), (2)(F), (3)(F), (4)(T), (5)(F), (6)(F), (7)(F), (8)(T), (9)(F), (10)(F), (11)(F), (12)(T), (13)(F), (14)(T), (15)(T)

(b) State Whether the Following Statements are True or False:

- 1 An IP datagram is a fixed-length datagram.
- 2 ARP is used for address binding.
- 3 The internet layer follows a datagram philosophy.
- 4 IP is a connection oriented protocol.
- 5 If a datagram is fragmented, the fragmentation offset field is useful.

Ans. (1)(F), (2)(T), (3)(T), (4)(F), (5)(T)

(c) Multiple Choice Questions:

- 1 Layer 2 from bottom in TCP/IP is the _____.
 - (a) Physical layer
 - (b) Application layer
 - (c) Transport layer
 - (d) Internet layer
- 2 IP address _____ the physical address.
 - (a) is the same as
 - (b) has no relation with
 - (c) means
 - (d) none
- 3 IP makes a _____ of datagram delivery.
 - (a) worst effort
 - (b) guaranteed delivery
 - (c) best effort
 - (d) all of the above
- 4 The _____ for all computers on the same physical network is the same.
 - (a) host id
 - (b) physical address
 - (c) IP address
 - (d) n/w-id

- 5 In _____ forwarding, the mask and destination addresses are both 0.0.0.0 in the routing table.
- (a) next-hop
 - (b) network-specific
 - (c) host-specific
 - (d) default
- 6 In _____ forwarding, the destination address is a network address in the routing table.
- (a) next-hop
 - (b) network-specific
 - (c) host-specific
 - (d) default
- 7 In _____ forwarding, the routing table holds the address of just the next hop instead of complete route information.
- (a) next-hop
 - (b) network-specific
 - (c) host-specific
 - (d) default
- 8 The idea of address aggregation was designed to alleviate the increase in routing table entries when using _____.
- (a) classful addressing
 - (b) classless addressing
 - (c) both a and b
 - (d) none of the above
- 9 The principle of _____ states that the routing table is sorted from the longest mask to the shortest mask.
- (a) first mask matching
 - (b) shortest mask matching
 - (c) longest mask matching
 - (d) none of the above
- 10 The use of hierarchy in routing tables can _____ the size of the routing tables.
- (a) reduce
 - (b) increase
 - (c) both a and b
 - (d) none of the above
11. An ARP reply is normally _____.
- (a) broadcast
 - (b) multicast
 - (c) unicast
 - (d) none of the above

12. An ARP request is normally _____.
- (a) broadcast
 - (b) multicast
 - (c) unicast
 - (d) none of the above
13. A technique called _____ is used to create a subnetting effect.
- (a) ARP
 - (b) RARP
 - (c) proxy ARP
 - (d) none of the above
14. A _____ is an ARP that acts on behalf of a set of hosts.
- (a) ARP
 - (b) RARP
 - (c) proxy ARP
 - (d) none of the above
15. ICMP is a _____ layer protocol.
- (a) data link
 - (b) transport
 - (c) network
 - (d) none of the above
16. ICMP messages are divided into two broad categories: _____.
- (a) query and error reporting messages
 - (b) request and response messages
 - (c) request and reply messages
 - (d) none of the above
17. An ICMP message has _____ header and a variable-size data section.
- (a) a 16-byte
 - (b) a 32-byte
 - (c) an 8-byte
 - (d) none of the above
18. Which of the following is true about ICMP messages?
- (a) An ICMP error message may be generated for an ICMP error message.
 - (b) An ICMP error message may be generated for each fragment.
 - (c) An ICMP error message may be generated for a multicast datagram.
 - (d) none is true
19. Which of the following is true about ICMP messages?
- (a) An ICMP error message may be generated for an ICMP error message.
 - (b) An ICMP error message may be generated only for the first fragment.
 - (c) An ICMP error message may be generated for a multicast datagram.
 - (d) none is true

20. IGMP is a companion to the _____ protocol.
- (a) UDP
 - (b) TCP
 - (c) ICM
 - (d) None of the above
21. IGMP is _____ protocol.
- (a) an error reporting
 - (b) a group management
 - (c) a transmission
 - (d) none of the above
22. The number of addresses in a class A block is _____.
- (a) 65,534
 - (b) 16,777,216
 - (c) 256
 - (d) none of the above
23. The number of addresses assigned to an organization in classless addressing _____.
- (a) can be any number
 - (b) must be a multiple of 256
 - (c) must be a power of 2
 - (d) none of the above
24. The first address assigned to an organization in classless addressing _____.
- (a) must be a power of 4
 - (b) must be evenly divisible by the number of addresses
 - (c) must belong to one of the A, B, or C classes
 - (d) none of the above
25. Which address could be the beginning address of a block of 32 classless addresses?
- (a) 2.4.6.5
 - (b) 2.4.6.16
 - (c) 2.4.6.64
 - (d) none of the above
26. A _____ is a local address. Its jurisdiction is over a local network.
- (a) physical
 - (b) logical
 - (c) a and b
 - (d) none of the above

27. If the sender is a host and wants to send a packet to another host on the same network, the logical address that must be mapped to a physical address is _____.
(a) the destination IP address in the datagram header
(b) the IP address of the router found in the routing table
(c) either a or b
(d) none of the above
28. If the sender is a host and wants to send a packet to another host on another network, the logical address that must be mapped to a physical address is _____.
(a) the destination IP address in the datagram header
(b) the IP address of the router found in the routing table
(c) either a or b
(d) none of the above
29. The sender is a router that has received a datagram destined for a host on another network. The logical address that must be mapped to a physical address is _____.
(a) the destination IP address in the datagram header
(b) the IP address of the router found in the routing table
(c) either a or b
(d) none of the above
30. The sender is a router that has received a datagram destined for a host on the same network. The logical address that must be mapped to a physical address is _____.
(a) the destination IP address in the datagram header
(b) the IP address of the router found in the routing table
(c) either a or b
(d) none of the above
31. Which one of the following is not a function of network layer?
(a) routing
(b) inter-networking
(c) congestion control
(d) none of the above
32. The 4 byte IP address consists of
(a) network id
(b) host id
(c) both (a) and (b)
(d) none of the above
33. In virtual circuit network each packet contains
(a) full source and destination address
(b) a short VC number
(c) both (a) and (b)
(d) none of the above

34. Which one of the following routing algorithm can be used for network layer design?
- (a) shortest path algorithm
 - (b) distance vector routing
 - (c) link state routing
 - (d) all of the above
35. Multi-destination routing
- (a) is same as broadcast routing
 - (b) contains the list of all destinations
 - (c) data is not sent by packets
 - (d) none of the above
36. A subset of a network that includes all the routers but contains no loops is called
- (a) spanning tree
 - (b) spider structure
 - (c) spider tree
 - (d) none
37. Which one of the following algorithm is not used for congestion control?
- (a) traffic aware routing
 - (b) admission control
 - (c) load shedding
 - (d) none
38. The network layer protocol of internet is
- (a) Ethernet
 - (b) internet protocol
 - (c) hypertext transfer protocol
 - (d) none of the above
39. ICMP is primarily used for
- (a) error and diagnostic functions
 - (b) addressing
 - (c) forwarding
 - (d) none of the above
40. The PDU of network layer is
- (a) bits
 - (b) frames
 - (c) packets
 - (d) none
41. Which of the following is a wrong example of network layer?
- (a) Internet Protocol (IP) - ARPANET
 - (b) X.25 Packet Level Protocol (PLP)-ISO
 - (c) Source routing and domain naming-USENet
 - (d) X.25 level 2-ISO

42. For data communications to occur, the communicating devices must be part of a communication system made up of a combination of?
- (a) WAN and LAN
 - (b) Hardware and software
 - (c) Full duplex and half duplex
 - (d) All of the above
43. Time required for a message to travel from one device to another is known as:
- (a) Transit time
 - (b) Dialogue time
 - (c) Response time
 - (d) Wait time
44. Which network is a cross between circuits switched network and a data-gram network?
- (a) Circuit-switched network
 - (b) Virtual-circuit network
 - (c) Virtual-circuit identifier
 - (d) None of these
45. Switching at the network layer in the Internet uses the datagram approach to:
- (a) Message switching
 - (b) Circuit switching
 - (c) IP switching
 - (d) Packet switching
46. Which is also known as a connectionless protocol for a packet-switching network that uses the Datagram approach?
- (a) IPV5
 - (b) IPV4
 - (c) IPV6
 - (d) None of these
47. Which switch is a multistage switch with micro switches at each stage that route the packets based on the output port represented as a binary string?
- (a) Banyan switch
 - (b) Crossbar switch
 - (c) Multistage crossbar
 - (d) Packet switch
48. In Address Resolution Protocol (ARP), a packet is encapsulated directly into a
- (a) Data link Integer
 - (b) data link IP
 - (c) Data link Station
 - (d) Data link Frame

49. Subnetting is actually
 (a) collection of networks
 (b) sub division of networks
 (c) one sub network
 (d) None
50. Packets in IPv4 layer are called
 (a) datagrams
 (b) header length
 (c) code point
 (d) tunneling

Ans. (1)(d), (2)(b), (3)(c), (4)(d),(5)(d), (6)(b), (7)(a), (8)(b), (9)(c), (10)(a), (11)(c), (12)(a), (13)(c), (14)(c), (15)(c), (16)(a), (17)(c), (18)(d), (19)(b), (20)(d), (21)(b), (22)(b), (23)(c), (24)(b), (25)(c), (26)(a), (27)(a), (28)(b), (29)(b), (30)(a), (31)(d), (32)(c), (33)(b), (34)(d), (35)(c), (36)(a), (37)(d), (38)(b), (39)(a), (40)(c), (41)(d), (42)(b), (43)(a), (44)(b), (45)(d), (46)(b), (47)(a), (48)(d), (49)(b), (50)(a)

(c) Fill in the Blanks:

- 1 When a datagram cannot be delivered to a destination, a router sends a message _____.
- 2 The MTU of _____ is the highest.
- 3 A zero in the “more fragments” flag indicates that _____.
- 4 The time to live field in a IP datagram is related to the _____ message.
- 5 The header portion of an IP datagram is _____.
- 6 The maximum number of class B network is _____.

Ans. (1)(Destination unreachable), (2)(token ring), (3)(this is an IP datagram), (4)(ICMP), (5)(fragmented if required), (6)(16384)

II Short Answer Type Questions:

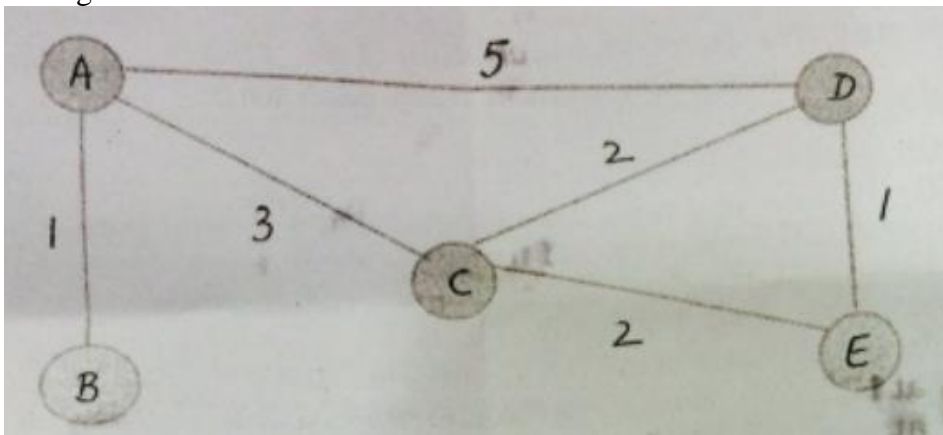
- 1 Describe the three parts of an IP address.
- 2 Why IP is called connectionless.
- 3 What is the purpose of the time to live field of the IP datagram header?
- 4 What is Maximum Transmission Unit?
- 5 Why IP is called a best-effort delivery protocol?
- 6 What is the use of routing table?
- 7 What is a router? How does it work?
- 8 How does a gateway work?
- 9 Define Unicast, multicast and broadcast
- 10 Explain internet hierarchy in brief?
- 11 What is use of Router?

- 12 What are the two main elements of distance vector routing?
- 13 Why is Inter-networking important?
- 14 What is a Virtual Network?
- 15 Explain the internal architecture of an ISP in detail.
- 16 Explain the Internet Topology in detail.
- 17 How can a user access Internet over the cable television? What are the requirements for this?
- 18 Explain the typical dial-up connection between a home user and an ISP.
- 19 Explain Address Resolution Protocol in detail. Illustrate.
- 20 What do you mean by Loopback in IPV4?
- 21 Find the class of each IP address given suitable explanation.
 - (a) 227.12.14.87
 - (b) 193.14.56.22
 - (c) 14.23.120.8
 - (d) 252.5.15.111
 - (e) 134.11.78.56
 - (f) 000 000 00 1111 0000 11111111 00110011
- 22 Identify the class and default subnet mask of the IP address 217.65.10.7.
- 23 Explain RARP. Why is it required? Illustrate.
- 24 Find the error if any the following IP address.
 - (a) 111.56.045.78
 - (b) 75.45.301.14
- 25 Explain routing of mobile hosting.
- 26 What is the key difference between 2g and 3g mobile networks
- 27 Describe the characteristics of 10 base 5 and 10 base 2 ethernet cables.
- 28 List all the congestion control techniques implemented at the network layer.
- 29 Differentiate between subnetting and supernetting.
- 30 What are various classes of IP Addresses?
- 31 What is router solicitation and advertisement?
- 32 What is jitter? How can we control jitter by buffering?
- 33 What is classful addressing?
- 34 What is the utility of NAT?

III Long Answer Type Questions:

- 1 Give a brief description of two groups of multicasting routing protocols. Illustrate using diagrams.
- 2 Explain in detail the Intra-domain routing protocols.
- 3 Explain in detail ICMP. Draw its message format.
- 4 What are the limitations of distance vector routing? How are they addressed in link state routing?
- 5 Why congestion does takes place in computer networks. How is congestion control done in datagram subnets

- 6 Describe the count to infinity problem
- 7 Differentiate between adaptive and non-adaptive routing algorithms with examples
- 8 Differentiate between classful addressing and classless addressing. Give examples.
- 9 What is routing in a network layer? Explain any two routing algorithms.
- 10 What is ARP? Briefly explain its functioning.
- 11 Why is IP called Best-Effort-Delivery protocol? Discuss how fragmentation is done in IP datagram?
- 12 What are the various congestion prevention policies on various layers?
- 13 What are the various unicast routing protocols? Explain an interdomain routing protocol.
- 14 Explain the IPv4 with the help of a datagram format.
- 15 Explain different types of ICMP messages.
- 16 Find the appropriate route from A to E in the following network through distance vector routing.



- 17 Describe congestion control and the methods to control congestion on a network.

IV Practical/Numerical Questions:

- 1 What is the type of each of the following addresses?
 - (a) FFO2 :: 0
 - (b) FEC0:: Z4A2
 - (c) FE80:: 12
 - (d) FE79:: 14

- 2 What is the address space in each of the following systems?
 - (a) A system with 16-bit addresses.
 - (b) A system with 64-bit addresses.
 - (c) A system with 128 bit addresses.

- 3 Show in hexadecimal colon notation
 - (a) The link level address in which the node identifier is O:: 124/48.
 - (b) The site local address in which the node identifier is O:: 124/48.

- 4 Find the net-id and hosted of the following addresses
- (a) 117.34.3.8
 - (b) 132.57.8.6
 - (c) 207.3.54.12
- 5 An organization is granted the block 130.56.0.0/16. The administrator wants to create 1024 subnets.
- (a) Find the subnet mask.
 - (b) Find the no. of addresses in each subnet.
 - (c) Find the 1st and last addresses in subnet 1.
 - (d) Find the 1st and last addresses in subnet 1024.

UNIT - IV

I Test Your Skills:

(a) State Whether the Following Statements are True or False:

- 1 The transport layer runs on top of the internal layer.
- 2 A server is always passive.
- 3 TCP is iterative.
- 4 A TCP packet consists of a header of size 20 to 60 bytes.
- 5 A SYN flag is used when TCP connection is being established or closed between two hosts.
- 6 UDP is a connection less reliable protocol
- 7 UDP is suitable for a process that requires simple request-response communication with little concern for flow and error control.
- 8 TCP provides process-to-process communication using port numbers.
- 9 TCP is a message oriented protocol.
- 10 Each byte is given a unique sequence number in TCP data transmission.
- 11 Acknowledgements are cumulative in sliding window GoBackN protocol.
- 12 FIN flag is set in a segment meant to release a TCP connection.
- 13 Maximum window size of hosts using TCP protocol is 65535 bytes.
- 14 TCP connections are established using four way handshake.
- 15 A SYN + ACK segment cannot carry data.

Ans. (1)(T), (2)(T), (3)(T), (4)(T), (5)(F), (6)(F), (7)(T), (8)(T), (9)(F), (10)(T), (11)(T), (12)(T), (13)(T), (14)(F), (15)(T)

(b) Multiple Choice Questions:

- 1 Transport layer protocols are useful for ensuring _____ delivery.
 - (a) H-2-H
 - (b) H-2-R
 - (c) N/W-2-N/W
 - (d) End-2-End

- 2 _____ is a reliable delivery mechanism.
- (a) IP
 - (b) TCP
 - (c) UDP
 - (d) ARP
- 3 Transport layer is _____ the data link layer.
- (a) Above
 - (b) Below
 - (c) Depended on
 - (d) None of the above
- 4 When a packet is lost in transit, it should be handled by _____.
- (a) Sequence control
 - (b) Loss control
 - (c) Error control
 - (d) Duplication control
- 5 Internet is
- (a) a local computer network
 - (b) a worldwide network of computers
 - (c) an interconnected network of computers
 - (d) a worldwide interconnected network of computers which use a common protocol to communicate with one another
- 6 World Wide Web
- (a) is another name for internet
 - (b) worldwide connection for computers
 - (c) a collection of linked information residing on computers connected by the internet
 - (d) a collection of worldwide information
- 7 HTML tags define
- (a) The data types of elements of document
 - (b) Presentation of specified elements of a document
 - (c) The contents of the document
 - (d) The structure of the document
8. One of the responsibilities of the transport layer protocol is to create a _____ communication.
- (a) host-to-host
 - (b) process-to-process
 - (c) node-to-node
 - (d) none of the above

9. UDP is called a _____ transport protocol.
- (a) connectionless, reliable
 - (b) connection-oriented, unreliable
 - (c) connectionless, unreliable
 - (d) none of the above
10. UDP does not add anything to the services of IP except for providing _____ communication.
- (a) node-to-node
 - (b) process-to-process
 - (c) host-to-host
 - (d) none of the above
11. UDP is an acronym for _____.
- (a) User Delivery Protocol
 - (b) User Datagram Procedure
 - (c) User Datagram Protocol
 - (d) None of the above
12. Although there are several ways to achieve process-to-process communication, the most common is through the _____ paradigm.
- (a) client-server
 - (b) client-client
 - (c) server-server
 - (d) none of the above
13. The local host and the remote host are defined using IP addresses. To define the processes, we need second identifiers called _____.
- (a) UDP addresses
 - (b) transport addresses
 - (c) port addresses
 - (d) none of the above
14. The ports ranging from 49,152 to 65,535 can be used as temporary or private port numbers. They are called the _____ ports.
- (a) well-known
 - (b) registered
 - (c) dynamic
 - (d) none of the above
15. In the sending computer, UDP receives a data unit from the _____ layer.
- (a) application
 - (b) transport
 - (c) IP
 - (d) none of the above

16. In the sending computer, UDP sends a data unit to the _____ layer.
- (a) application
 - (b) transport
 - (c) IP
 - (d) none of the above
17. UDP and TCP are both _____ layer protocols.
- (a) data link
 - (b) network
 - (c) transport
 - (d) none of the above
18. Which of the following functions does UDP perform?
- (a) process-to-process communication
 - (b) host-to-host communication
 - (c) end-to-end reliable data delivery
 - (d) none of the above
19. When the IP layer of a receiving host receives a datagram, _____.
- (a) delivery is complete
 - (b) a transport layer protocol takes over
 - (c) a header is added
 - (d) none of the above
20. UDP needs the _____ address to deliver the user datagram to the correct application process.
- (a) port
 - (b) application
 - (c) internet
 - (d) none of the above
21. A port address in UDP is _____ bits long.
- (a) 8
 - (b) 16
 - (c) 32
 - (d) any of the above
22. Which of the following does UDP guarantee?
- (a) flow control
 - (b) connection-oriented delivery
 - (c) flow control
 - (d) none of the above

23. Message _____ means that the receiver is ensured that the message is coming from the intended sender, not an imposter.
- (a) confidentiality
 - (b) integrity
 - (c) authentication
 - (d) none of the above
24. _____ means that a sender must not be able to deny sending a message that he sent.
- (a) Confidentiality
 - (b) Integrity
 - (c) Authentication
 - (d) Non-repudiation
25. _____ means to prove the identity of the entity that tries to access the system's resources.
- (a) Message authentication
 - (b) Entity authentication
 - (c) Message confidentiality
 - (d) none of the above
26. A(n) _____ can be used to preserve the integrity of a document or a message.
- (a) message digest
 - (b) message summary
 - (c) encrypted message
 - (d) none of the above
27. A(n) _____ function creates a message digest out of a message.
- (a) encryption
 - (b) decryption
 - (c) hash
 - (d) none of the above
28. A hash function must meet _____ criteria.
- (a) two
 - (b) three
 - (c) four
 - (d) none of the above
29. Challenge-response authentication can be done using _____.
- (a) symmetric-key ciphers
 - (b) asymmetric-key ciphers
 - (c) keyed-hash functions
 - (d) all of the above

30. A(n) _____ is a trusted third party that assigns a symmetric key to two parties.
- (a) KDC
 - (b) CA
 - (c) KDD
 - (d) none of the above
31. The _____ translates internet domain and host names to IP address.
- (a) domain name system
 - (b) routing information protocol
 - (c) network time protocol
 - (d) internet relay chat
32. Which one of the following allows a user at one site to establish a connection to another site and then pass keystrokes from local host to remote host?
- (a) HTTP
 - (b) FTP
 - (c) telnet
 - (d) none
33. Application layer protocol defines
- (a) types of messages exchanged
 - (b) message format, syntax and semantics
 - (c) rules for when and how processes send and respond to messages
 - (d) all of the above
34. Which one of the following protocol delivers/stores mail to receiver server?
- (a) simple mail transfer protocol
 - (b) post office protocol
 - (c) internet mail access protocol
 - (d) hypertext transfer protocol
35. Which one of the following is an internet standard protocol for managing devices on IP network?
- (a) dynamic host configuration protocol
 - (b) simple network management protocol
 - (c) internet message access protocol
 - (d) media gateway protocol
36. User datagram protocol is called connectionless because
- (a) all UDP packets are treated independently by transport layer
 - (b) it sends data as a stream of related packets
 - (c) both (a) and (b)
 - (d) none of the above

37. Transmission control protocol is
- (a) connection oriented protocol
 - (b) uses a three way handshake to establish a connection
 - (c) receives data from application as a single stream
 - (d) all of the above
38. An endpoint of an inter-process communication flow across a computer network is called
- (a) socket
 - (b) pipe
 - (c) port
 - (d) none of the above
39. Transport layer aggregates data from different applications into a single stream before passing it to
- (a) network layer
 - (b) data link layer
 - (c) application layer
 - (d) physical layer
40. The ASCII encoding of binary data is called
- (a) base 64 encoding
 - (b) base 32 encoding
 - (c) base 16 encoding
 - (d) base 8 encoding
41. A high speed communication equipment typically would not be needed for
- (a) E-mail
 - (b) Transferring large volume of data
 - (c) Supporting communication between nodes in a LAN
 - (d) All of these
42. What is Unicode?
- (a) Represents symbol or characters used in any language
 - (b) Only few languages are supported
 - (c) Supports only few characters
 - (d) Characters from A to Z
43. In OSI model dialogue control and token management are responsibilities of ?
- (a) Session Layer
 - (b) Network layer
 - (c) Transport layer
 - (d) Data link layer

44. An asymmetric-key (or public-key) cipher uses
- (a) 1 Key
 - (b) 2 Key
 - (c) 3 Key
 - (d) 4 Key
45. A straight permutation cipher or a straight P-box has same number of inputs as
- (a) cipher
 - (b) Frames
 - (c) Outputs
 - (d) Bits
46. Man-in-the-middle attack can endanger security of Diffie-Hellman method if two parties are not
- (a) Authenticated
 - (b) Joined
 - (c) Submit
 - (d) Separate
47. We use Cryptography term to transforming messages to make them secure and immune to
- (a) Change
 - (b) Idle
 - (c) Attacks
 - (d) Defend
48. Shift cipher is sometimes referred to as the
- (a) Caesar cipher
 - (b) Shift cipher
 - (c) cipher
 - (d) cipher text
49. Substitutional ciphers are
- (a) Monoalphabetic
 - (b) Semi alphabetic
 - (c) polyalphabetic
 - (d) both a and c
50. Heart of Data Encryption Standard (DES), is the
- (a) Cipher
 - (b) Rounds
 - (c) Encryption
 - (d) DES function

Ans. (1)(a), (2)(b), (3)(a), (4)(a) , (5) (d), (6)(c) ,7(b), (8)(b), (9)(c), (10)(b), (11)(c), (12)(a), (13)(c), (14)(c), (15)(a), (16)(c), (17)(c), (18)(a), (19)(b), (20)(a), (21)(b), (22)(d), (23)(c), (24)(d), (25)(b), (26)(a), (27)(c), (28)(b), (29)(d), (30)(a), (31)(a), (32)(c), (33)(d), (34)(a), (35)(b), (36)(a), (37)(d), (38)(a), (39)(a), (40)(a), (41)(a), (42)(a), (43)(a), (44)(b), (45)(c), (46)(a), (47)(c), (48)(a), (49)(d), (50)(d)

(c) Fill in the Blanks:

- 1 The client does _____.
- 2 TCP uses the mechanism of _____.
- 3 When a single packet reaches the destination twice, it should be handled by _____.
- 4 TCP is concurrent because _____.
- 5 Combination of _____ and _____ makes a socket.
- 6 Well-known parts are generally required _____.

Ans. (1)(active upon), (2)(virtual connections), (3)(error control), (4)(it processes multiple request at the same time), (5)(IP address, port number), (6)(on the client and the server)

II Short Answer Type Questions:

- 1 Discuss the idea of a port.
- 2 Which protocol is called Iterative protocol?
- 3 What is the difference between a port and a socket? Why are sockets important?
- 4 Explain why TCP is concurrent.
- 5 Discuss the idea of passive open and active open.
- 6 What factors make TCP reliable?
- 7 Draw a neat diagram of a transport layer segment.
- 8 What is the use of sequence numbers?
- 9 What is the purpose of sequence number inside a TCP packet header?
- 10 Explain the six-bit flag field of a TCP packet.
- 11 Why is urgent pointer used in TCP?
- 12 Give the total header length of a TCP packet.
- 13 What is the purpose of Urgent pointer in the TCP header
- 14 Discuss in detail the difference between TCP and UDP.
- 15 A client uses UDP to send data to a server. The data are 16 bytes. Calculate the efficiency of the transmission at the UDP Level
- 16 How is TCP connection established? Explain in detail
- 17 Draw and explain in detail about the State Transmission diagram of TCP.
- 18 Explain UDP in detail. Give the list for all well-known ports reserved for UDP and TCP.
- 19 Give the working of SCTP.
- 20 How is congestion control implemented in Transmission Control Protocol?
- 21 What are the types of security attacks?
- 22 Define Fire walls?
- 23 Compare plain text and cipher text?
- 24 Explain various types of substitution techniques.
- 25 What is symmetry key algorithm? List the limitations

- 26 What is the difference between a User agent (UA) and a mail transfer agent (MTA)?
- 27 What is purpose of HTML?
- 28 What is relationship between CGI and dynamic documents?
- 29 What is the difference between TCP and UDP
- 30 When web pages are sent out they are pre fixed by MIME headers. Why
- 31 The maximum payload of a TCP segment is 65495 bytes. Why was such a strange number chosen?
- 32 Describe RSA algorithm with example.
- 33 What are the services provided by a digital signature?
- 34 Explain Message Authentication Code.
- 35 What is MD5?
- 36 What are the various security goals in network communication?
- 37 Describe a 3-way handshake?
- 38 What is public key encryption?

III Long Answer Type Questions:

- 1 How is process to process communication established in TCP. Explain the use of sending and receiving buffers.
- 2 How is SYN flooding attack implemented? What steps can be used to counter it.
- 3 What is the difference between half-close and full-close TCP termination?
- 4 Explain retransmission in relation to TCP connection.
- 5 How is flow control implemented in TCP? Explain in detail.
- 6 Why does UDP exist? Would it not have been enough to just let users processes send raw IP packets?
- 7 Are deadlocks possible with the transport layer entity?
- 8 The maximum payload of a TCP segment is 65,495 bytes. Why?
- 9 Differentiate between public key and private key cryptography?
- 10 How is checksum calculation done in UDP and TCP?
- 11 What are the characteristics of TCP? What services does TCP provide for data communication
- 12 Why does TCP use the three way handshake and four way handshake
- 13 Differentiate between public key encryption and private key encryption.
- 14 What are the digital signatures? How are they used for data security
- 15 Discuss the types of DNS messages.
- 16 What are different types of timers in TCP? Explain them.
- 17 How is flow and error control implemented in TCP?
- 18 Draw state transition diagram for TCP.
- 19 Write short notes on any two of the following:-
(a) Proxy Servers (b) DNS (c) Cryptography
- 20 What are the solutions of silly window syndrome?
- 21 Explain the characteristics and applications of UDP. Compare it to TCP.
- 22 Explain the process of connection establishment and termination in TCP.
- 23 Describe the process of sending a message using the Digital Signature.
- 24 Write short notes on the following:
i) DNS ii) WWW

QUESTION BANK

C# PROGRAMMING

MCA 209

QUESTION BANK
C# PROGRAMMING – MCA 209
MCA III

UNIT - I

I Test Your Skills:

(a) State Whether the Following Statements are True or False:

- 1 Java is a .NET compatible language.
- 2 Common language specification(CLS) defines standard rules for defining .Net compliant languages.
- 3 CTS defines a set of rules for all compilers to generate managed code for .NET.
- 4 JIT compiler is a part of the runtime execution environment
- 5 Assemblies contains the code that CLR executes.
- 6 Assemblies consists of assembly manifest, type metadata, MSIL code that implements the type and set of resources.
- 7 Global assembly is installed in global assembly cache.
- 8 A satellite assembly is used by only a single application.
- 9 Namespaces corresponds to files and directory names.
- 10 .NET is not platform independent.

Ans. (1)(F), (2)(T), (3)(F), (4)(T), (5)(T), (6)(T), (7)(T), (8)(T), (9)(F), (10)(T)

(b) Multiple Choice Questions:

- 1 Which of the following statements are TRUE about the .NET CLR?
 1. It provides a language-neutral development & execution environment.
 2. It ensures that an application would not be able to access memory that it is not authorized to access.
 3. It provides services to run "managed" applications.
 4. The resources are garbage collected.
 5. It provides services to run "unmanaged" applications.
 - (a) Only 1 and 2
 - (b) Only 1,2 and 4
 - (c) 1,2,3,4
 - (d) Only 4 and 5
 - (e) Only 3 and 4
- 2 Which of the following are valid .NET CLR JIT performance counters?
 1. Total memory used for JIT compilation
 2. Average memory used for JIT compilation
 3. Number of methods that failed to compile with the standard JIT
 4. Percentage of processor time spent performing JIT compilation
 5. Percentage of memory currently dedicated for JIT compilation

- (a) 1,5
 - (b) 3,4
 - (c) 1,2
 - (d) 4,5
- 3 Which of the following statements is correct about Managed Code?
- (a) Managed code is the code that is compiled by the JIT compilers.
 - (b) Managed code is the code where resources are Garbage Collected.
 - (c) Managed code is the code that runs on top of Windows.
 - (d) Managed code is the code that is written to target the services of the CLR.
 - (e) Managed code is the code that can run on top of Linux.
- 4 Which of the following are NOT true about .NET Framework?
- 1. It provides a consistent object-oriented programming environment whether object code is stored and executed locally, executed locally but Internet-distributed, or executed remotely.
 - 2. It provides a code-execution environment that minimizes software deployment and versioning conflicts.
 - 3. It provides a code-execution environment that promotes safe execution of code, including code created by an unknown or semi-trusted third party.
 - 4. It provides different programming models for Windows-based applications and Web-based applications.
 - 5. It provides an event driven programming model for building Windows Device Drivers.
- (a) 1,2
 - (b) 2,4
 - (c) 4,5
 - (d) 1,2,4
- 5 Which of the following components of the .NET framework provide an extensible set of classes that can be used by any .NET compliant programming language?
- (a) NET class libraries
 - (b) Common Language Runtime
 - (c) Common Language Infrastructure
 - (d) Component Object Model
 - (e) Common Type System
- 6 Which of the following .NET components can be used to remove unused references from the managed heap?
- (a) Common Language Infrastructure
 - (b) CLR
 - (c) Garbage Collector
 - (d) Class Loader
 - (e) CT

- 7 Which of the following statements correctly define .NET Framework?
- (a) It is an environment for developing, building, deploying and executing Desktop Applications, Web Applications and Web Services
 - (b) It is an environment for developing, building, deploying and executing only Web Applications.
 - (c) It is an environment for developing, building, deploying and executing Distributed Applications.
 - (d) It is an environment for developing, building, deploying and executing Web Services.
 - (e) It is an environment for development and execution of Windows applications.
- 8 Which of the following constitutes the .NET Framework?
- 1. ASP.NET Applications
 - 2. CLR
 - 3. Framework Class Library
 - 4. WinForm Applications
 - 5. Windows Services
- (a) 1,2
 - (b) 2,3
 - (c) 3,4
 - (d) 2,5
- 9 Which of the following assemblies can be stored in Global Assembly Cache?
- (a) Private Assemblies
 - (b) Friend Assemblies
 - (c) Shared Assemblies
 - (d) Public Assemblies
 - (e) Protected Assemblies
- 10 Code that targets the Common Language Runtime is known as
- (a) Unmanaged
 - (b) Distributed
 - (c) Legacy
 - (d) Managed code
 - (e) Native code
- 11 Which of the following statements is correct about the .NET Framework?
- (a) NET Framework uses DCOM for achieving language interoperability.
 - (b) NET Framework is built on the DCOM technology.
 - (c) NET Framework uses DCOM for making transition between managed and unmanaged code.
 - (d) NET Framework uses DCOM for creating unmanaged applications.
 - (e) NET Framework uses COM+ services while creating Distributed Applications.

- 12 Which of the following benefits do we get on running managed code under CLR?
1. Type safety of the code running under CLR is assured.
 2. It is ensured that an application would not access the memory that it is not authorized to access.
 3. It launches separate process for every application running under it.
 4. The resources are Garbage collected.
- (a) Only 1 and 2
 - (b) Only 2, 3 and 4
 - (c) Only 1, 3 and 4
 - (d) Only 4
 - (e) All of the above
- 13 Which of the following jobs are done by Common Language Runtime?
1. It provides core services such as memory management, thread management, and remoting.
 2. It enforces strict type safety.
 3. It provides Code Access Security.
 4. It provides Garbage Collection Services.
- (a) Only 1 and 2
 - (b) Only 3 and 4
 - (c) Only 1, 3 and 4
 - (d) Only 2, 3 and 4
 - (e) All of the above
- 14 Which of the following statements are correct about a .NET Assembly?
1. It is the smallest deployable unit.
 2. Each assembly has only one entry point - *Main()*, *WinMain()* or *DLLMain()*.
 3. An assembly can be a Shared assembly or a Private assembly.
 4. An assembly can contain only code and data.
 5. An assembly is always in the form of an EXE file.
- (a) 1,2,3
 - (b) 2,4,5
 - (c) 1,3,5
 - (d) 1,2
- 15 Which of the following statements are correct about JIT?
1. JIT compiler compiles instructions into machine code at run time.
 2. The code compiler by the JIT compiler runs under CLR.
 3. The instructions compiled by JIT compilers are written in native code.
 4. The instructions compiled by JIT compilers are written in Intermediate Language (IL) code.
 5. The method is JIT compiled even if it is not called
- (a) 1, 2, 3
 - (b) 2,4
 - (c) 3,4,5
 - (d) 1,2

- 16 Which of the following are parts of the .NET Framework?
1. The Common Language Runtime (CLR)
 2. The Framework Class Libraries (FCL)
 3. Microsoft Published Web Services
 4. Applications deployed on IIS
 5. Mobile Applications
- (a) Only 1, 2, 3
(b) Only 1, 2
(c) Only 1, 2, 4
(d) Only 4,5
(e) All of the above
- 17 In C#, a subroutine is called a _____.
- (a) Function
(b) Metadata
(c) Method
(d) Managed code
- 18 All C# applications begin execution by calling the _____ method.
- (a) Class()
(b) Main()
(c) Submain()
(d) Namespace
- 19 A _____ is an identifier that denotes a storage location
- (a) Constant
(b) Reference type
(c) Variable
(d) Object
- 20 _____ are reserved, and cannot be used as identifiers.
- (a) Keywords
(b) literal
(c) variables
(d) Identifiers
- 21 Boxing converts a value type on the stack to an _____ on the heap.
- (a) Bool type
(b) Instance type
(c) Class type
(d) Object type
- 22 The character pair?: is an _____ available in C#.
- (a) Unary operator
(b) Ternary operator
(c) Decision operator
(d) Functional operator

- 23 In C#, all binary operators are _____.
(a) Center-associative
(b) Right-associative
(c) Left-associative
(d) Top-associative
- 24 An _____ is a symbol that tells the computer to perform certain mathematical or logical manipulations.
(a) Operator
(b) Expression
(c) Condition
(d) Logic
- 25 A _____ is any valid C# variable ending with a colon.
(a) goto
(b) Label
(c) Logical
(d) Bitwise
- 26 C# has _____ operator, useful for making two way decisions.
(a) Looping
(b) Functional
(c) Exponential
(d) Conditional
- 27 _____ causes the loop to continue with the next iteration after skipping any statements in between.
(a) Loop
(b) Exit
(c) Break
(d) Continue
- 28 An _____ is a group of contiguous or related data items that share a common name.
(a) Operator
(b) Integer
(c) Exponential
(d) Array
- 29 Arrays in C# are _____ objects
(a) Reference
(b) Logical
(c) Value
(d) Arithmetic

- 30 Multidimensional arrays are sometimes called _____ Arrays.
- (a) Square
 - (b) Triangular
 - (c) Rectangular
 - (d) Cube
- 31 Which of the following define the rules for .Net Languages?
- (a) GAC
 - (b) CLS
 - (c) CTS
 - (d) CLR
- 32 _____ namespace is not defined in the .NET class library.
- (a) System.CodeDom
 - (b) System
 - (c) System.IO
 - (d) System.Text
- 33 Dot Net Framework consists of :
- (a) Common language runtime
 - (b) Set of class libraries
 - (c) Common language runtime and set of class libraries
 - (d) None of above
- 34 Which of the following statements are correct about JIT?
1. JIT compiler compiles instructions into machine code at run time.
 2. The code compiler by the JIT compiler runs under CLR.
 3. The instructions compiled by JIT compilers are written in native code.
 4. The instructions compiled by JIT compilers are written in Intermediate Language (IL) code.
- (a) 1,2,3
 - (b) 2,4
 - (c) 3,4
 - (d) 1,2
- 35 Which of the following is the root of the .NET type hierarchy?
- (a) System.Type
 - (b) System.Base
 - (c) System.Parent
 - (d) System.Object
- 36 Code that targets the Common Language Runtime is known as
- (a) Unmanaged
 - (b) Distributed
 - (c) Managed Code
 - (d) Native Code

- 37 Which of the following statements correctly define .NET Framework?
- (a) It is an environment for developing, building, deploying and executing Desktop Applications, Web Applications and Web Services.
 - (b) It is an environment for developing, building, deploying and executing only Web Applications.
 - (c) It is an environment for developing, building, deploying and executing Distributed Applications.
 - (d) It is an environment for developing, building, deploying and executing Web Services.
- 38 How many types of compilers available under CLR?
- (a) 4
 - (b) 2
 - (c) 1
 - (d) 3
- 39 Which of the following statements is correct about Managed Code?
- (a) Managed code is the code that is compiled by the JIT compilers.
 - (b) Managed code is the code where resources are Garbage Collected.
 - (c) Managed code is the code that runs on top of Windows.
 - (d) Managed code is the code that is written to target the services of the CLR.
- 40 Which of the following utilities can be used to compile managed assemblies into processor-specific native code?
- (a) gacutil
 - (b) ngen
 - (c) sn
 - (d) ildasm

Ans. (1)(c), (2)(b), (3)(d), (4)(c), (5)(a),(6)(c), (7)(a), (8)(b), (9)(c), (10)(d), (11)(c), (12)(e), (13)(e), (14)(d), (15)(a), (16)(b), (17)(c), (18)(b), (19)(c), (20)(a), (21)(d), (22)(b), (23)(c), (24)(a), (25)(b), (26)(d), (27)(d), (28)(d), (29)(a), (30)(c), (31)(b), (32)(a), (33)(c), (34)(a), (35)(d), (36)(c) , (37)(a) , (38)(d), (39)(d), (40)(b)

(c) Fill in the Blanks:

- 1 Contents of assembly can be viewed using _____.
- 2 _____ and _____ types are supported by CTS.
- 3 The three types of JIT compilers in .NET environment are _____, _____ and _____.
- 4 _____ of the CLR component allows .net application exchange data with COM application.
- 5 Assemblies can be divided into two categories as _____ and _____.
- 6 An assembly that is shared by multiple applications is called a _____.
- 7 The three types of assemblies are _____, _____ and _____.
- 8 _____ allow you to create a system to organize your code.

9 _____ is an open source implementation of Microsoft's .Net Framework based on the ECMA standards for C# and the Common Language Runtime

Ans. (1)(ILDASM.exe), (2)(value and reference), (3)(Pre-JIT, Econo- JIT and Normal JIT), (4)(COM marshaler), (5)(static and dynamic), (6)(global assembly), (7)(private, shared and satellite), (8)(Namespaces), (9)(Mono)

II Short Answer Type Questions:

- 1 What is .NET?
- 2 Name the various flavors of .NET?
- 3 What is MSIL?
- 4 Explain CLR. What are the main services CLR is responsible for?
- 5 Define the term namespaces.
- 6 What is CTS?
- 7 Give the differences between Namespace and Assembly.
- 8 What is the difference between private and shared assembly?
- 9 What is manifest?
- 10 What is strong name?
- 11 Explain the term GAC. Where are shared assembly stored?
- 12 Where's the Global Assembly Cache(GAC) located on the system?
- 13 What is Garbage collection?
- 14 Can we force garbage collection to run?
- 15 What is ILDASM?
- 16 What is a managed environment? Differentiate between managed code and unmanaged code
- 17 Define CIL.
- 18 What is software component?
- 19 Difference between object oriented and object based programming.
- 20 What was the motivation behind c# evolution?
- 21 What is single file and multi-file assembly?
- 22 Different editions of visual studios 2010?
- 23 Short note on versions of .net(evolution in tabular form)?
- 24 Write Short notes on
 - (a) Private Vs shared assembly
 - (b) Value type Vs Reference Type
 - (c) Single file Assembly Vs Multi file assembly
 - (d) Satellite Assembly
 - (e) CTS
 - (f) FCL Vs BCL
 - (g) Managed code Vs Unmanaged code
 - (h) Namespaces in .net
- 25 Explain the role of assembly in the .Net Framework.
- 26 Define declarative and imperative security.
- 27 Define role-based security.

- 28 Explain code access security.
- 29 What do you understand by side-by-side execution of assembly?

III Long Answer Type Questions:

- 1 Explain the features of .NET framework in detail.
- 2 What's a Microsoft .NET Framework?
- 3 Explain the architecture of .NET framework in detail.
- 4 What are assemblies? Explain its various types in detail.
- 5 What is JIT? Explain its various types.
- 6 Discuss the Mono and Portable .NET distributions.
- 7 Is .NET Platform independent? Explain.
- 8 Explain the structure of a .NET application.
- 9 Discuss the flavors of .NET in detail.
- 10 How is .NET able to support multiple languages?
- 11 Explain .NET Framework Base Class Library.
- 12 Differentiate between Object Oriented Programming and Component Oriented Programming.
- 13 What are different programming paradigms? Explain.
- 14 How CLR does implements C# program?
- 15 Define Strong Name. How do you apply a strong name to assembly?
- 16 What are the features of automatic management in .Net
- 17 How to force garbage collector to run?
- 18 What are design patterns? Define basic classification of patterns.
- 19 Define trace class.

UNIT - II

I Test Your Skills:

(a) State Whether the Following Statements are True or False:

- 1 The space required for structure variables is allocated on stack.
- 2 Creating empty structures is allowed in C#.NET.
- 3 C#.NET structures are always value types.
- 4 Multiple inheritance is different from multiple levels of inheritance.
- 5 The way a derived class member function can access base class public members, the base class member functions can access public member functions of derived class.
- 6 There is no private or protected inheritance in C#.NET.
- 7 The string built using the String class are immutable (unchangeable), whereas, the ones built- using the StringBuilder class are mutable.
- 8 Try blocks cannot be nested.
- 9 It is possible for a value type to contain the null value.
- 10 Branching is performed using jump statements which cause an immediate transfer of the program control.

Ans. (1)(T), (2)(F), (3)(T), (4)(T), (5)(F), (6)(T), (7)(T), (8)(F), (9)(F), (10)(T)

(b) Multiple Choice Questions:

- 1 Which of the following statements are correct about data types?
 1. If the integer literal exceeds the range of byte, a compilation error will occur.
 2. We cannot implicitly convert non-literal numeric types of larger storage size to byte.
 3. Byte cannot be implicitly converted to float.
 4. A char can be implicitly converted to only int data type.
 5. We can cast the integral character codes.
 - (a) 1,3,5
 - (b) 2,4
 - (c) 3,5
 - (d) 1,2,5

- 2 Which of the following is NOT an Integer?
 - (a) Char
 - (b) Byte
 - (c) Integer
 - (d) Long
 - (e) Short

- 3 What will be the output of the following code snippet when it is executed?

```
int x = 1;
float y = 1.1f;
short z = 1;
Console.WriteLine((float) x + y * z - (x += (short) y));
```

 - (a) 0.1
 - (b) 1.0
 - (c) 1.1
 - (d) 11

- 4 Which of the following is the correct size of a Decimal datatype?
 - (a) 8 bytes
 - (b) 4 bytes
 - (c) 10 bytes
 - (d) 16 bytes
 - (e) None of the above

- 5 Which of the following statements are correct?
 1. We can assign values of any type to variables of type object.
 2. When a variable of a value type is converted to object, it is said to be unboxed.
 3. When a variable of type object is converted to a value type, it is said to be boxed.
 4. Boolean variable cannot have a value of *null*.

5. When a value type is boxed, an entirely new object must be allocated and constructed.
- (a) 2,5
 - (b) 1,5
 - (c) 3,4
 - (d) 2,3
6. Which of the following is the correct ways to set a value *3.14* in a variable *pi* such that it cannot be modified?
- (a) `float pi = 3.14F;`
 - (b) `#define pi 3.14F;`
 - (c) `const float pi = 3.14F;`
 - (d) `const float pi; pi = 3.14F;`
 - (e) `pi = 3.14F;`
7. Which of the following can be used to terminate a *while* loop and transfer control outside the loop?
- 1. `exit while`
 - 2. `continue`
 - 3. `exit statement`
 - 4. `break`
 - 5. `goto`
- (a) 1,3
 - (b) 2,4
 - (c) 3,5
 - (d) 4,5
 - (e) None of these
8. Which of the following statements are correct about the C#.NET code snippet given below?
- ```
if (age > 18 && no < 11)
a = 25;
```
- 1. The condition `no < 11` will be evaluated only if `age > 18` evaluates to True.
  - 2. The statement `a = 25` will get executed if any one condition is True.
  - 3. The condition `no < 11` will be evaluated only if `age > 18` evaluates to False.
  - 4. The statement `a = 25` will get executed if both the conditions are True.
  - 5. `&&` is known as a short circuiting logical operator.
- (a) 1,3
  - (b) 2,5
  - (c) 1,4,5,
  - (d) 3,4,5
  - (e) None of these

- 9 Which of the following is the correct output for the C#.NET code snippet given below?  
Console.WriteLine(13 / 2 + " " + 13 % 2);
- (a) 6.5 1
  - (b) 6.5 0
  - (c) 6 0
  - (d) 6 1
  - (e) 6.5 6.5
- 10 Which of the following statements are correct?
- 1. Instance members of a *class* can be accessed only through an object of that class.
  - 2. A class can contain only instance data and instance member function.
  - 3. All objects created from a class will occupy equal number of bytes in memory.
  - 4. A class can contain Friend functions.
  - 5. A class is a blueprint or a template according to which objects are created.
- (a) 1,3,5
  - (b) 2,4
  - (c) 3,5
  - (d) 2,4,5
  - (e) None of these
- 11 Which of the following is the correct way to create an object of the class Sample?
- 1. Sample s = new Sample();
  - 2. Sample s;
  - 3. Sample s; s = new Sample();
  - 4. s = new Sample();
- (a) 1,3
  - (b) 2,4
  - (c) 1,2,3
  - (d) 4,5
  - (e) None of these
- 12 Which of the following statements is correct about constructors?
- (a) If we provide a one-argument constructor then the compiler still provides a zero-argument constructor.
  - (b) Overloaded constructors have the same name as the class name
  - (c) Overloaded constructors cannot use optional arguments.
  - (d) If we do not provide a constructor, then the compiler provides a zero-argument constructor.
  - (e) Static constructors can use optional arguments.
- 13 Which of the following statements is correct?
- (a) There is one garbage collector per program running in memory.
  - (b) There is one common garbage collector for all programs.
  - (c) An object is destroyed by the garbage collector when only one reference refers to it.

- (d) We have to specifically run the garbage collector after executing Visual Studio.NET.
- 14 Which of the following can be facilitated by the Inheritance mechanism?
1. Use the existing functionality of base class.
  2. Override the existing functionality of base class.
  3. Implement new functionality in the derived class.
  4. Implement polymorphic behaviour.
  5. Implement containership.
- (a) 1,2,3  
(b) 3,4  
(c) 2,4,5  
(d) 3,5
- 15 Which one of the following statements is correct?
- (a) Array elements can be of integer type only.
  - (b) The rank of an Array is the total number of elements it can contain.
  - (c) The length of an Array is the number of dimensions in the Array.
  - (d) The default value of numeric array elements is zero.
  - (e) The Array elements are guaranteed to be sorted.
- 16 Which of the following statements are correct about arrays used in C#.NET?
1. Arrays can be rectangular or jagged.
  2. Rectangular arrays have similar rows stored in adjacent memory locations.
  3. Jagged arrays do not have an access to the methods of *System.Array* Class.
  4. Rectangular arrays do not have an access to the methods of *System.Array* Class.
  5. Jagged arrays have dissimilar rows stored in non-adjacent memory locations.
- (a) 1,2  
(b) 1,3,5  
(c) 3,4  
(d) 1,2,5  
(e) 4,5
- 17 Which of the following statements are correct?
1. A struct can contain properties.
  2. A struct can contain constructors.
  3. A struct can contain protected data members.
  4. A struct cannot contain methods.
  5. A struct cannot contain constants.
- (a) 1,2  
(b) 3,4  
(c) 1,2,4  
(d) 3,5

- 18 Which of the following will be the correct output for the C#.NET code snippet given below?  
String s1 = "ALL MEN ARE CREATED EQUAL";  
String s2;  
s2 = s1.Substring(12, 3);  
Console.WriteLine(s2);
- (a) ARE
  - (b) CRE
  - (c) CR
  - (d) REA
  - (e) CREATED
- 19 If s1 and s2 are references to two strings, then which of the following is the correct way to compare the two references?
- (a) s1 is s2
  - (b) s1=s2
  - (c) s1==s2
  - (d) strcmp(s1, s2)
  - (e) s1.Equals(s2)
- 20 Which of the following statements is correct about an Exception?
- (a) It occurs during compilation.
  - (b) It occurs during linking.
  - (c) It occurs at run-time.
  - (d) It occurs during Just-In-Time compilation.
  - (e) It occurs during loading of the program.
- 21 Which of the following statements are correct about exception handling in C#.NET?
- 1 If an exception occurs then the program terminates abruptly without getting any chance to recover from the exception.
  - 2 No matter whether an exception occurs or not, the statements in the finally clause (if present) will get executed.
  - 3 A program can contain multiple finally clauses.
  - 4 A finally clause is written outside the try block.
  - 5 Finally clause is used to perform cleanup operations like closing the network/database connections.
- (a) 1 only
  - (b) 2 only
  - (c) 2 and 5 only
  - (d) 3 and 4 only
  - (e) None of the above
- 22 \_\_\_\_\_ parameters are used to pass results back to the calling method.
- (a) Input
  - (b) Reference
  - (c) Value
  - (d) Output

- 23 The formal-parameter-list is always enclosed in \_\_\_\_\_.  
(a) Square  
(b) Semicolon  
(c) Parenthesis  
(d) Colon
- 24 \_\_\_\_\_ variables are visible only in the block they are declared.  
(a) System  
(b) Global  
(c) Local  
(d) Console
- 25 C# does not support \_\_\_\_\_ constructors.  
(a) parameterized  
(b) parameter-less  
(c) Class  
(d) Method
- 26 A structure in C# provides a unique way of packing together data of \_\_\_\_\_ types.  
(a) Different  
(b) Same  
(c) Invoking  
(d) Calling
- 27 Struct's data members are \_\_\_\_\_ by default.  
(a) Protected  
(b) Public  
(c) Private  
(d) Default
- 28 A \_\_\_\_\_ creates an object by copying variables from another object.  
(a) Copy constructor  
(b) Default constructor  
(c) Invoking constructor  
(d) Calling constructor
- 29 The methods that have the same name, but different parameter lists and different definitions is called \_\_\_\_\_.  
(a) Method Overloading  
(b) Method Overriding  
(c) Method Overwriting  
(d) Method Overreading

- 30 The C# provides special methods known as \_\_\_\_\_ methods to provide access to data members.
- (a) Loop
  - (b) Functions
  - (c) Methods
  - (d) Accessor
- 31 Storage location used by computer memory to store data for usage by an application is ?
- (a) Pointers
  - (b) Constants
  - (c) Variable
  - (d) None of the mentioned
- 32 Which of these can be overloaded?
- (a) Constructors
  - (b) Methods
  - (c) Both a & b
  - (d) None of the mentioned
- 33 Number of constructors a class can define of ?
- (a) 1
  - (b) 2
  - (c) Any number
  - (d) None of the mentioned
- 34 Correct statement about constructors in C#.NET is ?
- (a) Constructor cannot be overloaded
  - (b) Constructor allocate space for object in memory
  - (c) Constructor are never called explicitly
  - (d) Constructor have same name as name of the class
- 35 Constructors are used to
- (a) initialize the objects
  - (b) construct the data members
  - (c) both a & b
  - (d) None of the mentioned
- 36 To overload a method which of the following statement is false?
- (a) If the return type is different methods are overloaded
  - (b) Name of the overloaded method should be same
  - (c) Type of the parameter should be different
  - (d) Order of the parameter should be different if types are same



- 37 Which of the following statements is correct about constructors in C#.NET?
- A constructor cannot be declared as private
  - A constructor cannot be overloaded
  - A constructor can be a static constructor
  - None of the mentioned
- 38 What is return type of constructors?
- int
  - float
  - void
  - None of the mentioned
- 39 Which method have same name as that of its class?
- delete
  - class
  - constructor
  - None of mentioned
- 40 Which of following statement are correct about functions?
- C# allows a function to have arguments with default values
  - Redefining a method parameter in the method's body causes an exception
  - C# allows function to have arguments of private type
  - Omitting the return type in method definition results into exception

**Ans.** (1)(d), (2)(a), (3)(a), (4)(e), (5)(b),(6)(c), (7)(d), (8)(c), (9)(d), (10)(a), (11)(a), (12)(d), (13)(b), (14)(a), (15)(d), (16)(d), (17)(a), (18)(b), (19)(e), (20)(c), (21)(c), (22)(d), (23)(c), (24)(c), (25)(b), (26)(a), (27)(c), (28)(a), (29)(a), (30)(d), (31)(c), (32)(c), (33)(c), (34)(d), (35)(c), (36)(a), (37)(d), (38)(c), (39)(c), (40)(a)

**(c) Fill in the Blanks:**

- The characters used in C# are represented in \_\_\_\_\_.
- The \_\_\_\_\_ operator is used to create the objects.
- C# supports \_\_\_\_\_ statement to access array elements without using a subscript.
- The \_\_\_\_\_ modifier limits method access to the containing class or program.
- Reference parameters are declared by \_\_\_\_\_ modifier.
- Every class you create is automatically supplied with a \_\_\_\_\_ constructor with no parameters.
- We cannot create instances for an \_\_\_\_\_ class.
- The keyword \_\_\_\_\_ is an alias for the System.Object class.
- \_\_\_\_\_ is thrown when an attempt to access a class member fails.

**Ans.** (1)(Unicode), (2)(new), (3)(foreach), (4)(internal access), (5)(ref), (6)(public), (7)(abstract), (8)(object), (9)(System.MemberAccessException)

## II Short Answer Type Questions:

- 1 What are identifiers?
- 2 Explain the terms types, classes and objects and give the relationship among the three with the help of an example.
- 3 What are format specifiers?
- 4 How can we accept user input from the keyboard in C#?
- 5 What is a conditional operator?
- 6 What is boxing and unboxing?
- 7 Define return statement in C#.
- 8 Difference between if..else and switch statement.
- 9 What is continue statement?
- 10 What are indexers?
- 11 Define destructors.
- 12 What are static constructors?
- 13 What are jagged arrays?
- 14 Does C# support multiple-inheritance?
- 15 Where is a protected class-level variable available?
- 16 Are private class-level variables inherited?
- 17 Describe the accessibility modifier “protected internal”.
- 18 When do you absolutely have to declare a class as abstract?
- 19 What happens if you inherit multiple interfaces and they have conflicting method names?
- 20 What’s the difference between an interface and abstract class?
- 21 What is the difference between a Struct and a Class?
- 22 What’s the implicit name of the parameter that gets passed into the set method/property of a class?
- 23 If a base class has a number of overloaded constructors, and an inheriting class has a number of overloaded constructors; can you enforce a call from an inherited constructor to a specific base constructor?
- 24 How is method overriding different from method overloading?
- 25 What is this reference?
- 26 What does the term immutable mean?
- 27 What’s the difference between System.String and System.Text.StringBuilder classes?
- 28 Can you store multiple data types in System.Array?
- 29 What’s the difference between the System.Array.CopyTo() and System.Array.Clone()?
- 30 Will the finally block get executed if an exception has not occurred?
- 31 What’s the C# syntax to catch any possible exception?
- 32 Can multiple catch blocks be executed for a single try statement?
- 33 What is custom exception? Explain with example?
- 34 Does the static constructor runs only one time? Why/Why not?
- 35 Differentiate between managed code and unmanaged code?
- 36 What is an assembly what are its components?
- 37 What is XML briefly explain the use of it?
- 38 Write some difference between value type and reference type?
- 39 What is sealed and abstract class? Explain with an example.
- 40 What is compile time and run time polymorphism? Explain with example?

41 What is a delegate? Explain using example?

### III Long Answer Type Questions:

- 1 Explain the .NET Common Type System in detail.
- 2 Explain the implicit and explicit conversions with the help of examples.
- 3 Write a note on decision making statements in C#.
- 4 Differentiate between counter controlled loop and sentinel controlled loop.
- 5 What is Array class? Discuss its methods in detail.
- 6 What are methods? Discuss types of method accessibility in detail.
- 7 What are the types of formal parameters associated with methods? Explain.
- 8 Write a note on properties in C#.
- 9 What are constructors? Discuss in detail.
- 10 What are interfaces in C#? How are they defined?
- 11 Discuss the various types of inheritance in c#.
- 12 How polymorphism is achieved in C#?
- 13 What are abstract classes? Discuss in detail.
- 14 How multiple exceptions are handled in C#?
- 15 Explain the usage of finally block.
- 16 Write a note on DateTime class.
- 17 What are the various methods of StringBuilder class? Discuss.
- 18 Discuss the various methods of String class in detail.
- 19 Explain CLI, CTS and CLS?
- 20 Constant Vs Readonly field (with example)

### IV Practical Questions:

- 1 Write a program that declares a minute's variable to represent minutes worked on a job, and assign a value to it. Display the value in hours and minutes. Save the program as Hours AndMinutes.cs.
- 2 Write a program for a college's admission office. The user enters a numeric high school grade point average(for e.g. 3.2) and an admission test score. Print the message "Accept" if the student meets either of the following requirements:
  - A grade point average of 3.0 or higher and an admission test score of atleast 60
  - A grade point average of less than 3.0 and an admission test score of atleast 80.If the student does not meet either of the qualification criteria, print "Reject". Save the program as Admission.cs.
- 3 Write a program that prints every perfect number from 1 to 100. a number is perfect if it equals the sum of all the smaller positive integers that divide evenly into it. For example, 6 is perfect because 1, 2 and 3 divide evenly into it and their sum is 6.
- 4 Create three arrays of type double. Do a compile time initialization and place 10 different values in two of the arrays. Write a program to store the product of the two arrays in the third array. Produce a display using the MessageBox class that shows the contents of all three arrays using a single line for an element from all three arrays.
- 5 Create a class named Square. In the main() method, declare an integer and prompt the user for a value. Display the value of the integer, then pass it to a method that accepts the

- value as a reference parameter and prints its square. In main(), print the value again, proving that the original argument to the method was altered.
- 6 Create a class named Area. Include three overloaded methods that compute the area of a rectangle when two dimensions are passed to it. One method takes two integers as parameters, one takes two doubles, and the third takes an integer and a double. Write a main() method that demonstrates each method works correctly.
  - 7 Create a base class titled ReadingMaterial. Include subclasses of Book and Magazine. Define an interface called IPrintable that has a method that returns the date of publication. Design your classes so that common characteristics are placed in the ReadingMaterial class.
  - 8 Create a class named Game that contains a string with the name of the Game and an integer that holds the maximum number of players. Include properties with get and set accessors for each field. Also, include a ToString() Game method that overrides the Object class's ToString() method and returns a string that contains the name of the class, the name of the Game, and the number of players. Create a child class named GameWithTimeLimit that includes an integer time limit in minutes and a property that contains get and set accessors for the field. Write a program that instantiates an object of each class and demonstrates all the methods.
  - 9 Write a program in which you declare an array of five integers and store five values in the array. Write a try block in which you place a loop that attempts to access each element of the array, incrementing a subscript from 0 to 100. create a catch block that catches the eventual Index Out Of Range Exception; within the block, display message on the screen.
  - 10 Write a C# Program to implement the swapping of two values by call by value and call by reference using class and methods.
  - 11 Write a program to calculate the cube of a number entered by the user.
    - (a) Do this by multiplication.
    - (b) Do this by raising the number to the power 3. (Hint: look at the Math class for a Method that you can use.)
  - 12 Write a C# Program to implement to Convert Decimal to Binary, Octal, Hexadecimal and reverse too.
  - 13 WAP to search a number using linear search.

### **UNIT - III**

#### **I Test Your Skills:**

##### **(a) State Whether the Following Statements are True or False:**

- 1 The delegate base class type is defined in the System namespace.
- 2 The Form designer is for viewing and managing project files and settings.
- 3 The Properties Window is for configuring properties and events on controls in the user interface.
- 4 MouseDown event occurs when a mouse button is pressed while the mouse is within the control's boundaries.
- 5 Keychar is an event.

- 6 All generic method declarations have a type-parameter list delimited by angle brackets..
- 7 A generic class provides a means for describing a class in a type-independent manner.
- 8 When you create a WPF application, four files are generated .
- 9 WPF was introduced in .NET Framework 2.0.
- 10 The System.DateTime class of the .NET Framework allows you to use, store, and manipulate data of time and date.

**Ans.** (1)(T), (2)(F), (3)(T), (4)(T), (5)(F), (6)(T), (7)(T), (8)(T), (9)(F), (10)(T)

**(b) Multiple Choice Questions:**

- 1 Which of the following statements are correct about an *ArrayList* collection that implements the *IEnumerable* interface?
1. The *ArrayList* class contains an inner class that implements the *IEnumerator* interface.
  2. An *ArrayList* Collection cannot be accessed simultaneously by different threads.
  3. The inner class of *ArrayList* can access *ArrayList* class's members.
  4. To access members of *ArrayList* from the inner class, it is necessary to pass *ArrayList* class's reference to it.
  5. Enumerator's of *ArrayList* Collection can manipulate the array.
- (a) 1 and 2 only  
 (b) 1,3 and 4 only  
 (c) 2 and 5 only  
 (d) None of the above  
 (e) All of the above
- 2 How many enumerators will exist if four threads are simultaneously working on an *ArrayList* object?
- (a) 1  
 (b) 3  
 (c) 2  
 (d) 4  
 (e) Depends upon the Project Setting made in Visual Studio.NET.
- 3 In which of the following collections is the Input/Output index-based?
1. Stack
  2. Queue
  3. BitArray
  4. *ArrayList*
  5. HashTable
- (a) 1 and 2 only  
 (b) 3 and 4 only  
 (c) 5 only  
 (d) 1, 2 and 5 only  
 (e) All of the above

- 4 Which of the following statements are correct about the *Stack* collection?
1. It can be used for evaluation of expressions.
  2. All elements in the *Stack* collection can be accessed using an enumerator.
  3. It is used to maintain a FIFO list.
  4. All elements stored in a *Stack* collection must be of similar type.
  5. Top-most element of the *Stack* collection can be accessed using the *Peek()* method.
- (a) 1 and 2 only  
(b) 3 and 4 only  
(c) 1, 2 and 5 only  
(d) All of the above  
(e) None of the above
- 5 Which of the following is the correct way to access all elements of the *Queue* collection created using the C#.NET code snippet given below?
- ```
Queue q = new Queue();  
q.Enqueue("Sachin");  
q.Enqueue('A');  
q.Enqueue(false);  
q.Enqueue(38);  
q.Enqueue(5.4);
```
- (a) `IEnumerator e;`
`e = q.GetEnumerator();`
`while (e.MoveNext())`
`Console.WriteLine(e.Current);`
- (b) `IEnumerable e;`
`e = q.GetEnumerator();`
`while (e.MoveNext())`
`Console.WriteLine(e.Current);`
- (c) `IEnumerator e;`
`e = q.GetEnumerable();`
`while (e.MoveNext())`
`Console.WriteLine(e.Current);`
- (d) `IEnumerator e;`
`e = Queue.GetEnumerator();`
`while (e.MoveNext())`
`Console.WriteLine(e.Current);`
- 6 Which of the following statements is incorrect about delegate?
- (a) Delegates are reference types.
 - (b) Delegates are object oriented.
 - (c) Delegates are type-safe.
 - (d) Delegates serve the same purpose as function pointers in C and pointers to member function operators in C++.
 - (e) Only one method can be called using a delegate.

- 7 Which of the following statements are correct about the delegate declaration given below?
delegate void del(int i);
1. On declaring the delegate a class called del will get created.
 2. The signature of del need not be same as the signature of the method that we intend to call using it.
 3. The del class will be derived from the MulticastDelegate class.
 4. The method that can be called using del should not be a *static* method.
 5. The del class will contain a one-argument constructor and an Invoke() method.
- (a) 1, 2 and 3 only
(b) 1, 3 and 5 only
(c) 2 and 4 only
(d) 4 only
(e) All of the above
- 8 Suppose a Generic class called SortObjects is to be made capable of sorting objects of any type (Integer, Single, Byte etc.). Which of the following programming constructs should be used to implement the comparison function?
- (a) Namespace
(b) Interface
(c) Encapsulation
(d) Delegate
(e) Attribute
- 9 What is a delegate?
- (a) A strongly typed function pointer.
(b) A light weight thread or process that can call a single method.
(c) A reference to an object in a different process.
(d) An inter-process message channel.
- 10 Which of the following is included in Visual Studio IDE?
- (a) Form Designer
(b) Code Editor
(c) Solution Explorer
(d) All of the above
- 11 Which of the following is true about dispose() method?
- (a) This method is protected.
(b) Its return type is int.
(c) It accepts a float parameter.
(d) All of the above.

- 12 Button class derives from
- (a) Checkbox
 - (b) RadioButton
 - (c) ButtonBase
 - (d) None of the above
- 13 Which namespace includes most of the Control classes for developing Windows applications?
- (a) System;
 - (b) System.Windows.Controls
 - (c) System.Windows.Components.Forms
 - (d) System.Windows.Forms
 - (e) System.Windows.Drawing
- 14 Which of the Control objects is viewed as a container that can hold other objects when you design a Windows application?
- (a) Control
 - (b) Button
 - (c) Window
 - (d) Frame
 - (e) Form
- 15 When an instance method declaration includes the abstract modifier, the method is said to be an _____.
- (a) Abstract method
 - (b) Instance method
 - (c) Sealed method
 - (d) Expression method
- 16 The theory of _____ implies that user can control the access to a class, method, or variable.
- (a) Data hiding
 - (b) Encapsulation
 - (c) Information Hiding
 - (d) Polymorphism
- 17 Inheritance is _____ in nature.
- (a) Commutative
 - (b) Associative
 - (c) Transitive
 - (d) Iterative
- 18 The point at which an exception is thrown is called the _____.
- (a) Default point
 - (b) Invoking point
 - (c) Calling point
 - (d) Throw point

- 19 In C#, having unreachable code is always an _____.
(a) Method
(b) Function
(c) Error
(d) Iterative
- 20 C# treats the multiple catch statements like cases in a _____ statement.
(a) If
(b) Switch
(c) For
(d) While
- 21 C# supports a technique known as _____, which allows a method to specify explicitly the name of the interface it is implementing.
(a) Method Implementation
(b) Implicit Interface Implementation
(c) Explicit Interface Implementation
(d) Iterative Interface Implementation
- 22 The reason that C# does not support multiple inheritances is because of _____.
(a) Method collision
(b) Name collision
(c) Function collision
(d) Interface collision
- 23 _____ is a set of devices through which a user communicates with a system using interactive set of commands.
(a) Console
(b) System
(c) Keyboard
(d) Monitor
- 24 Exponential formatting character ('E' or 'e') converts a given value to string in the form of _____.
(a) m.dddd
(b) E+xxx
(c) m.dddd
(d) E+xxx
- 25 The _____ are the Graphical User Interface (GUI) components created for web based interactions..
(a) Web forms
(b) Window Forms
(c) Application Forms
(d) None of the above

- 26 In Microsoft Visual Studio, _____ technology and a programming language such as C# is used to create a Web based application.
- (a) JAVA
 - (b) J#
 - (c) VB.NET
 - (d) ASP.NET
- 27 The controls available in the tool box of the _____ are used to create the user interface of a web based application.
- (a) Microsoft visual studio IDE
 - (b) Application window
 - (c) Web forms
 - (d) None of the above
- 28 Web Forms consists of a _____ and a _____ .
- (a) Template, Component
 - (b) CLR, CTS
 - (c) HTML Forms, Web services
 - (d) Windows, desktop
- 29 The _____ parentheses that follow _____ indicate that no information is passed to Main ().
- (a) Empty, class
 - (b) Empty, submain
 - (c) Empty, Main
 - (d) Empty, Namespace
- 30 The scope of a variable depends on the _____ and _____.
- (a) Main method, place of its declaration
 - (b) Type of the variable, console
 - (c) compiler, main
 - (d) Type of the variable, place of its declaration
- 31 Which of the following statements is correct about the C#.NET code snippet given below?
- ```
class Student s1, s2; // Here 'Student' is a user-defined class.
s1 = new Student();
s2 = new Student();
```
- (a) Contents of s1 and s2 will be exactly same.
  - (b) The two objects will get created on the stack.
  - (c) Contents of the two objects created will be exactly same.
  - (d) The two objects will always be created in adjacent memory locations.
  - (e) We should use delete() to delete the two objects from memory.

- 32 Which of the following can be facilitated by the Inheritance mechanism?
- 1 Use the existing functionality of base class.
  - 2 Override the existing functionality of base class.
  - 3 Implement new functionality in the derived class.
  - 4 Implement polymorphic behaviour.
  - 5 Implement containership.
- (a) 1, 2, 3  
(b) 3, 4  
(c) 2, 4, 5  
(d) 3, 5
- 33 Which of the following should be used to implement a 'Has a' relationship between two entities?
- (a) Polymorphism  
(b) Templates  
(c) Containership  
(d) Encapsulation  
(e) Inheritance
- 34 Which of the following should be used to implement a 'Like a' or a 'Kind of' relationship between two entities?
- (a) Polymorphism  
(b) Containership  
(c) Templates  
(d) Encapsulation  
(e) Inheritance
- 35 How can you prevent inheritance from a class in C#.NET ?
- (a) Declare the class as shadows.  
(b) Declare the class as overloads.  
(c) Declare the class as sealed.  
(d) Declare the class as suppress.  
(e) Declare the class as override.
- 36 A class implements two interfaces each containing three methods. The class contains no instance data. Which of the following correctly indicate the size of the object created from this class?
- (a) 12 bytes  
(b) 24 bytes  
(c) 0 byte  
(d) 8 bytes  
(e) 16 bytes

- 37 Which of the following statements is correct about an interface used in C#.NET?
- (a) One class can implement only one interface.
  - (b) In a program if one class implements an interface then no other class in the same program can implement this interface.
  - (c) From two base interfaces a new interface cannot be inherited.
  - (d) Properties can be declared inside an interface.
  - (e) Interfaces cannot be inherited.
- 38 Which of the following statements is correct about Interfaces used in C#.NET?
- (a) All interfaces are derived from an Object class.
  - (b) Interfaces can be inherited.
  - (c) All interfaces are derived from an Object interface.
  - (d) Interfaces can contain only method declaration.
  - (e) Interfaces can contain static data and methods.
- 39 Which of the following statements is correct about an interface used in C#.NET?
- (a) If a class implements an interface partially, then it should be an abstract class.
  - (b) Class cannot implement an interface partially.
  - (c) An interface can contain static methods.
  - (d) An interface can contain static data.
  - (e) Multiple interface inheritance is not allowed.
- 40 Which of the following statements is correct about an interface?
- (a) One interface can be implemented in another interface.
  - (b) An interface can be implemented by multiple classes in the same program.
  - (c) A class that implements an interface can explicitly implement members of that interface.
  - (d) The functions declared in an interface have a body.

**Ans.** (1)(b), (2) (d), (3)(b), (4)(c), (5)(a),(6)(e), (7)(b), (8)(d), (9)(a), (10)(d), (11)(a), (12)(c), (13)(c), (14)(e), (15)(a), (16)(b), (17)(c), (18)(d), (19)(c), (20)(b), (21)(c), (22)(b), (23)(a), (24)(a), (25)(b), (26)(d), (27)(a), (28)(a), (29)(c), (30)(b), (31)(c), (32)(a), (33)(c), (34)(e), (35)(c), (36)(b), (37)(d), (38)(b), (39)(a), (40)(c)

**(c) Fill in the Blanks:**

- 1 An \_\_\_\_\_ is a notification from the operating system that an action has occurred.
- 2 \_\_\_\_\_ are objects that can display and respond to user interaction.
- 3 \_\_\_\_\_ class is used as a container to hold other controls.
- 4 \_\_\_\_\_ are special types of .NET classes whose instances store references to methods .
- 5 The delegate maintains a list of the registered \_\_\_\_\_ for an event.
- 6 A \_\_\_\_\_ is a GUI object that can contain text, buttons and symbols that inform and instruct a user.
- 7 \_\_\_\_\_ provide the means to create general models.
- 8 \_\_\_\_\_ is an ordered collection that can be manipulated like an array.

- 9 All collection classes in the .NET framework implement some combination of the  
10 WPF stands for \_\_\_\_\_

**Ans.** (1)(event), (2)(controls), (3)(Form), (4)(Delegates), (5)(event handlers), (6)(MessageBox), (7)(Generics), (8)(IList), (9)(collection interface), (10)(Windows Presentation Foundation)

## **II Short Answer Type Questions:**

- 1 What are collections?
- 2 What is a delegate?
- 3 What is the main use of delegates in C#?
- 4 What are multicast delegates?
- 5 What are lambda expressions?
- 6 Define anonymous functions.
- 7 What are action delegates?
- 8 What are generics in C#?
- 9 What is the basic difference between generics and collections?
- 10 What is a messagebox?
- 11 What is Dispose() method?
- 12 Explain working of main() method .
- 13 What is the difference between Combobox and Listbox.
- 14 What are keyboard events?
- 15 What is a property? Give an example?
- 16 What is Delegate ? Explain using example?
- 17 What is Metadata? What kind of information does it contain in context of assemblies?
- 18 Explain Explicit Vs implicit type conversions in C#?
- 19 What is a Event? Explain briefly how delegates act as base for events.
- 20 What is the significance of throw and finally block in Exception Handling?
- 21 What is the difference between C++ and C#?
- 22 Why Main( ) is static ? Explain the structure for writing main in C#?
- 23 Can constructors be static? How will that affect its working?
- 24 What do you mean my platform independence? Is .net platformIndependent?

## **III Long Answer Type Questions:**

- 1 Explain the delegates in C# along with its features.
- 2 How can we create delegates using lambda expressions.
- 3 What are generic interfaces? Discuss in detail.
- 4 What are generic collections? Explain.
- 5 What is a form? Discuss its various properties in detail.
- 6 What is IDE? Explain its various components.
- 7 Discuss the important parts of the automatically generated code while you design a form.
- 8 Discuss in detail ten public control properties.
- 9 Discuss in detail ten control class public instance events.

- 10 Explain some of the common mouse events.
- 11 Explain subscriber – notification paradigm for even handling.
- 12 Explain the classes stacks, linkedlist, queue,dictionary and their generic versions.
- 13 What is IEnumerable ? Explain its method and properties?
- 14 WAP to demonstrate hiding and overriding in C#?
- 15 Write a program to explain anonymous methods.
- 16 Explain delegate multi casting with example?
- 17 Explain the concept of Generalization and Specialization in C#?

#### **IV Practical Questions:**

- 1 Create a game form that contains six buttons. Display different prizes depending on the button the user selects.
- 2 Create a Form that contains at least five RadioButton objects, each labeled with a color. When the user clicks the RadioButton, change the BackColor of the Form appropriately.
- 3 Create a Form for a restaurant. Allow the user to choose one item from at least three options in each of the following categories-appetizer, entrée and dessert. Assign a different price to each selection and display the total when the user clicks a Button. Use the Controls that you think are best for each function.
- 4 Create a Message Displayer that has one ComboBox Object with a list of four of your favourite sayings. In your design, include the capability of letting users enter their own sayings. When a selection is made or a new entry is typed, display the selection on a Label object on your form.
- 5 Write a program in which create a class rectangle with class variables for storing length and breadth and define method area() in that class which will return the area of the rectangle. Create a class square which extends rectangle class but doesn't declare any class variables and overrides the area() method to return the area of square.
- 6 Write a C# program having an anonymous method that counts from 0 to 10, call this method using delegate and also include lambda expressions in it.
- 7 Write a C# program that declares a class containing an event and handle it with proper message.
- 8 Make an application of Shopping Cart
- 9 Make an application which presents a form with a text box to write comments. It will allow the user to change the font and color of the text in the text box. The form looks like this
- 10 Design a windows application For Standard Calculator
- 11 Write a program to demonstrate command object methods in a windows application

#### **UNIT - IV**

##### **I Test Your Skills:**

##### **(a) State Whether the Following Statements are True or False:**

- 1 A markup is an instruction that defines XML
- 2 To implement XML, the .NET Framework provides the **System.Xml** namespace.

- 3 The Document object model holds information about the structure of an XML document.
- 4 Language Integrated Query is an innovation introduced in Visual Studio 2005.
- 5 LINQ to SQL fully supports transactions, views, and stored procedures
- 6 There are around 100 standard LINQ operators.
- 7 LINQ to SQL allows you to query SQL Server database without writing data access code.
- 8 ADO.NET uses data providers to connect, execute commands and retrieve results from a database.
- 9 DataAdapter object establishes a connection to a data source.
- 10 System.Data classes represent the ADO.NET architecture.

**Ans.** (1)(T), (2)(T), (3)(F), (4)(F), (5)(T), (6)(F), (7)(T), (8)(T), (9)(F), (10)(T)

**(b) Multiple Choice Questions:**

- 1 All of the following are examples of ADO.NET data providers except:
  - (a) OLE DB
  - (b) Oracle
  - (c) ODBC
  - (d) Sql Server
  - (e) Access
  
- 2 Databases store information in records, fields and:
  - (a) data providers
  - (b) grids
  - (c) columns
  - (d) tables
  
- 3 Each data provider class is grouped and accessible through its:
  - (a) namespace
  - (b) database
  - (c) datagrid
  - (d) provider
  - (e) system
  
- 4 In Visual Studio, the tool that enables you to connect to a database and automatically populate a dataset object using a TableAdapter object is the \_\_\_\_\_ wizard:
  - (a) Data Source Configuration
  - (b) Data Source
  - (c) Query Builder
  - (d) DataSet Designer
  - (e) TableAdapter Query Configuration

- 5 In XML, a document is a hierarchy of
- (a) attributes
  - (b) elements
  - (c) tags
  - (d) All of the above
- 6 Which of the following namespace contains the LINQ to XML?
- (a) System.Xml;
  - (b) System.Data;
  - (c) System.Xml.Linq;
  - (d) System.Linq;
- 7 LINQ to SQL works with
- (a) SQL Server
  - (b) SQL Server Compact 3.5
  - (c) Both (a) and (b)
  - (d) None of the above
- 8 A connection string contains
- (a) a using directive
  - (b) the name of the data source
  - (c) the version number of database management system
  - (d) the list of fields in the database
- 9 To avoid writing additional SQL statements to update a live database, you instantiate an object of which class?
- (a) DataAdapter
  - (b) DataReader
  - (c) DataSet
  - (d) CommandBuilder
  - (e) DataGrid
- 10 The following namespaces (System.Data.OleDb, System.Data.SqlClient, System.Data.Odbc, System.Data.OracleClient) include classes for different:
- (a) Data providers
  - (b) File streams
  - (c) ADO.NET applications
  - (d) Databases
  - (e) Data readers
- 11 Which of the following is a definition of a database?
- (a) It is a collection of related information organized on a computer.
  - (b) It is single flat file.
  - (c) It is a file that can only be set up on a single PC.
  - (d) It is a group of files that can be set up only on a network.



- 12 A computer application for managing databases and pulling together data to generate reports and make decisions is known as a(n)
- (a) Database System (DS).
  - (b) File Manager (FM).
  - (c) Management System (MS).
  - (d) Database Management System (DBMS).
- 13 Which of the following characterizes the relational model for databases?
- (a) It organizes data into a hierarchal format.
  - (b) It splits data into separate row and column areas called tables.
  - (c) It organizes data into one large table.
  - (d) It organizes data into a network format.
- 14 A field is a
- (a) group of records.
  - (b) index that locates information in a table.
  - (c) common characteristic in a table of information.
  - (d) code that represents a record.
- 15 A record is a
- (a) index that locates information in a table.
  - (b) common characteristic in a table of information.
  - (c) code that represents a record.
  - (d) collection of fields in one row of a table.
- 16 Forms and reports, used for entering and editing records, and for generating useful information in reports are
- (a) additional database objects.
  - (b) only useful for complex databases.
  - (c) difficult to generate.
  - (d) stored separately from databases.
- 17 A computer application that manages a database, in which different kinds of data are stored in separate tables, is known as a
- (a) Normal database system.
  - (b) Network database system.
  - (c) Standalone database system.
  - (d) Relational database management system.
- 18 Which of the following are examples of relational database management systems?
- (a) Adobe Publisher and Autocad
  - (b) Delphi and Turbo C++
  - (c) Microsoft Excel and Microsoft Project
  - (d) Microsoft Access and SQL 2000

- 19 A unique field which distinguishes a record is known as a
- (a) Foreign key.
  - (b) Primary key.
  - (c) Tertiary key.
  - (d) Secondary key.
- 20 In a database, a parent-child relationship is also known as a
- (a) Many-to-one relationship.
  - (b) Many-to-many relationship.
  - (c) One-to-many relationship.
  - (d) One-to-one relationship.
- 21 The field in the child table that links information to the parent table is known as the
- (a) Foreign key.
  - (b) Primary key.
  - (c) Tertiary key.
  - (d) Secondary key.
- 22 ADO.NET is the data access component of Microsoft's .NET framework that enables you to
- (a) connect your Visual Basic.NET applications to your company's local area network.
  - (b) connect your Visual Basic.NET applications to databases.
  - (c) connect your PC to the Internet.
  - (d) connect your local area network to the Internet.
- 23 ADO.NET was created for
- (a) Multiple users.
  - (b) Single users.
  - (c) Home network users.
  - (d) Limited users.
- 24 Which of the following statements characterizes the relationship between a Visual Basic.NET program and a database record?
- (a) They are connected.
  - (b) External databases cannot be accessed by Visual Basic.NET.
  - (c) They are connected as long as the program is running.
  - (d) They are not connected.
- 25 A copy of a database is called a
- (a) Duplicate database.
  - (b) Dataset.
  - (c) Table.
  - (d) Database copy.

- 26 When is the dataset connected to the database?
- (a) Whenever the program makes changes to a field or record
  - (b) They are always connected
  - (c) They are always disconnected
  - (d) Whenever the program is running
- 27 The connection to the database is established by
- (a) Using a local area network.
  - (b) Installing a special software package.
  - (c) Using managed providers.
  - (d) Using a wide area network.
- 28 The ADO.NET disconnected dataset
- (a) Provides a flexible way of working with database records.
  - (b) Makes working with databases very complex.
  - (c) Requires a large amount of memory space.
  - (d) Is required when single users want to access a database.
- 29 XML provides a(n)
- (a) Difficult format for data storage.
  - (b) Numeric based code for data storage.
  - (c) Consistent format for data across applications, networks, and the Internet.
  - (d) Limited format for data storage.
- 30 Why does Visual Studio.NET use XML as a data storage technology?
- (a) XML works best for the single PC user.
  - (b) XML restricts the number of applications that can interface with Visual Basic.NET.
  - (c) XML is optimized for sharing data across the Internet.
  - (d) XML is easier to understand than Visual Basic.NET.
- 31 Choose the correct statements about the LINQ?
- (a) The main concept behind the linq is query
  - (b) linq make use of for loop to execute the query
  - (c) It is not required that linq should make use of IEnumerable interface
  - (d) None of the mentioned
- 32 Choose the namespace in which the interface IEnumerable is declared?
- (a) System.Collections
  - (b) System.Collections.Generic
  - (c) Both a & b
  - (d) None of the mentioned

- 33 Can we use linq to query against a DataTable?
- (a) Yes
  - (b) No
  - (c) Situational
  - (d) None of the mentioned
- 34 Select the namespace which should be included while making use of LINQ operations:
- (a) System.Text
  - (b) System.Collections.Generic
  - (c) System.Linq
  - (d) None of the mentioned
- 35 What is meant by the term generics?
- (a) parameterized types
  - (b) class
  - (c) structure
  - (d) interface
- 36 Are generics in C# are same as the generics in java and templates in C++?
- (a) Yes
  - (b) No
  - (c) May be
  - (d) None of the mentioned
- 37 Choose the advantages of using generics?
- (a) Generics facilitate type safety
  - (b) Generics facilitate improved performance and reduced code
  - (c) Generics promote the usage of parameterized types
  - (d) All of the mentioned
- 38 Which among the given classes present in System.Collection.Generic.namespace?
- (a) Stack
  - (b) Tree
  - (c) Sorted Array
  - (d) All of the mentioned
- 39 Which feature enables to obtain information about use and capabilities of types at runtime?
- (a) Runtime type ID
  - (b) Reflection
  - (c) Attributes
  - (d) None of the mentioned

- 40 Choose the namespace which consists of classes that are part of .NET Reflection API:
- (a) System.Text
  - (b) System.Name
  - (c) System.Reflection
  - (d) None of the mentioned

**Ans.** (1)(e), (2)(d), (3)(a), (4)(a), (5)(b),(6)(c), (7)(c), (8)(b), (9)(a), (10)(a), (11)(a) (12)(d), (13)(b), (14)(c), (15)(d), (16)(d), (17)(d), (18)(d), (19)(d),(20)(c), (21)(a), (22)(b), (23)(a), (24)(c), (25)(b), (26)(a), (27)(c), (28)(a), (29)(c), (30)(c), (31)(a), (32)(a), (33)(a), (34)(c), (35)(a), (36)(a), (37)(d), (38)(a) (39)(b), (40)(c)

**(c) Fill in the Blanks:**

- 1 XML stands for \_\_\_\_\_.
- 2 The fundamental formula of a markup is \_\_\_\_\_.
- 3 An XML file is a normal text-based document that has a \_\_\_\_\_ extension.
- 4 The standards for an XML file are defined by the W3C\_\_\_\_\_.
- 5 The \_\_\_\_\_ keyword in the LINQ vocabulary indicates the collection or sequence from which data will be drawn.
- 6 \_\_\_\_\_ are extension methods that allow the expression of queries.
- 7 \_\_\_\_\_ is the namespace for Oracle data provider.
- 8 The \_\_\_\_\_ object performs a sequential access of the data in the data source.
- 9 A \_\_\_\_\_ is a cache of records retrieved from some data source .
- 10 There are \_\_\_\_\_ data providers included with .NET.

**Ans.** (1)(Extensible Markup Language ), (2)(<tag>), (3)(.xml), (4)(Document Object model), (5)(from), (6)( Query operators), (7)(System.Data.OracleClient), (8)(command), (9)(dataset), (10)(four)

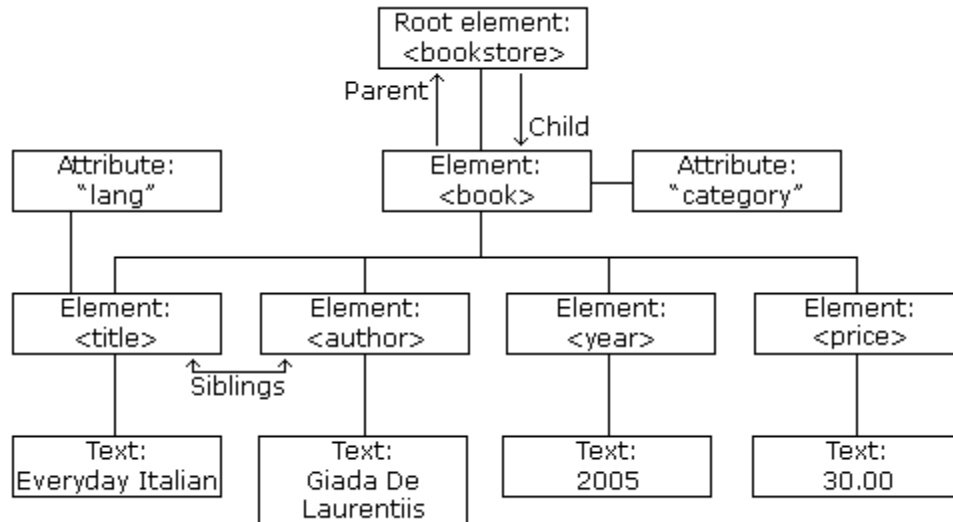
**II Short Answer Type Questions:**

- 1 What is XML?
- 2 Define XAML.
- 3 What is XHTML?
- 4 Define XML attributes.
- 5 Discuss select, from and where keywords in the LINQ vocabulary.
- 6 Give some examples of LINQ operators.
- 7 What is ADO.NET?
- 8 Give the names of ADO.NET data providers.
- 9 What are the core objects that make up ADO.NET data providers?
- 10 What is a dataset?
- 11 What are the different namespaces for various data providers?
- 12 What are the interfaces implemented by the core ADO.NET objects?
- 13 What does System.Data classes represent?
- 14 What does the app.config file stores?
- 15 What is Query Builder?

- 16 Explain DTD and XSLT ?
- 17 What is the need of using XML?
- 18 Differentiate between XML and HTML?

**III Long Answer Type Questions:**

- 1 Explain XML Namespaces.
- 2 What are the various elements in XML?
- 3 What is LINQ? Explain its features in detail.
- 4 Explain how the data can be retrieved using LINQ in C#.
- 5 Explain how LINQ is associated with SQL.
- 6 Explain Data Source Configuration Wizard in detail.
- 7 Describe the role of a Data Reader with the help of an example.
- 8 What is Data Adapter object? Give an example.
- 9 Describe the DataGridView object along with an example.
- 10 What is TableAdapter Object? Explain.
- 11 Differentiate between connected and disconnected architecture in ADO.NET?
- 12 What are Extension methods explain with example?
- 13 Why does from clause comes before select clause in LINQ?
- 14 Differentiate between Connected and Disconnected architecture?
- 15 What is XML? Write an XML for following hierarchy?



- 16 WAP to demonstrate hiding and overriding in C#?
- 17 Write a program to explain anonymous methods.
- 18 Explain delegate multi casting with example?
- 19 Explain the concept of Generalization and Specialization in C#?
- 20 Perform the following Queries using linq(Use NorthWind Database)
  - (a) Retrieve the data of Product table in the datagrid
  - (b) Display the details of the Product whose name starts with 'A'
  - (c) Display the details of the Product lying in the 'Beverages' category

- (d) Select the details of the Product whose order has not been placed yet and whose cost is more than 100
  - (e) Select the details of the Product whose product name contains 'Chef'
- 21 Perform the following operations using Linq
- (a) Insert a new Product in the product table having the following values  
ProductName="Maggie"  
QuantityPerUnit ="15";  
UnitPrice =20;
  - (b) Update the quantity of "Tofu" to 50 in Product table
  - (c) Delete the Product which are not in Stock
  - (d) Display the Data
- 22 What is stack collection? Explain following methods of stack collection
- (1) Clear()
  - (2) Peek()
  - (3) Contains()
  - (4) Pop()
  - (5) Copyto() .
- 23 Why 'select' clause comes after 'from' clause in LINQ?
- 24 What is XAML?
- 25 Differentiate between generic and non-generic Collection?

# **QUESTION BANK**

## **JAVA PROGRAMMING**

### **MCA 205**



**QUESTION BANK**  
**JAVA PROGRAMMING - MCA 205**  
**MCA III**

**UNIT - I**

**I Test Your Skills:**

**(a) State Whether the Following Statements are True or False:**

- 1 By convention, method names begin with an uppercase first letter and all subsequent words in the name begin with a capital first letter.
- 2 An import declaration is not required when one class in a package uses another in the same package.
- 3 Empty parentheses following a method name in a method declaration indicate that the method does not require any parameters to perform its task.
- 4 Variables or methods declared with access modifier private are accessible only to methods of the class in which they are declared.
- 5 A primitive-type variable can be used to invoke a method.
- 6 Variables declared in the body of a particular method are known as instance variables and can be used in all methods of the class.
- 7 Every method's body is delimited by left and right braces ({ and }).
- 8 Primitive-type local variables are initialized by default.
- 9 Reference-type instance variables are initialized by default to the value null.
- 10 Floating-point values that appear in source code are known as floating-point literals and are type float by default.
- 11 Java is a pure object oriented programming language.
- 12 Each method in a class must have a unique name.
- 13 The access level of an overridden method cannot be changed in a subclass.
- 14 The return value from a method must always match the declared return type.
- 15 A method declaration must always contain the access level.

**Ans.** (1)(F), (2)(T), (3)(T), (4)(T), (5)(F), (6)(F), (7)(T), (8)(F), (9)(T), (10)(F), (11)(T), (12)(T), (13)(T), (14)(T), (15)(F)

**(b) Multiple Choice Questions:**

- 1 Which of the following statements is legal in Java?
  - (i) `mysRef = (Mystery) mySecret;`
  - (ii) `mysRef = (Mystery) secRef;`
  - (a) Only (i)
  - (b) Only (ii)
  - (c) Both (i) and (ii)
  - (d) None of these

2 Consider the following class definitions.

```
public class BClass
{
 private int x;
 private double y;
 public void print() { }
}
public class DClass extends BClass
{
 private int a;
 private int b;
 public void print() { }
}
```

Suppose that you have the following statement.

```
DClass dObject = new DClass();
```

How many instance variables DObject has?

- (a) 0
- (b) 2
- (c) 4
- (d) None of these

3 What is the value of the following expression?

```
5 < 3 || 6 < 7 || 4 > 1 && 5 > 3 || 2 < x
```

- (a) true
- (b) false
- (c) x
- (d) It cannot be determined.

4 In a \_\_\_\_ control structure, the computer executes particular statements depending on some condition(s).

- (a) looping
- (b) repetition
- (c) selection
- (d) sequence

5 What is the value of y if  $x = 2$ ?

- (a) 2
- (b) 3
- (c) 7
- (d) 9

6 Two-way selection in Java is implemented using \_\_\_\_\_.

- (a) if statements
- (b) for loops
- (c) if...else statements
- (d) sequential statements

- 7 Which of the following will cause a semantic error, if you are trying to compare x to 5?
- (a) if (x == 5)
  - (b) if (x = 5)
  - (c) if (x <= 5)
  - (d) if (x >= 5)
- 8 How many constructors does the class Exception have?
- (a) 0
  - (b) 1
  - (c) 2
  - (d) 3
- 9 If class Dog has a subclass Retriever, which of the following is true?
- (a) Because of single inheritance, Dog can have no other subclasses.
  - (b) Because of single inheritance, Retriever can extend no other class except Dog.
  - (c) The relationship between these classes implies that Dog “is-a” Retriever.
  - (d) The relationship between these classes implies that Retriever “has-a” Dog.
- 10 If there are three classes: Shape, Circle, and Square, what is the most likely relationship between them?
- (a) Square is a superclass, and Shape and Circle are subclasses of Square.
  - (b) Shape is a superclass, and Circle and Square are subclasses of Shape.
  - (c) Shape, Circle, and Square are all sibling classes.
  - (d) These three classes cannot be related.
- 11 What is byte code in the context of Java?
- (a) The type of code generated by a Java compiler
  - (b) The type of code generated by a Java Virtual Machine
  - (c) It is another name for a Java source file
  - (d) It is the code written within the instance methods of a class.
- 12 What is garbage collection in the context of Java?
- (a) The operating system periodically deletes all of the java files available on the system.
  - (b) Any package imported in a program and not used is automatically deleted.
  - (c) When all references to an object are gone, the memory used by the object is automatically reclaimed.
  - (d) The JVM checks the output of any Java program and deletes anything that doesn't make sense.
- 13 What is different between a Java applet and a Java application?
- (a) An application can in general be trusted whereas an applet can't.
  - (b) An applet must be executed in a browser environment.
  - (c) An applet is not able to access the files of the computer it runs on
  - (d) All of the above

- 14 JAR stands for?  
(a) Java Archive  
(b) Java Archive Runner  
(c) Java Application Runner  
(d) None of the above
- 15 What are the pillars of OOPS concept?  
(a) Abstraction, Inheritance, Encapsulation, Polymorphism  
(b) Atomicity, Inheritance, Encapsulation, Polymorphism  
(c) Abstraction, Inheritance, Polymorphism  
(d) None of the Above
- 16 What is the default buffer size used by any buffered class?  
(a) 128 bytes  
(b) 256 bytes  
(c) 512 bytes  
(d) 1024 bytes
- 17 Which class cannot be a subclass in java  
(a) Abstract class  
(b) Parent class  
(c) Final class  
(d) None of above
- 18 Why we use array as a parameter of main method  
(a) It is syntax  
(b) Can store multiple values  
(c) Both of above  
(d) None of above
- 19 What is process of defining two or more methods within same class that have same name but different parameters declaration?  
(a) Method overloading  
(b) Method overriding  
(c) Method hiding  
(d) None of the mentioned
- 20 Which of these can be overloaded?  
(a) Methods  
(b) Constructors  
(c) Both a & b  
(d) None of the mentioned

- 21 Which of these is correct about passing an argument by call-by-value process?
- (a) Copy of argument is made into the formal parameter of the subroutine.
  - (b) Reference to original argument is passed to formal parameter of the subroutine.
  - (c) Copy of argument is made into the formal parameter of the subroutine and changes made on parameters of subroutine have effect on original argument.
  - (d) Reference to original argument is passed to formal parameter of the subroutine and changes made on parameters of subroutine have effect on original argument.
- 22 What is the process of defining a method in terms of itself that is a method that calls itself?
- (a) Polymorphism
  - (b) Abstraction
  - (c) Encapsulation
  - (d) Recursion
- 23 Which of the following statements are incorrect?
- (a) Default constructor is called at the time of declaration of the object if a constructor has not been defined.
  - (b) Constructor can be parameterized.
  - (c) Finalize() method is called when a object goes out of scope and is no longer needed.
  - (d) Finalize() method must be declared protected.
- 1 What is the stored in the object obj in following lines of code?  
box obj;
- (a) Memory address of allocated memory of object.
  - (b) NULL
  - (c) Any arbitrary pointer
  - (d) Garbage
- 25 Which of the following is a valid declaration of an object of class Box?
- (a) Box obj = new Box();
  - (b) Box obj = new Box;
  - (c) obj = new Box();
  - (d) new Box obj;
- 26 Which of this statement is incorrect?
- (a) Every class must contain a main() method.
  - (b) Applets do not require a main() method at all.
  - (c) There can be only one main() method in a program.
  - (d) main() method must be made public.

- 27 Which of the following statements is correct?
- (a) Public method is accessible to all other classes in the hierarchy
  - (b) Public method is accessible only to subclasses of its parent class
  - (c) Public method can only be called by object of its class.
  - (d) Public method can be accessed by calling object of the public class.

- 28 What is the output of this program?

```
1. class box {
2. int width;
3. int height;
4. int length;
5. }
6. class mainclass {
7. public static void main(String args[])
8. {
9. box obj = new box();
10. obj.widht = 10;
11. obj.height = 2;
12. obj.length = 10;
13. int y = obj.widht * obj.height * obj.length;
14. System.out.print(y);
15. }
16. }
```

- (a) 12
- (b) 200
- (c) 400
- (d) 100

- 29 What is the output of this program?

```
1. class box {
2. int width;
3. int height;
4. int length;
5. }
6. class mainclass {
7. public static void main(String args[])
8. {
9. box obj = new box();
10. System.out.println(obj);
11. }
12. }
```

- (a) 0
- (b) 1
- (c) Runtime error
- (d) Garbage value

- 30 Program which executes applet is known as
- (a) applet engine
  - (b) virtual machine
  - (c) JVM
  - (d) None of above
- 31 What is byte code in the context of Java?
- (a) The type of code generated by a Java compiler
  - (b) The type of code generated by a Java Virtual Machine
  - (c) It is another name for a Java source file
  - (d) It is the code written within the instance methods of a class.
- 32 What is different between a Java applet and a Java application?
- (a) An application can in general be trusted whereas an applet can't.
  - (b) An applet must be executed in a browser environment.
  - (c) An applet is not able to access the files of the computer it runs on
  - (d) All of the above
- 33 You read the following statement in a Java program that compiles and executes.  
submarine.dive(depth);  
What can you say for sure?
- (a) Depth must be an int
  - (b) Dive must be a method.
  - (c) Dive must be the name of an instance field.
  - (d) Submarine must be the name of a class
- 34 Which is true about an anonymous inner class?
- (a) It can extend exactly one class and implement exactly one interface.
  - (b) It can extend exactly one class and can implement multiple interfaces.
  - (c) It can implement multiple interfaces regardless of whether it also extends a class.
- 35 If a thread is to be declared as a daemon thread, it must be declared before
- (a) start method
  - (b) run method
  - (c) stop method
  - (d) none
- 36 Under what circumstances might you use the yield method of the Thread class
- (a) To call from the currently running thread to allow another thread of the same or higher priority to run
  - (b) To call on a waiting thread to allow it to run
  - (c) To allow a thread of higher priority to run
  - (d) To call from the currently running thread with a parameter designating which thread should be allowed to run

- 37 Which of the following is the correct syntax for suggesting that the JVM performs garbage collection?
- (a) `System.free();`
  - (b) `System.setGarbageCollection();`
  - (c) `System.out.gc();`
  - (d) `System.gc();`
- 38 A class that cannot be a subclass is called as \_\_\_\_\_ class.
- (a) abstract
  - (b) parent class
  - (c) Final
  - (d) none of these
- 39 What is the default buffer size used by any buffered class?
- (a) 128 bytes
  - (b) 256 bytes
  - (c) 512 bytes
  - (d) 1024 bytes
- 40 When method defined in subclass which has same signature as a method in a super class, it is known as method
- (a) Overloading
  - (b) Overriding
  - (c) Packing
  - (d) None of these
- 41 Which of the following statement is correct?
- (a) For positive numbers, result of operators `>>` and `>>>` are same
  - (b) Java provides two operators to do left shift `<<<` and `<<`
  - (c) `>>` is the zero fill right shift operator
  - (d) `>>>` is the signed right shift operator
- 42 Java language has support for which of the following types of comment ?
- (a) block, line and javadoc
  - (b) javadoc, literal and string
  - (c) javadoc, char and string
  - (d) single, multiple and quote
- 43 Consider the following program:
- ```
import myLibrary.*;
public class ShowSomeClass
{
// code for the class...
}
```
- What is the name of the java file containing this program?

- (a) myLibrary.java
 - (b) ShowSomeClass.java
 - (c) ShowSomeClass
 - (d) ShowSomeClass.class 1.
- 44 Which of the following is TRUE?
- (a) In java, an instance field declared public generates a compilation error.
 - (b) int is the name of a class available in the package java.lang
 - (c) Instance variable names may only contain letters and digits.
 - (d) A class has always a constructor (possibly automatically supplied by the java compiler).
- 45 Consider the following code snippet
String river = new String("Columbia");
System.out.println(river.length());
What is printed?
- (a) 6
 - (b) 7
 - (c) 8
 - (d) Columbia
- 46 What is different between a Java applet and a Java application?
- (a) An application can in general be trusted whereas an applet can't.
 - (b) An applet must be executed in a browser environment.
 - (c) An applet is not able to access the files of the computer it runs on
 - (d) (A), (B) and (C).
- 47 You read the following statement in a Java program that compiles and executes.
submarine.dive(depth);
What can you say for sure?
- (a) depth must be an int
 - (b) dive must be a method.
 - (c) dive must be the name of an instance field.
 - (d) submarine must be the name of a class 10. E. submarine must be a method.
- 48 What is garbage collection in the context of Java?
- (a) The operating system periodically deletes all of the java files available on the system.
 - (b) Any package imported in a program and not used is automatically deleted.
 - (c) When all references to an object are gone, the memory used by the object is automatically reclaimed.
 - (d) The JVM checks the output of any Java program and deletes anything that doesn't make sense.

49 Consider
public class MyClass{
public MyClass(){/*code*/}
// more code...
}

To instantiate MyClass, you would write?

- (a) MyClass mc = new MyClass();
- (b) MyClass mc = MyClass();
- (c) MyClass mc = MyClass;
- (d) MyClass mc = new MyClass; 7. E. It can't be done. The constructor of MyClass should be defined as public void MyClass(){/*code*/}

50 In Java Inheritance

- (a) all fields of a class are private
- (b) all fields of a class are protected
- (c) a new class is derived from an existing class
- (d) none of these above

Ans. (1)(b), (2)(c), (3)(a), (4)(c), (5)(d), (6)(c), (7)(b), (8)(c), (9)(b), (10)(b), (11)(a), (12)(c), (13)(d), (14)(a), (15)(a), (16)(c), (17)(c), (18)(b), (19)(a), (20)(c), (21)(a), (22)(d), (23)(c), (24)(b), (25)(a), (26)(a), (27)(a), (28)(b), (29)(d), (30)(a), (31)(a), (32)(d), (33)(b), (34)(b), (35)(a), (36)(a), (37)(d), (38)(c), (39)(c), (40)(b), (41)(a), (42)(a), (43)(b), (44)(d), (45)(c), (46)(d), (47)(b), (48)(c), (49)(a), (50)(c).

(c) Fill in the Blanks:

- 1 A house is to a blueprint as a(n) ___ is to a class.
- 2 Each class declaration that begins with keyword ___ must be stored in a file that has exactly the same name as the class and ends with the .java file-name extension.
- 3 Every class declaration contains keyword ___ followed immediately by the class's name.
- 4 Keyword ___ creates an object of the class specified to the right of the keyword.
- 5 Each parameter must specify both a(n) ___ and a(n) ___.
- 6 By default, classes that are compiled in the same directory are considered to be in the same package known as the ___.
- 7 When each object of a class maintains its own copy of an attribute, the field that represents the attribute is also known as a(n) _____.
- 8 Java provides two primitive types for storing floating-point numbers in memory ___ and _____.
- 9 Variables of type double represent ___ floating-point numbers.
- 10 Scanner method ___ returns a double value.
- 11 Keyword public is a(n) ___.
- 12 Return type ___ indicates that a method will perform a task but will not return any information when it completes its task.
- 13 Scanner method ___ reads characters until a newline character are encountered, and then returns those characters as a String.
- 14 Class String is in package ___.

- 15 A(n) ___ is not required if you always refer to a class with its fully qualified class name.
- 16 A(n) ___ is a number with a decimal point, such as 7.33, 0.0975 or 1000.12345.
- 17 Variables of type float represent ___ floating-point numbers.
- 18 The format specifier ___ is used to output values of type float or double.
- 19 Types in Java are divided into two categories ___ types and ___ types.
- 20 Lists and tables of values can be stored in _____.
- 21 An array is a group of _____ (called elements or components) containing values that all have the same _____.
- 22 The _____ allows programmers to iterate through the elements in an array without using a counter.
- 23 The number used to refer to a particular element of an array is called the element's _____.
- 24 Any class that contains public static void main (String args[]) can be used to _____ an application.
- 25 The number of arguments in the method call must match the number of parameters in the method _____ parameter list.

Ans. (1)(object), (2)(public), (3)(class), (4)(new), (5)(type, name), (6)(default package), (7)(instance variable), (8)(float, double), (9)(double-precision), (10)(nextDouble), (11)(access modifier), (12)(void), (13)(nextLine), (14)(java.lang), (15)(import declaration), (16)(floating-point number), (17)(single-precision), (18)(%f), (19)(primitive, reference), (20)(arrays), (21)(variables, type), (22)(enhanced for statement), (23)(index), (24)(Execute), (25)(declaration's)

II Short Answer Type Questions:

- 1 What is the difference between a local variable and a field?
- 2 Explain the purpose of a method parameter. What is the difference between a parameter and an argument?
- 3 Write four different Java statements that each adds 1 to integer variable x.
- 4 Identify and correct the errors in each of the following sets of code:
- (a) while (c <= 5)
- (b) {
- (c) product *= c;
- (d) ++c;
- (e) }
- (f) if (gender == 1)
- (g) System.out.println("Woman");
- (h) else;
- (i) System.out.println("Man");
- 5 What is wrong with the following while statement?
- ```
while (z >= 0)
sum += z;
```

6 Find the error in each of the following code segments, and explain how to correct it:

- (a) `i = 1;`  
`while ( i <= 10 );`  
`i++;`  
`}`
- (b) `for ( k = 0.1; k != 1.0 ; k += 0.1 )`  
`System.out.println( k );`
- (c) `switch ( n )`  
`{`  
`case 1:`  
`System.out.println( "The number is 1" );`  
`case 2:`  
`System.out.println( "The number is 2" );`  
`break;`  
`default:`  
`System.out.println( "The number is not 1 or 2" );`  
`break;`  
`}`

7 Why is the `Math.random` method useful for simulating games of chance?

8 Write a method `squareOfAsterisks` that displays a solid square (the same number of rows and columns) of asterisks whose side is specified in integer parameter `side`. For example, if `side` is 4, the method should display

```



```

Incorporate this method into an application that reads an integer value for `side` from the user and outputs the asterisks with the `squareOfAsterisks` method.

9 Explain the notion of package access in Java. Explain the negative aspects of package access.

10 What happens when a return type, even `void`, is specified for a constructor?

11 Explain why the value of the expression `2 + 3 + "test"` is the string `"5test"` while the value of the expression `"test" + 2 + 3` is the string `"test23"`. What is the value of `"test" + 2 * 3`?

12 If you have the source code for a Java program, and you want to run that program, you will need both a *compiler* and an *interpreter*. What does the Java compiler do, and what does the Java interpreter do?

13 Java is a "platform-independent language." What does this mean?

14 What if the `main` method is declared as `private`?

15 What if the `static` modifier is removed from the signature of the `main` method?

16 What are Wrapper Classes?

17 Define Inheritance.

18 What is Dynamic Method Dispatch?

19 Define Package.

20 Define Interface.

21 Differentiate `String` and `String Buffer`.

22 What is 'out' in `System.out.println()`.

- 23 What is numeric promotion?
- 24 What does the following statement display –  
 String s= “six:”+3+3:  
 System .out.println(s):
- 25 “Java is Architectural Neutral” Comment.
- 26 What is JVM? Explain.
- 27 When do we declare a ‘Class’ or ‘Method’ ‘Final’.
- 28 What is byte code verifier? Why is it necessary?
- 29 Give an example situation when it would be advantageous to create a class with package level accessibility.
- 30 What does the statement “ Java strings are immutable “ imply? State an advantage of immutability of string in java?
- 31 What is transient variable? Why do need it?

### III Long Answer Type Questions:

- 1 Write Java statements to accomplish each of the following tasks:
- Assign the sum of x and y to z, and increment x by 1 after the calculation. Use only one statement.
  - Test whether variable count is greater than 10. If it is, print "Count is greater than 10".
  - Decrement the variable x by 1, and then subtract it from the variable total. Use only one statement.
  - Calculate the remainder after q is divided by divisor, and assign the result to q. Write this statement in two different ways.
- 2 Write a Java statement to accomplish each of the following tasks:
- Declare variables sum and x to be of type int.
  - Assign 1 to variable x.
  - Assign 0 to variable sum.
  - Add variable x to variable sum, and assign the result to variable sum.
  - Print "The sum is: ", followed by the value of variable sum.
- 3 Write a complete Java application to prompt the user for the double radius of a sphere, and call method sphere Volume to calculate and display the volume of the sphere. Use the following statement to calculate the volume:  
`double volume = ( 4.0 / 3.0 ) * Math.PI * Math.pow( radius, 3 )`
- 4 Write an application that calculates the product of a series of integers that are passed to method product using a variable-length argument list. Test your method with several calls, each with a different number of arguments.
- 5 Write an application that uses an enhanced for statement to sum the double values passed by the command-line arguments. [Hint: Use the static method parse Double of class Double to convert a String to a double value.]
- 6 A small airline has just purchased a computer for its new automated reservations system. You have been asked to develop the new system. You are to write an application to assign seats on each flight of the airline's only plane (capacity: 10 seats).

Your application should display the following alternatives: Please type 1 for First Class and Please type 2 for Economy. If the user types 1, your application should assign a seat in the first-class section (seats 15). If the user types 2, your application should assign a seat in the economy section (seats 610). Your application should then display a boarding pass indicating the person's seat number and whether it is in the first-class or economy section of the plane.

Use a one-dimensional array of primitive type boolean to represent the seating chart of the plane. Initialize all the elements of the array to false to indicate that all the seats are empty. As each seat is assigned, set the corresponding elements of the array to true to indicate that the seat is no longer available.

Your application should never assign a seat that has already been assigned. When the economy section is full, your application should ask the person if it is acceptable to be placed in the first-class section (and vice versa). If yes, make the appropriate seat assignment. If no, display the message "Next flight leaves in 3 hours."

- 7 Write a program that reads a list of positive numbers < 100 and displays the largest and the smallest. A 0 (the number zero) should terminate the list. Do not use an array to answer this. Do not use any methods either. There is at least one number before the 0.
- 8 Explain what will happen if we do not provide the String array as the argument to the main method?
- 9 Explain method overloading and method overriding with suitable examples.
- 10 Explain vectors and their types.
- 11 Explain classes and objects of java classes.
- 12 Explain all types of control structures and looping statements.
- 13 Explain all types of inheritance supported by Java. Which type of Inheritance is not supported by Java?
- 14 Explain the way through which we can implement multiple inheritance in Java.
- 15 What are Constructors? What is their return type? Explain with the help of suitable examples various types of constructors.
- 16 What is JVM? Explain the architecture of JVM.
- 17 What is Interface? Write a program in java to explain the concept of multiple inheritances by using interface.
- 18 Discuss access protection in java classes and packages.
- 19 Write a program in java to search a particular String stored in an array. (The elements should be entered in array through keyboard).
- 20 Explain the architecture of JVM. Explain the super keyword in context of constructor, variable and method with example.
- 21 Explain the various accesses specifies of Java. Explain the concept of dynamic method dispatch using an example.
- 22 How do we handle exceptions in Java? Explain with support of an example. Write a TCP/IP program to calculate the area of a circle. (Radius must be given by the client program and serve calculates and returns the result.
- 23 Explain the contents of a class file?
- 24 Explain the need of user defined exceptions with the help of an example.

- 25 Describe the sandbox model of security in Java.
- 26 An organization employs two types of employees: permanent and temporary. Permanent employees are paid on the basis of their designation whereas temporary employees are paid on the basis of hours worked. Define classes to show overriding of calculate Pay method so that different logic can be implemented for different types of employees. Write main method to maintain the different arrays of employees and demonstrate the concept of polymorphism. State your assumptions clearly.

## UNIT - II

### I Test Your Skills:

#### (a) State Whether the Following Statements are True or False:

- 1 Multicast broadcasts DatagramPackets to every host on the Internet.
- 2 UDP is a connection-oriented protocol.
- 3 With stream sockets a process establishes a connection to another process.
- 4 A server waits at a port for connections from a client.
- 5 Datagram packet transmission over a network is reliable packets are guaranteed to arrive in sequence.
- 6 For security reasons, many Web browsers, such as Mozilla, allow Java applets to do file processing only on the machines on which they execute.
- 7 Web browsers often restrict an applet so that it can only communicate with the machine from which it was originally downloaded.
- 8 IP addresses from 224.0.0.0 to 239.255.255.255 are reserved for multicast.
- 9 A thread is not runnable if it is dead.
- 10 In Java, a higher-priority runnable thread should preempt threads of lower priority.
- 11 Some operating systems use timeslicing with threads. Therefore, they can enable threads to preempt threads of the same priority.
- 12 When the thread's quantum expires, the thread returns to the running state as the operating system assigns the thread to a processor.
- 13 Without timeslicing, each thread in a set of equal-priority threads runs to completion before other threads of equal priority get a chance to execute.
- 14 In Java, threads can be implemented through two ways.
- 15 Reader and Writer classes are part of the Byte Stream.

**Ans.** (1)(False), (2)(False), (3)(True), (4)(True), (5)(False), (6)(False), (7)(True), (8)(True), (9)(True), (10)(True), (11)(False), (12)(False), (13)(True), (14)( True), (15)( False)

**(b) Multiple Choice Questions:**

- 1 What happens in a method if there is an exception thrown in a try block but there is no catch block following the try block?
- (a) The program ignores the exception.
  - (b) The program will not compile without a complete try/catch structure.
  - (c) The program terminates immediately.
  - (d) The program throws an exception and proceeds to execute the finally block.

- 2
- ```
int number;
boolean done = false;
do
{
try
{
System.out.print("Enter an integer: ");
number = console.nextInt();
System.out.println();
done = true;
System.out.println("number = " + number);
}
catch (InputMismatchException imeRef)
{
str = console.next();
System.out.println("Exception "
+ imeRef.toString()
+ " " + str);
}
}
while (!done);
```

What is most likely the type of exception in the code above?

- (a) `IllegalArgumentException`
 - (b) `InputMismatchException`
 - (c) `FileNotFoundException`
 - (d) `NumberFormatException`
- 3 The class `RuntimeException` is the superclass of which of the following classes?
- (a) `NullPointerException`
 - (b) `NoSuchMethodException`
 - (c) `IllegalAccessionException`
 - (d) `NoSuchFileException`

- 4 How many finally blocks can there be in a try/catch structure?
- (a) There must be 1.
 - (b) There can be 1 following each catch block.
 - (c) There can be 0 or 1 following the last catch block.
 - (d) There is no limit to the number of finally blocks following the last catch block.
- 5 Which of the following statements is NOT true about creating your own exceptions?
- (a) Typically, constructors are the only methods that you include when you define your own exception class.
 - (b) The exception class that you define extends either the class Throwable or one of its subclasses.
 - (c) If you have created an exception class, you can define other exception classes extending the definition of the exception class you created.
 - (d) You must throw your own exceptions using the throw statement.
- 6 What can a method do with a checked exception?
- (a) Check the exception or ignore it.
 - (b) Return the exception to the sender or handle it in a catch block.
 - (c) Throw the exception to the method that called this method, or handle the exception in a catch block.
 - (d) Handle the exception in the try block or handle the exception in the catch block.
- 7 Which of the following is an exception thrown by the methods of the class String?
- (a) NullPointerException
 - (b) FileNotFoundException
 - (c) NoSuchElementException
 - (d) NumberFormatException
- 8 Which of the following statements is true?
- (a) The class Exception, which is derived from the class Object, is the superclass of the class Throwable.
 - (b) The class Throwable, which is derived from the class Exception, is the superclass of the class Object.
 - (c) The class Throwable, which is derived from the class Object, is the superclass of the class Exception.
 - (d) None of these
- 9 A message string is returned by which method of an Exception object?
- (a) `printMessage()`
 - (b) `getMessage()`
 - (c) `printStackTrace()`
 - (d) `traceMessage()`

- 10 When is a finally {} block executed?
- (a) Only when an exception is thrown by a try block
 - (b) Only when there are no exceptions thrown
 - (c) At the end of a program
 - (d) Always after the execution of a try block, regardless of whether or not an exception is thrown
- 11 When does Exceptions in Java arises in code sequence?
- (a) Run Time
 - (b) Compilation Time
 - (c) Can Occur Any Time
 - (d) None of the mentioned
- 12 Which of these keywords is not a part of exception handling?
- (a) try
 - (b) finally
 - (c) thrown
 - (d) catch
- 13 Which of these keywords is used to manually throw an exception?
- (a) try
 - (b) finally
 - (c) throw
 - (d) catch
- 14 What is the output of this program?
- ```
1. class exception_handling {
2. public static void main(String args[]) {
3. try {
4. System.out.print("Hello" + " " + 1 / 0);
5. }
6. catch(ArithmeticException e) {
7. System.out.print("World");
8. }
9. }
10. }
```
- (a) Hello
  - (b) World
  - (c) HelloWorld
  - (d) Hello World
- 15 What is the output of this program?
- ```
1. class exception_handling {
2.     public static void main(String args[]) {
3.         try {
```

```
4.   int a, b;
5.   b = 0;
6.   a = 5 / b;
7.   System.out.print("A");
8.   }
9.   catch(ArithmeticException e) {
10.  System.out.print("B");
11.  }
12.  }
13.  }
```

- (a) A
 - (b) B
 - (c) Compilation Error
 - (d) Runtime Error
- 16 What is multithreaded programming?
- (a) It's a process in which two different processes run simultaneously.
 - (b) Its a process in which two or more parts of same process run simultaneously.
 - (c) Its a process in which many different process are able to access same information.
 - (d) Its a process in which a single process can access information from many sources.
- 17 Which of these are types of multitasking?
- (a) Process based multitasking
 - (b) Thread based multitasking
 - (c) Both a & b
 - (d) None of the mentioned
- 18 Which of these packages contain all the Java's built in exceptions?
- (a) java.io
 - (b) java.util
 - (c) java.lang
 - (d) java.net
- 19 Thread priority in Java is?
- (a) Integer
 - (b) Float
 - (c) Double
 - (d) Long

- 20 What will happen if two thread of same priority are called to be processed simultaneously?
- (a) Any one will be executed first lexographically
 - (b) Both of them will be executed simultaneously
 - (c) None of them will be executed
 - (d) It is dependent on the operating system.
- 21 Which of these statements is incorrect?
- (a) By multithreading CPU's idle time is minimized, and we can take maximum use of it.
 - (b) By multitasking CPU's idle time is minimized, and we can take maximum use of it.
 - (c) Two thread in Java can have same priority
 - (d) A thread can exist only in two states, running and blocked.
- 22 What is the name of the thread in output of this program?
- ```
class multithreaded_programing {
public static void main(String args[]) {
Thread t = Thread.currentThread();
System.out.println(t);
}
}
```
- (a) Main
  - (b) Thread
  - (c) System
  - (d) None of the mentioned
- 23 Which method executes only once
- (a) start() method
  - (b) init() method
  - (c) stop() method
  - (d) destroy() method
- 24 Thread class is available in
- (a) java.io package
  - (b) java.lang package
  - (c) java.awt package
  - (d) java.util package
- 25 Minimum threads in a program are
- (a) 1
  - (b) 2
  - (c) 5
  - (d) Many

- 26 Interfaces helps in which type of inheritance
- (a) Multiple inheritance
  - (b) Multilevel inheritance
  - (c) Hierarchical inheritance
  - (d) None of above
- 27 Which of these values is returned by read () method is end of file (EOF) is encountered?
- (a) 0
  - (b) 1
  - (c) -1
  - (d) Null
- 28 Which of these exception is thrown by close () and read () methods?
- (a) IOException
  - (b) FileNotFoundException
  - (c) FileNotFountException
  - (d) FileInputOutputException
- 29 What is the output of this program?
- ```
import java.io.*;
public class filesinputoutput {
public static void main(String[] args) {
String obj = "abc";
byte b[] = obj.getBytes();
ByteArrayInputStream obj1 = new ByteArrayInputStream(b);
for (int i = 0; i < 2; ++ i) {
int c;
while((c = obj1.read()) != -1) {
if(i == 0) {
System.out.print(Character.toUpperCase((char)c));
obj2.write(1);
}
}
System.out.print(obj2);
}
}
}
```
- (a) AaBaCa
 - (b) ABCaaa
 - (c) AaaBaaCaa
 - (d) AaBaaCaaa

30 What is the output of this program?

```
1. import java.io.*;
2. class Chararrayinput {
3.     public static void main(String[] args) {
4.         String obj = "abcdefgh";
5.         int length = obj.length();
6.         char c[] = new char[length];
7.         obj.getChars(0, length, c, 0);
8.         CharArrayReader input1 = new CharArrayReader(c);
9.         CharArrayReader input2 = new CharArrayReader(c, 1, 4);
10.        int i;
11.        int j;
12.        try {
13.            while((i = input1.read()) == (j = input2.read())) {
14.                System.out.print((char)i);
15.            }
16.        }
17.        catch (IOException e) {
18.            e.printStackTrace();
19.        }
20.    }
21. }
```

- (a) abc
- (b) abcd
- (c) abcde
- (d) None of the mentioned

31 Which exception is thrown by the read () method of input stream class?

- (a) Exception
- (b) ClassNotFoundException
- (c) read Exception
- (d) IOException

32 What garbage collection in the context of java?

- (a) The operating system periodically deletes all of the java files available on the system.
- (b) Any package imported in a program and not used in automatically deleted.
- (c) When all references to an object are gone, the memory used by the object is automatically reclaimed.
- (d) The JVM checks the output of any Java program and deletes anything that doesn't make sense.

- 33 In order for a source code file, containing the public class test, to successfully compile, which of the following must be true?
- (a) It must have a package statement
 - (b) It must be named test.java
 - (c) It must import java.lang
 - (d) It must declare a public class named test.
- 34 Which of the following are true about the Error and Exception classes?
- (a) Both classes extend throwable
 - (b) The error class is final and exception class is not.
 - (c) The Exception class is final and the Error is not.
 - (d) Both classes implement Throwable
- 35 Which of the following are true?
- (a) The void class extends the class class
 - (b) The float class extends double class
 - (c) The system class extends the runtime class
 - (d) The integer class extends the number class
- 36 How do you create a Reader object from an InputStream object?
- (a) Use the static createReader() method of InputStream class
 - (b) Use the static createReader() method of Reader class
 - (c) Create an InputStreamReader object passing the InputStream object and an argument to the InputStreamReader constructor.
 - (d) Create an OutputStreamReader object, passing the InputStream object as an argument to the OutputStreamReader constructor.
- 37 Which of the following is true?
- (a) The event inheritance model has replaced the event delegation model
 - (b) The event inheritance model is more efficient than event delegation model
 - (c) The event delegation model uses event listeners to define the methods of event handling classes.
 - (d) The event delegation model uses the handleEvent() method to support event handling.
- 38 Which of the following is the highest class in the event delegation model?
- (a) java.util.EventListner
 - (b) java.util.EventObject
 - (c) java.util.AWTEvent
 - (d) java.util.event.AWTEvent

- 39 When two or more objects are added as listeners for the same event, which listener is first invoked to handle the event?
- (a) The first object that was added as listener.
 - (b) The last object that was added as listener.
 - (c) There is no way to determine which listener will be invoked first.
 - (d) It is impossible to have more than one listener for a given event.
- 40 Suppose that you want to have an object eh handle the TextEvent of TextArea object t. How should you add eh as the event handler for?
- (a) `t.addTextListener(eh);`
 - (b) `eh.addTextListner(t);`
 - (c) `addTextListner(eh.t);`
 - (d) `addTextListner(t,eh);`
- 41 Which is true about an anonymous inner class?
- (a) It can extend exactly one class and implement exactly one interface.
 - (b) It can extend exactly one class and can implement multiple interfaces.
 - (c) It can extend exactly one class or implement exactly one interface.
 - (d) It can implement multiple interfaces regardless of whether it also extends a class.
- 42 Which is true about a method-local inner class?
- (a) It must be marked final.
 - (b) It can be marked abstract.
 - (c) It can be marked public.
 - (d) It can be marked static.
- 43 Which statement is true about a static nested class?
- (a) You must have a reference to an instance of the enclosing class in order to instantiate it.
 - (b) It does not have access to nonstatic members of the enclosing class.
 - (c) Its variables and methods must be static.
 - (d) It must extend the enclosing class.
- 44 Which of these is correct way of inheriting class A by class B?
- (a) `class B + class A { }`
 - (b) `class B inherits class A { }`
 - (c) `class B extends A { }`
 - (d) `class B extends class A { }`
- 45 Which of the following are true about interfaces.
- (a) Methods declared in interfaces are implicitly private.
 - (b) Variables declared in interfaces are implicitly public, static, and final.
 - (c) An interface contains any number of method definitions.
 - (d) The keyword implements indicate that an interface inherits from another.

- 46 Which of the following is correct way of implementing an interface salary by class manager?
- (a) class Manager extends salary { }
 - (b) class Manager implements salary { }
 - (c) class Manager imports salary { }
 - (d) None of the mentioned.
- 47 Which of the following is incorrect statement about packages?
- (a) Package defines a namespace in which classes are stored.
 - (b) A package can contain other package within it.
 - (c) Java uses file system directories to store packages.
 - (d) A package can be renamed without renaming the directory in which the classes are stored.
- 48 Which exception is thrown by read() method?
- (a) IOException
 - (b) InterruptedException
 - (c) SystemException
 - (d) SystemInputException
- 49 Which method in Thread class is used to check weather a thread is still running?
- (a) isAlive()
 - (b) Join()
 - (c) isRunning()
 - (d) Alive()
- 50 Which of these class contains the methods print() & println()?
- (a) System
 - (b) System.out
 - (c) BufferedOutputStream
 - (d) PrintStream

Ans. (1)(d), (2)(b), (3)(a), (4)(c), (5)(b), (6)(c), (7)(a), (8)(c), (9)(b), (10)(d), (11)(a), (12)(c), (13)(c), (14)(b), (15)(c), (16)(b), (17)(d), (18)(c), (19)(a), (20)(d), (21)(d), (22)(a), (23)(b), (24)(b), (25)(a), (26)(a), (27)(c), (28)(a), (29)(d), (30)(d), (31)(d), (32)(c), (33)(b), (34)(a), (35)(d), (36)(c), (37)(c), (38)(b), (39)(c), (40)(d), (41)(c), (42)(b), (43)(b), (44)(c), (45)(b), (46)(b), (47)(d), (48)(a), (49)(a), (50)(d).

(c) Fill in the Blanks:

- 1 Exception _____ occurs when an input/output error occurs when closing a socket.
- 2 Exception _____ occurs when a host name indicated by a client cannot be resolved to an address.
- 3 If a DatagramSocket constructor fails to set up a DatagramSocket properly, an exception of type _____ occurs.
- 4 Many of Java's networking classes are contained in package _____.

- 5 Class _____ binds the application to a port for datagram transmission.
- 6 An object of class _____ contains an IP address.
- 7 The two types of sockets we discussed in this chapter are _____ and _____.
- 8 The acronym URL stands for _____.
- 9 The acronym URI stands for _____.
- 10 The key protocol that forms the basis of the World Wide Web is _____.
- 11 Applet Context method _____ receives a URL object as an argument and displays in a browser the World Wide Web resource associated with that URL.
- 12 C and C++ are _____ -threaded languages, whereas Java is a(n) _____ threaded language.
- 13 A thread enters the terminated state when _____.
- 14 To pause for a designated number of milliseconds and resume execution, a thread should call method _____.
- 15 Method _____ of class Condition moves a single thread in an object's waiting state to the runnable state.
- 16 Method _____ of class Condition moves every thread in an object's waiting state to the runnable state.
- 17 A(n) _____ thread enters the _____ state when it completes its task or otherwise terminates.
- 18 A runnable thread can enter the _____ state for a specified interval of time.
- 19 At the operating-system level, the runnable state actually encompasses two separate states, _____ and _____.
- 20 Runnable are executed using a class that implements the _____ interface.

Ans.

(1)(IOException),(2)(UnknownHostException),(3)(SocketException),(4)(java.net.), (5)(DatagramSocket), (6)(InetAddress), (7)(stream sockets, datagram sockets), (8)(Uniform Resource Locator), (9)(Uniform Resource Identifier), (10)(HTTP), (11)(showDocument), (12)(single, multi), (13)(its run method ends), (14)(Thread.sleep), (15)(signal), (16)(signalAll), (17)(runnable, terminated), (18)(timed waiting), (19)(ready, running), (20)(Executor)

II Short Answer Type Questions:

- 1 What are exceptions? How do we handle them?
- 2 Code monitored for exceptions must be part of what statement?
- 3 What does catch do? After a catch executes, what happens to the flow of execution? Does the exception type in a catch statement matter?
- 4 What is networking?
- 5 What happens if an exception is not caught? When an exception occurs, what should your program do?
- 6 What is the difference between Connection-oriented and Connectionless protocol?
- 7 Can one try block be used to handle two or more different types of exceptions?
- 8 Can a catch statement for a superclass exception also catch subclasses of that super class?
- 9 In nested try blocks, what happens to an exception that is not caught by the inner block?

- 10 Differentiate between Byte Stream and Character Stream.
- 11 What are collections?
- 12 What is Socket? What is an Inet address?
- 13 Exception classes are subclasses of what class? Does throw types or objects? Can an exception be re-thrown after it is caught?
- 14 When is the code within a finally block executed?
- 15 How can you display a stack trace of the events leading up to an exception?
- 16 Define each of the following terms.
- Hash set
 - Reader/Writer
 - runnable state
 - timed waiting state
 - preemptive scheduling
 - runnable interface
 - Hash map
 - producer/consumer relationship
 - quantum
- 17 Two problems that can occur in systems like Java, that allow threads to wait, are deadlock, in which one or more threads will wait forever for an event that cannot occur, and indefinite postponement, in which one or more threads will be delayed for some unpredictably long time. Give an example of how each of these problems can occur in a multithreaded Java program
- 18 What are Maps? Give the three classes that implement the interface map.
- 19 Name three threads that are created automatically by the Java virtual machine and discuss the purpose of each thread.
- 20 What is wrong with this fragment?
- ```
// ...
vals[18] = 10;
catch (ArrayIndexOutOfBoundsException exc) {
// handle error
}
```
- 21 Find the error in each block of code and show how to correct it.
- Assume that account, company and amount are declared.

```
ObjectOutputStream outputStream;
outputStream.writeInt(account);
outputStream.writeChars(company);
outputStream.writeDouble(amount);
```
  - The following statements should read a record from the file "payables.txt". The Scanner variable in Payable should be used to refer to this file.

```
Scanner inPayable = new Scanner (new File("payables.txt"));
PayablesRecord record = (PayablesRecord) inPayable.readObject();
```
- 22 Define threads. What is multithreading?
- 23 Discuss in brief the concept of synchronization.
- 24 What are Streams?
- 25 What does throw do? What is the difference between throw and throws?
- 26 Give two major requirements of event listeners.

- 27 What is dynamic method dispatch?
- 28 What are Wrapper Classes?
- 29 What is Applet in java?
- 30 Define adapter classes.
- 31 Give the uses of final keyword.
- 32 What is the significance of wait and notify methods on object class?
- 33 A server socket needs to be bound to a specific port not client socket,why?
- 34 What is object serialization? When is it required?

### III Long Answer Type Questions:

- 1 What class is at the top of the exception hierarchy? Briefly explain how to use try and catch.
- 2 Discuss the difference between Condition method await with no arguments and Condition method await with a time-interval argument. In particular, what states do threads enter, and how can those threads return to the runnable state?
- 3 Discuss some of the important classes and interfaces in java.lang package.
- 4 Write a program to copy the contents of one file into another character by character.
- 5 What is wrong with this fragment? Explain in detail  

```

class A extends Exception { ...
class B extends A { ...
// ...
try {
// ...
}
catch (A exc) { ... }
catch (B exc) { ... }

```
- 6 Explain the Input/Output mechanism in Java.
- 7 What are Files? Explain how we can read from and write into a file giving examples.
- 8 What type of exceptions must be explicitly declared in a throws clause of? What are the two direct subclasses of Throwable?
- 9 What are the three ways that an exception can be generated?
- 10 Discuss java.util package emphasizing on calendar class.
- 11 Under what circumstances would a SocketException be thrown?
- 12 How can a client get a line of text from a server?
- 13 Describe how a client connects to a server.
- 14 Describe how a server sends data to a client
- 15 Describe how to prepare a server to receive a stream-based connection request from a single client
- 16 Explain Exception handling mechanism in detail.
- 17 Discuss the concept of multiple catch statement with respect to Exception Handling. Can an exception caught by an inner catch re-throw that exception to an outer catch?
- 18 Explain Multithreading programming with suitable example.
- 19 Explain the Java thread model.
- 20 Write a code for implementing a user defined exception.

- 21 What do you mean multithreading? Explain suspending, resuming and stopping threads in java?
- 22 What are different keywords in java exception? Explain briefly, how they work? Give their example.
- 23 What is the difference between process- based and thread – based multitasking? Describe thread priorities and synchronization.
- 24 Describe the functions of File class in java.
- 25 What do you understand by Synchronization? Explain the life cycle of a thread and its associated methods. Describe the various methods of file class.
- 26 How is thread synchronization implemented in java.
- 27 Write and explain a code snippet to transfer an object over a TCP connection.What are the restrictions on the object being transferred.
- 28 How is file class different from Stream classes?
- 29 Write a client server application that uses UDP to implement echo server.

### UNIT - III

#### I Test Your Skills:

##### (a) State Whether the Following Statements are True or False:

- 1 A sound is marked for garbage collection after it plays.
- 2 Class ImageIcon provides constructors that allow an ImageIcon object to be initialized only with an image from the local computer.
- 3 Method play of class AudioClip continuously loops an audio clip.
- 4 The Java Image I/O API is used for adding 3D graphics to a Java application.
- 5 Applet method getTDocumentBase returns, as an object of class URL, the location on the Internet of the HTML file that invoked the applet.
- 6 Servlets usually are used on the client side of a networking application.
- 7 Servlet methods are executed by the servlet container.
- 8 The two most common HTTP requests are get and put.
- 9 The well-known port number on a Web server where requests for HTML documents are made is 8080.
- 10 Java supports several image formats, including GIF, JPEG and PNG.
- 11 Java supports socket programming.
- 12 Java doesnot support applets.
- 13 Java supports user defined exceptions.
- 14 In java, one has to call delete() to clear buffer.
- 15 Applets can only be run from appletviewer.

**Ans.** (1)(True), (2)(False), (3)(False), (4)(False), (5) True (6)(False), (7)(True), (8)(False), (9)(False), (10)(True), (11) (True), (12)(False), (13)(True), (14)(False), (15)(False)

**(b) Fill in the Blanks:**

- 1 Java applets begin execution with a series of three method calls \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.
- 2 The \_\_\_\_\_ method is invoked for an applet each time the user of a browser leaves an HTML page on which the applet resides.
- 3 Every applet should extend class \_\_\_\_\_.
- 4 The \_\_\_\_\_ or a browser can be used to execute a Java applet.
- 5 The \_\_\_\_\_ method is called each time the user of a browser revisits the HTML page on which an applet resides.
- 6 To load an applet into a browser, you must first define a(n) \_\_\_\_\_ file.
- 7 The \_\_\_\_\_ method is called once when an applet begins execution.
- 8 The \_\_\_\_\_ method is invoked to draw on an applet.
- 9 The \_\_\_\_\_ method is invoked for an applet when the browser removes it from memory.
- 10 The \_\_\_\_\_ and \_\_\_\_\_ HTML tags specify that an applet should be loaded into an applet container and executed
- 11 Applet method \_\_\_\_\_ loads an image into an applet.
- 12 Graphics method \_\_\_\_\_ displays an image on an applet.
- 13 Java provides two mechanisms for playing sounds in an applet the Applet's play method and the play method of the \_\_\_\_\_ interface.
- 14 A(n) \_\_\_\_\_ is an image that has hot areas that the user can click to accomplish a task such as loading a Web page.
- 15 Method \_\_\_\_\_ of class ImageIcon displays the ImageIcon's image.

**Ans.** (1)(init, start, paint), (2)(stop), (3)(JApplet (or Applet)), (4)(appletviewer), (5)(start), (6)(HTML), (7)(init), (8)(paint), (9)(destroy), (10)( <applet>, </applet>), (11)(getImage), (12)(drawImage), (13)(AudioClip), (14)(image map), (15)(paintIcon)

**(c) Multiple Choice Questions:**

- 1 To design a general-purpose search method, searchList, to search a list, which of the following must be parameters of the method searchList?
  - (i) The array containing the list.
  - (ii) The length of the list.
  - (iii) The search item.
  - (iv) A boolean variable indicating whether the search is successful.
  - (a) (i) and (ii)
  - (b) (i), (ii), and (iii)
  - (c) (ii), (iii), and (iv)
  - (d) (i), (ii), (iii), and (iv)

- 2 Consider the following list. `list = {24, 20, 10, 75, 70, 18, 60, 35}`  
Suppose that list is sorted using the selection sort algorithm as discussed in the book.  
What is the resulting list after two passes of the sorting phase, that is, after two iteration of the outer for loop?
- (a) `list = {10, 18, 24, 20, 75, 70, 60, 35}`
  - (b) `list = {10, 18, 20, 24, 75, 70, 60, 35}`
  - (c) `list = {10, 18, 24, 75, 70, 20, 60, 35}`
  - (d) None of these
- 3 Which method would you most likely use to add an element to an end of a vector?
- (a) `insertElementAt`
  - (b) `addElement`
  - (c) `copyInto`
  - (d) `lastElement`
- 4 In which package is the class `Vector` located?
- (a) `java.io`
  - (b) `java.lang`
  - (c) `java.util`
  - (d) `java.text`
- 5 An abstract method \_\_\_\_.
- (a) is any method in the abstract class
  - (b) cannot be inherited
  - (c) has no body
  - (d) is found in a subclass and overrides methods in a super-class using the reserved word `abstract`
- 6 The classes `Reader` and `Writer` are derived from the class \_\_\_\_.
- (a) `Streams`
  - (b) `Inputs`
  - (c) `Outputs`
  - (d) `Object`
- 7 The method `toString()` is a public member of the class \_\_\_\_.
- (a) `Object`
  - (b) `String`
  - (c) `Writer`
  - (d) `Output`
- 8 For the interface `WindowListener` that contains more than one method, Java provides the class \_\_\_\_.
- (a) `MouseAdapter`
  - (b) `WindowAdapter`
  - (c) `KeyListener`
  - (d) `KeyAdapter`

- 9 If a negative value is used for an array index, \_\_\_\_.
- (a) a NumberFormatException is thrown
  - (b) the program terminates immediately
  - (c) the last index of the array is automatically accessed instead
  - (d) an IndexOutOfBoundsException is thrown
- 10 Consider the following list.  
`int[] intList = {35, 12, 27, 18, 45, 16, 38};`  
What is the minimum number of comparisons that have to be made to find 18 using a sequential search on intList?
- (a) 1
  - (b) 2
  - (c) 3
  - (d) 4
- 11 Which of these packages contains all the classes and methods required for even handling in Java?
- (a) `java.applet`
  - (b) `java.awt`
  - (c) `java.event`
  - (d) `java.awt.event`
- 12 What is an event in delegation event model used by Java programming language?
- (a) An event is an object that describes a state change in a source.
  - (b) An event is an object that describes a state change in processing.
  - (c) An event is an object that describes any change by the user and system.
  - (d) An event is a class used for defining object, to create events.
- 13 Which of these methods are used to register a keyboard event listener?
- (a) `KeyListener()`
  - (b) `addKistener()`
  - (c) `addKeyListener()`
  - (d) `eventKeyboardListener()`
- 14 Which of these methods are used to register a mouse motion listener?
- (a) `addMouse()`
  - (b) `addMouseListener()`
  - (c) `addMouseMotionListner()`
  - (d) `eventMouseMotionListener()`
- 15 What is a listener in context to event handling?
- (a) A listener is a variable that is notified when an event occurs.
  - (b) A listener is an object that is notified when an event occurs.
  - (c) A listener is a method that is notified when an event occurs.
  - (d) None of the mentioned



- 16 Which command disassembles a class file
- (a) javaamd
  - (b) javacmd
  - (c) java
  - (d) javap
- 17 JDBC stands for:
- (a) Java Database Connectivity
  - (b) Java Database Components
  - (c) Java Database Control
  - (d) None of the above is correct.
- 18 Which of the following statements is false as far as different type of statements is concern in JDBC?
- (a) Regular Statement
  - (b) Prepared Statement
  - (c) Callable Statement
  - (d) Interim Statement
- 19 Which statement is static and synchronized in JDBC API?
- (a) executeQuery()
  - (b) executeUpdate()
  - (c) getConnection()
  - (d) prepareCall()
- 20 Which driver is efficient and always preferable for using JDBC applications?
- (a) Type – 4
  - (b) Type – 1
  - (c) Type – 3
  - (d) Type – 2
- 21 Given:
- ```
try {  
ResourceConnection con = resourceFactory.getConnection();  
Results r = con.query("GET INFO FROM CUSTOMER");  
info = r.getData();  
con.close();  
} catch (ResourceException re) {  
errorLog.write(re.getMessage());  
}  
return info;
```
- Which statement is true if a ResourceException is thrown on line 86?
- (a) Line 92 will not execute.
 - (b) The connection will not be retrieved in line 85
 - (c) The resource connection will not be closed on line 88.
 - (d) The enclosing method will throw an exception to its caller.

22 Which checkbox will be selected in the following code (Assume with main and added to a Frame)

```
Frame myFrame = new Frame("Test");
CheckboxGroup cbg = new CheckboxGroup();
Checkbox cb1 = new Checkbox("First",true,cbg);
Checkbox cb2 = new Checkbox("Scond",true,cbg);
Checkbox cb3 = new Checkbox("THird",false,cbg);
cbg.setSelectedCheckbox(cb3);
```

- myFrame.add(cb1);
- myFrame.add(cb2);
- myFrame.add(cb3);
- (a) cb1
- (b) cb2,cb1
- (c) cb1,cb2,cb3
- (d) cb3

23 What will be the output of line 5

```
1 Choice c1 = new Choice();
2 c1.add("First");
3 c1.addItem("Second");
4 c1.add("Third");
5 System.out.println(c1.getItemCount());
```

- (a) 1
- (b) 2
- (c) 3
- (d) None of the above

24 What will be the order of four items added

```
Choice c1 = new Choice();
c1.add("First");
c1.addItem("Second");
c1.add("Third");
c1.insert("Lastadded",2);
System.out.println(c1.getItemCount());
```

- (a) First,Second,Third,Fourth
- (b) First,Second,Lastadded,Third
- (c) Lastadded,First,Second,Third

25 Answer based on following code

```
1 Choice c1 = new Choice();
2 c1.add("First");
3 c1.addItem("Second");
4 c1.add("Third");
5 c1.insert("Lastadded",1000);
6 System.out.println(c1.getItemCount());
```

- (a) Compile time error
 - (b) Run time error at line 5
 - (c) No errors and line 6 will print 1000
 - (d) No error and line 6 will print 4
- 26 Which one of the following does not extends java.awt.Component
- (a) CheckBox
 - (b) Canvas
 - (c) CheckbocGroup
 - (d) Label
- 27 What is default layout manager for panels and applets?
- (a) Flowlayout
 - (b) Gridlayout
 - (c) BorderLayout
- 28 java.awt.Component class method getLocation() returns Point (containg x and y coordinate).What does this x and y specify
- (a) Specify the postion of components lower-left component in the coordinate space of the component's parent.
 - (b) Specify the postion of components upper-left component in the coordinate space of the component's parent.
 - (c) Specify the postion of components upper-left component in the coordinate space of the screen.
- 29 Which of the following methods finds the maximum number of connections that a specific driver can obtain?
- (a) Database.getMaxConnections
 - (b) Connection.getMaxConnection
 - (c) DatabaseMetaData.getMaxConnections
 - (d) ResultSetMetaData.getMaxConnections
- 30 What is the disadvantage of Type-4 Native-Protocol Driver?
- (a) At client side, a separate driver is needed for each database.
 - (b) Type-4 driver is entirely written in Java
 - (c) The driver converts JDBC calls into vendor-specific database protocol
 - (d) It does not support to read MySQL data.
- 31 What is the preferred way to handle an object's events in Java 2?
- (a) Override the object's handleEvent() method.
 - (b) Add one or more event listeners to handle the events
 - (c) Have the object override its process Event () methods.
 - (d) Have the object override its dispatch Event () methods.

- 32 Which component method is used to access a component's immediate container?
- (a) `setVisible()`
 - (b) `getImmediate()`
 - (c) `getParent()`
 - (d) `getContainer()`
- 33 Which of the following creates a List with 5 visible items and multiple selections enabled?
- (a) `new List(5, true)`
 - (b) `new List(true, 5)`
 - (c) `new List(5, false)`
 - (d) `new List(false, 5)`
- 34 An Applet has its Layout Manager set to the default of FlowLayout. What code would be the correct to change to another Layout Manager?
- (a) `setLayoutManager(new GridLayout());`
 - (b) `setLayout(new GridLayout(2,2));`
 - (c) `setGridLayout(2,2);`
 - (d) `setBorderLayout();`
- 35 How do you change the current layout manager for a container?
- (a) Use the `setLayout` method.
 - (b) Once created you cannot change the current layout manager of a component
 - (c) Use the `setLayoutManager` method.
 - (d) Use the `updateLayout` method.
- 36 Which of the following methods can be used to draw the outline of a square within a `JAVA.awt.Component` object?
- (a) `drawLine()`
 - (b) `fillRect()`
 - (c) `drawPolygon()`
 - (d) `drawPolygon()`
- 37 State true or false
- (i) `JPanel` is a class included in `awt` package
 - (ii) Anonymous classes are mostly used for event handling
 - (iii) Names of anonymous classes must be unique
 - (iv) `JOptionPane` is an inner class
- (a) i-false, ii-false, iii-true, iv-true
 - (b) i-true, ii-false, iii-true, iv-false
 - (c) i-false, ii-true, iii-false, iv-false
 - (d) i-true, ii-true, iii-false, iv-true

- 38 State true or false
- (i) Java RMI supports distributed objects written entirely in java
 - (ii) Java RMI makes use of stubs and skeleton
 - (iii) In Java RMI an object registers itself with a media server
 - (iv) IDL is interface declaration language
- (a) True, True, False, False
 - (b) False, True, True, True
 - (c) True, False, True, False
 - (d) True, True, True, True
- 39 Match the following
- | | |
|---------------------|--|
| (a) Datagram Socket | (i) UDP connection |
| (b) URL | (ii) provides necessary framework of debugging java programs |
| (c) java.net | (iii) makes it possible to communicate over a network with java programs |
| (d) sun.tools.debug | (iv) is a java object that represent WWW address |
- (a) a-i, b-iv, c-iii, d-ii
 - (b) a-i, b-iv, c-ii, d-iii
 - (c) a-ii, b-iii, c-i, d-iv
 - (d) a-ii, b-i, c-iii, d-iv
- 40 State true or false
- (i) public can only be assigned to class
 - (ii) protected protects a statement
 - (iii) protected method is never accessible outside the package
 - (iv) friendly variable may be accessible outside class
- (a) True, True, False, True
 - (b) False, False, False, True
 - (c) False, True, False, False
 - (d) True, False, False, False
- 41 Which refers to a channel through which data flow from the source to the destination:
- (a) String
 - (b) Character
 - (c) Stream
 - (d) Buffer
- 42 The _____ method help in clearing the contents of the buffer:
- (a) flush()
 - (b) clear()
 - (c) rub()
 - (d) vanish()

- 43 Which of these methods can be used to output a string in an applet?
- (a) display()
 - (b) print()
 - (c) drawString()
 - (d) transient()
- 44 What is an event in delegation event model used by Java programming language?
- (a) An event is an object that describes a state change in a source.
 - (b) An event is an object that describes a state change in processing.
 - (c) An event is an object that describes any change by the user and system.
 - (d) An event is a class used for defining object, to create events.
- 45 Which of these methods are used to register a MouseMotionListener?
- (a) addMouse()
 - (b) addMouseListener()
 - (c) addMouseMotionListner()
 - (d) eventMouseMotionListener()
- 46 What is a listener in context to event handling?
- (a) A listener is a variable that is notified when an event occurs.
 - (b) A listener is an interface that is notified when an event occurs.
 - (c) A listener is a method that is notified when an event occurs.
 - (d) None of the mentioned
- 47 Which of these events will be generated if scroll bar is manipulated?
- (a) ActionEvent
 - (b) ComponentEvent
 - (c) AdjustmentEvent
 - (d) WindowEvent
- 48 Which of these events will be generated if we close a Frame window?
- (a) ActionEvent
 - (b) ComponentEvent
 - (c) AdjustmentEvent
 - (d) WindowEvent
- 49 Which of these methods in KeyEvent class can be used to know which key is pressed?
- (a) getKeyCode()
 - (b) getModifier()
 - (c) getActionKey()
 - (d) getActionEvent()

- 50 The default layout manager of an Applet is
- (a) Flowlayout
 - (b) Gridlayout
 - (c) BorderLayout
 - (d) BoxLayout

Ans. (1)(b), (2)(c), (3)(b), (4)(c), (5)(c), (6)(d), (7)(a), (8)(b), (9)(d), (10)(d), (11)(d), (12)(a), (13)(c), (14)(c), (15)(b), (16)(d), (17)(a), (18)(d), (19)(c), (20)(a), (21)(c), (22)(d), (23)(c), (24)(b), (25)(d), (26)(c), (27)(a), (28)(b), (29)(c), (30)(a) , (31)(b), (32)(c), (33)(a), (34)(b), (35)(a), (36)(a), (37)(c), (38)(a), (39)(a), (40)(a), (41)(c), (42)(c), (43)(c), (44)(a), (45)(c), (46)(b), (47)(d), (48)(d), (49)(a), (50)(a).

II Short Answer Type Questions:

- 1 What is an applet? What is the difference between an applet and an application?
- 2 What are Java Beans?
- 3 What package must be included when creating an applet? What method outputs to the applet's window?
- 4 How are applets run?
- 5 What are the five methods that most applets will override?
- 6 What must your applet do when start () is called? What must your applet do when stop() is called?
- 7 What are menus? What is a menu bar?
- 8 How do you cause an applet's paint () method to be called?
- 9 Where does showStatus() display a string?
- 10 What method is used to obtain a parameter specified in the APPLET tag?
- 11 Create a servlet that displays the current date and time.
- 12 Create a HTML form with three input fields: first name, last name and e-mail. Use the get method to pass these values to a servlet. Notice how data is attached to the URL. In the servlet, verify all input fields are non-null and display them back to the client.
- 13 Briefly explain the significance of EventObject and AWTEvent.
- 14 What is an event source? What is an event listener?
- 15 What method is called when an applet first begins running? What method is called when an applet is removed from the system?
- 16 Explain why an applet must use multithreading if it needs to run continually.
- 17 What are events?
- 18 Briefly describe the assert keyword.
- 19 Give one reason why a native method might be useful to some types of programs.
- 20 Write an applet that draws rectangles of different sizes and locations.
- 21 Which layout is the default layout manager for a frame? Which is the only layout manager that always honors the size of a component?
- 22 Which method defined in the EventObject class returns the Object that generated an event?
- 23 Name the class that may be used to create submenus in pull-down menus. Which abstract class is the super class of all menu-related classes?
- 24 What is multimedia?

- 25 What is a layout manager?
- 26 Write short notes on (i) Layout Manager and (ii) Applet. Write an applet that displays odd and even numbers in a different color at a particular interval (use Multithreading).
- 27 What are the advantages of Prepared Statement over a statement in JDBC?
- 28 How would you make two applets on the same web page, communicate with each other?
- 29 What are tagging interfaces? What is their use?
- 30 What is parameter marshalling? How it is achieved in Java?

III Long Answer Type Questions:

- 1 Write an applet that draws a checkerboard pattern as follows:

```

* * * * *
* * * * *
* * * * *
* * * * *
* * * * *

```
- 2 Write an applet that allows the user to input the four arguments required by method drawOval, then draws an oval using the four input values.
- 3 Write a Web application that consists of a servlet (DirectoryServlet) and several Web documents. Document index.html should be the first document the user sees. In it, you should have a series of links for other Web pages in your site. When clicked, each link should invoke the servlet with a get request that contains a page parameter. The servlet should obtain parameter page and redirect the request to the appropriate document.
- 4 Write a program that uses the paintComponent method to draw the current value of a JSlider on a subclass of JPanel. In addition, provide a JTextField where a specific value can be entered. The JTextField should display the current value of the JSlider at all times. A JLabel should be used to identify the JTextField. The JSlider methods setValue and getValue should be used. [Note: The setValue method is a public method that does not return a value and takes one integer argument, the JSlider value, which determines the position of the thumb.]
- 5 Write an applet that displays the following the pattern:

```

*
* * * *
* * * * *
* * * * * *

```
- 6 Find any errors in each of the following lines of code and explain how to correct them
 - (a) import javax.swing.JFrame
 - (b) panelObject.GridLayout(8, 8); // set GridLayout
 - (c) container.setLayout(new FlowLayout(FlowLayout.DEFAULT));
 - (d) container.add(eastButton, EAST); // BorderLayout
- 7 Write an applet to draw a hut using graphics functions.
- 8 Explain the various types of layouts available in java.
- 9 Explain what Inner Classes are.
- 10 Discuss the concept of Adapter Classes.
- 11 Explain in detail the Delegation Event Model.
- 12 How we can add multimedia to our applets?

- 13 What are Swings? How do they enhance the functionality of AWT controls?
- 14 Explain the life cycle of Servlets.
- 15 Explain the life cycle of Applets.
- 16 What are the different models of Event- Handling in Java? Write a program to display the sum of two numbers of two textboxes within third textbox on clicking ADD button on the screen.
- 17 Explain JDBC Application architecture and steps for obtaining a connection with database.
- 18 Explain Collection Interface and give examples of Collection Classes.
- 19 Explain various JDBC Models.
- 20 What is Java Bean and advantages of that? Write an example for creating a Bean and add customizable properties to a Bean and how to generate and receive property change events.
- 21 Write a code to add two numbers and display the result in the third textbox when the user clicks on ADD button.
- 22 Write various classes of collection sets.
- 23 Give examples of situation when you would use the collections: HashMap, Hashset, TreeMap' and TreeSet.
- 24 Create an Applet that uses JDBC to display five latest news items stored in a news table.
- 25 Describe any two methods of the class ResultSet Meta Data?
- 26 Create a Login Panel that accepts a username and a password from the user and validates it against a set of values contained in a Map, when user clicks the Login button. The input fields should be reset when user clicks the reset button.

UNIT - IV

I Test Your Skills:

(a) State Whether the Following Statements are True or False:

- 1 There are four processes that participate in supporting remote method invocation.
- 2 With the JavaBeans API you cannot create re-useable, platform-independent components.
- 3 Java RMI is a mechanism that allows one to invoke a method on an object that exists in another address space.
- 4 Swing works independently of the underlying operating system.
- 5 A custom event class must extend java.util. Event Object or a subclass of it.
- 6 A JScrollPane has a view port.
- 7 Every container does not have a layout manager that is responsible for arranging its components.
- 8 Java provides specialized containers like Box, JScrollPane with fixed layout managers.
- 9 Bean property is not necessarily a data field.
- 10 Java Beans properties describe the state of the bean
- 11 The UnicastRemoteObject class provides support for point-to-point active object references using TCP streams?
- 12 RMI uses a layered architecture; each of the layers could be enhanced or replaced without affecting the rest of the system?

- 13 RMI is a server-side component; It is not required to be deployed on the server?
14 RMI and EJB, provides services to access an object running in another JVM (known as remote object)?
15 RMI allows an object to invoke methods on an object running in another JVM?

Ans. (1)(F), (2)(F), (3)(T), (4)(T), (5)(T), (6)(T), (7)(F), (8)(T), (9)(T), (10)(T), (11)(T), (12)(T),(13)(F),(14)(T),(15)(T),

(b) Multiple Choice Questions:

- 1 The processes that participate in supporting remote method invocation are
(a) Client
(b) Server
(c) Object Registry
(d) All of the above
- 2 Through the design mode of a builder tool, we use ____ or ____ to customize the bean.
(a) Property sheet
(b) Bean customizer
(c) Either (a) or (c)
(d) None of the above
- 3 Swing is a _____ framework
(a) connection-based
(b) component-based
(c) platform-based
(d) None of the above
- 4 How many kinds of classes can be used in Java RMI?
(a) One
(b) Two
(c) Three
(d) Four
- 5 Which method is used to enable an event for a particular object?
(a) enableEvent()
(b) enable()
(c) enableObject()
(d) enableEvents()
- 6 How would you detect a keypress in a JComboBox?
(a) Add a KeyListener to the JComboBox
(b) Add a KeyListener to the JComboBox's editor component
(c) Either (a) or (b)
(d) None of the above

- 7 Which Swing methods are thread-safe?
- (a) repaint()
 - (b) revalidate()
 - (c) invalidate()
 - (d) all of the above
- 8 Which of the following is not true?
- (a) The Frame class extends Window
 - (b) The CheckboxMenuItem class extends the MenuItem class
 - (c) JComponent is a subclass of Container
 - (d) None of the above
- 9 What is the correct way to write a JavaScript array?
- (a) `var txt = new Array:1=("tim")2=("kim")3=("jim")`
 - (b) `var txt = new Array(1:"tim",2:"kim",3:"jim")`
 - (c) `var txt = new Array="tim","kim","jim")`
 - (d) `var txt = new Array("tim","kim","jim")`
- 10 What is the correct JavaScript syntax to insert a comment that has more than one line?
- (a) `<!--This comment has more than one line-->`
 - (b) `/*This comment has more than one line*/`
 - (c) `//This comment has more than one line//`
 - (d) `<>//This comment has more than one line//>`
- 11 What is Remote method invocation (RMI)?
- (a) RMI allows us to invoke a method of java object that executes on another machine.
 - (b) RMI allows us to invoke a method of java object that executes on another Thread in multithreaded programming.
 - (c) RMI allows us to invoke a method of java object that executes parallely in same machine.
 - (d) None of the mentioned
- 12 Which of this package is used for remote method invocation?
- (a) java.applet
 - (b) java.rmi
 - (c) java.lang.rmi
 - (d) java.lang.reflect

- 13 Which of these methods are member of Remote class?
- (a) checkIP()
 - (b) addLocation()
 - (c) AddServer()
 - (d) None of the mentioned
- Explanation: Remote class does not define any methods, its purpose is simply to indicate that an interface uses remote methods.
- 14 Which of these Exceptions is thrown by remote method?
- (a) RemoteException
 - (b) InputOutputException
 - (c) RemoteAccessException
 - (d) RemoteInputOutputException
- 15 Which of this class is used for creating a client for server-client operations?
- (a) serverClientjava
 - (b) Client.java
 - (c) AddClient.java
 - (d) ServerClient.java
- 16 Which of this package is used for all the text related modifications?
- (a) java.text
 - (b) java.awt
 - (c) java.lang.text
 - (d) java.text.mofify
- 17 What is the output of this program?
- ```
import java.lang.reflect.*;
class Additional_packages {
public static void main(String args[]) {
try {
Class c = Class.forName("java.awt.Dimension");
Constructor constructors[] = c.getConstructors();
for (int i = 0; i < constructors.length; i++)
System.out.println(constructors[i]);
}
catch (Exception e){
System.out.print("Exception");
}
}
}
```
- (a) Program prints all the constructors of 'java.awt.Dimension' package.
  - (b) Program prints all the possible constructors of class 'Class'.
  - (c) Program prints "Exception"
  - (d) Runtime Error

18 What is the output of this program?

```
import java.lang.reflect.*;
class Additional_packages {
public static void main(String args[]) {
try {
Class c = Class.forName("java.awt.Dimension");
Field fields[] = c.getFields();
for (int i = 0; i < fields.length; i++)
System.out.println(fields[i]);
}
catch (Exception e){
System.out.print("Exception");
}
}
}
```

- (a) Program prints all the constructors of 'java.awt.Dimension' package.
- (b) Program prints all the methods of 'java.awt.Dimension' package.
- (c) Program prints all the data members of 'java.awt.Dimension' package.
- (d) program prints all the methods and data member of 'java.awt.Dimension' package.

19 What is the length of the application box made by this program?

```
import java.awt.*;
import java.applet.*;
public class myapplet extends Applet {
Graphic g;
g.drawString("A Simple Applet",20,20);
}
```

- (a) 20
- (b) Default value
- (c) Compilation Error
- (d) Runtime Error

20 What is the output of this program?

```
1. import java.lang.reflect.*;
2. class Additional_packages {
3. public static void main(String args[]) {
4. try {
5. Class c = Class.forName("java.awt.Dimension");
6. Method methods[] = c.getMethods();
7. for (int i = 0; i < methods.length; i++)
8. System.out.println(methods[i]);
9. }
10. catch (Exception e){
11. System.out.print("Exception");
```

12. \_\_\_\_\_ }
13. \_\_\_\_\_ }
14. \_\_\_\_\_ }
- (a) Program prints all the constructors of 'java.awt.Dimension' package.
- (b) Program prints all the methods of 'java.awt.Dimension' package.
- (c) Program prints all the data members of 'java.awt.Dimension' package.
- (d) Program prints all the methods and data member of 'java.awt.Dimension' package.
- 21 Which of this package contains classes and interfaces for networking?
- (a) java.io
- (b) java.util
- (c) java.net
- (d) java.network
- 22 Which of these is superclass of ContainerEvent class?
- (a) WindowEvent
- (b) ComponentEvent
- (c) ItemEvent
- (d) InputEvent
- 23 Which of these events is generated when the size of an event is changed?
- (a) ComponentEvent
- (b) ContainerEvent
- (c) FocusEvent
- (d) InputEvent
- 24 Which of these methods can be used to obtain the reference to the container that generated a ContainerEvent?
- (a) getContainer()
- (b) getContainerCommand()
- (c) getActionEvent()
- (d) getContainerEvent()
- 25 To locate a remote object with a name t at port 7000 on host panda.armstrong.edu, use
- (a) Remote remoteObj = Name.lookup("rmi://panda.armstrong.edu:7000/t");
- (b) Remote remoteObj = Name.lookup("//panda.armstrong.edu:7000/t");
- (c) Remote remoteObj = Name.lookup("http://panda.armstrong.edu:7000/t");
- (d) Remote remoteObj = Naming.lookup("rmi://panda.armstrong.edu:7000/t");
- 26 \_\_\_\_\_ is a subinterface of java.rmi.Remote that defines the methods for the server object.
- (a) Server stub
- (b) Server implementation
- (c) Server object interface
- (d) RMI Registry
- (e) Server Skeleton

- 27 Which of the following statements are true?
- (a) RMI enables you to program at a higher level of abstraction. It hides the details of socket server, socket, connection, and sending or receiving data. It even implements a multithreading server under the hood, whereas with socket-level programming you have to explicitly implement threads for handling multiple clients.
  - (b) In socket-level programming, a client operation to send data requires a server operation to read it. The implementation of client and server at the socket-level is tightly synchronized.
  - (c) RMI clients can directly invoke the server method, whereas socket-level programming is limited to passing values.
  - (d) RMI applications are scalable and easy to maintain. You can change the RMI server or move it to another machine without modifying the client program except for resetting the URL to locate the server.
  - (e) All of the above
- 28 Each remote object has a unique name identified by an URL with the protocol rmi as follows:
- (a) http://host:port/name
  - (b) //host:port/name
  - (c) http://host/name
  - (d) rmi://host:port/name
- 29 \_\_\_\_\_ provides the naming services for the server to register the object and for the client to locate the object.
- (a) Server stub
  - (b) RMI Registry
  - (c) Server implementation
  - (d) Server Skeleton
  - (e) Server object interface
- 30 To start an RMI registry, use \_\_\_\_\_ from the command window.
- (a) rmiregistry
  - (b) start rmiregistry
  - (c) rmiregistry 7000
  - (d) start rmiregistry 7000
- 31 The following specifies the advantages of  
It is lightweight.  
It supports pluggable look and feel.  
It follows MVC (Model View Controller) architecture.
- (a) Swing
  - (b) AWT
  - (c) Both A & B
  - (d) None of the above

- 32 Swing is not a part of JFC (Java Foundation Classes) that is used to create GUI application?  
(a) True  
(b) False
- 33 These two ways are used to create a Frame  
By creating the object of Frame class (association)  
By extending Frame class (inheritance)  
(a) True  
(b) False
- 34 Which package provides many event classes and Listener interfaces for event handling?  
(a) java.awt  
(b) java.awt.Graphics  
(c) java.awt.event  
(d) None of the above
- 35 The ActionListener interface is used for handling action events,For example,it's used by a  
(a) JButton  
(b) JCheckbox  
(c) JMenuItem  
(d) All of these
- 36 Which is the container that doesn't contain title bar and MenuBars. It can have other components like button, textfield etc?  
(a) Window  
(b) Frame  
(c) Panel  
(d) Container
- 37 Which of these methods are member of Remote class?  
(a) checkIP()  
(b) addLocation()  
(c) AddServer()  
(d) None of the mentioned
- 38 Which of these package is used for all the text related modifications?  
(a) java.text  
(b) java.awt  
(c) java.lang.text  
(d) java.text.mofify
- 39 What is the output of this program?  

```
import java.lang.reflect.*;
class Additional_packages {
public static void main(String args[]) {
 try {
```



```

 Class c = Class.forName("java.awt.Dimension");
 Field fields[] = c.getFields();
 for (int i = 0; i < fields.length; i++)
 System.out.println(fields[i]);
 }
 catch (Exception e){
System.out.print("Exception");
 }
}
}

```

- (a) Program prints all the constructors of 'java.awt.Dimension' package.  
 (b) Program prints all the methods of 'java.awt.Dimension' package.  
 (c) Program prints all the data members of 'java.awt.Dimension' package.  
 (d) Program prints all the methods and data member of 'java.awt.Dimension' package.
- 40 What is the length of the application box made by this program?  
 import java.awt.\*;  
 import java.applet.\*;  
 publicclass myapplet extends Applet {  
 Graphic g;  
 g.drawString("A Simple Applet",20,20);  
 }  
 (a) 20  
 (b) Default value  
 (c) Compilation Error  
 (d) Runtime Error
- 41 RMI has which of these protocols implementations?  
 (a) Java Remote Method Protocol (JRMP)  
 (b) Internet Inter-ORB Protocol (IIOP)  
 (c) Jinni Extensible Remote Invocation (JERI)  
 (d) All mentioned above
- 42 In RMI which layer defines and supports the invocation semantics of the RMI connection, this layer maintains the session during the method call?  
 (a) The Stub & Skeleton Layer  
 (b) The Application Layer  
 (c) The Remote Reference Layer  
 (d) The Transport Layer
- 43 Which method of the Naming class (found in java.rmi) is used to update the RMI registry on the server machine?  
 (a) rebind ()  
 (b) lookup()  
 (c) Both A & B  
 (d) None of the above

- 44 In RMI program the following two steps are used to, Either extend the UnicastRemoteObject class, the exportObject() method of the UnicastRemoteObject class,
- (a) Provide the Implementation of the remote interface
  - (b) Create the remote interface
  - (c) Create and start the remote application
  - (d) Compile the implementation class and create the stub and skeleton objects using the rmic tool
- 45 Which is built on the top of socket programming?
- (a) EJB
  - (b) RMI
  - (c) Both A & B
  - (d) None of the above
- 46 In RMI program the following example shows the,
- ```
import java.rmi.*;
public interface Adder extends Remote{

    public int add(int x,int y)throws RemoteException;
}
```
- (a) Create and start the remote application
 - (b) Create and start the client application
 - (c) Create the remote interface
 - (d) Provide the implementation of the remote interface
- 47 In RMI applications which program obtains a remote reference to one or more remote objects on a server and then invokes methods on them?
- (a) Server
 - (b) Client
 - (c) Both A & B
 - (d) None of the above
- 48 Which is a one-way communication only between the client and the server and it is not a reliable and there is no confirmation regarding reaching the message to the destination?
- (a) TCP/IP
 - (b) UDP
 - (c) Both A & B
 - (d) None of the above

- 49 In a RMI Client Program, what are the exceptions which might have to handled?
- (a) RemoteException
 - (b) NotBoundException
 - (c) MalformedURLException
 - (d) All mentioned above

- 50 Abbreviate the term DGC?
- (a) Digital Garbage Collection
 - (b) Distributed Garbage Collection
 - (c) Distributed Garbage Connection
 - (d) None of the above

Ans. (1)(d), (2)(c), (3)(b), (4)(b), (5)(d), (6)(b), (7)(d), (8)(d), (9)(d), (10)(b), (11)(a), (12)(b), (13)(d), (14)(a), (15)(c), (16)(a), (17)(a), (18)(c), (19)(c), (20)(b),(21)(c), (22)(b),(23)(a), (24)(d), (25)(d), (26)(c), (27)(e), (28)(b), (29)(b), (30)(b,d),(31)(a), (32)(b), (33)(b), (34)(c), (35)(d), (36)(c), (37)(d), (38)(c), (39)(c), (40)(c), (41)(d), (42)(c), (43)(a), (44)(a), (45)(b), (46)(c), (47)(b), (48)(b), (49)(d), (50)(b).

(c) Fill in the Blanks:

- 1 JComponent is a subclass of _____
- 2 Canvas is a _____ while ScrollPane is a _____.
- 3 Support for _____ allows a builder tool to analyze how a bean works.
- 4 A remote object can be associated with a name using the Naming class's _____ or _____ methods.
- 5 _____ is the protocol used by RMI.
- 6 AWT stands for _____.
- 7 JFC stands for _____.
- 8 An object whose class implements the enterprise bean's remote interface is known as _____.
- 9 An enterprise bean that represents persistent data maintained in a database is an _____ bean.
- 10 RemoteException might have to be handled in _____.

Ans. (1)(Container), (2)(component, container), (3)(introspection), (4)(bind, rebound), (5)(java remote method protocol), (6)(Abstract Window Toolkit), (7)(Java Foundation Classes), (8)(EJB), (9)(entity), (10)(RMI Client Program)

II Short Answer Type Questions:

- 1 What is the common defining features which most of the Java Beans share?
- 2 What are Java Beans?
- 3 What are Swings?
- 4 How can we pack beans?
- 5 How do we create remote objects in Java?
- 6 How can we generate stub and skeleton using RMI?
- 7 What are the main characteristics of the Swing toolkit?

- 8 Write a short note on RMI Packages.
- 9 What is RMI?
- 10 Discuss in brief the Java security model as it relates to RMI.
- 11 What is a Java Beans Component?
- 12 What is an event pair?
- 13 Since JButton is a subclass of Container, can we add a button inside a button? If yes, how? If No, why?
- 14 How do you set an image icon in a JFrame's title bar?
- 15 Describe the naming conventions for JavaBeans registration and deregistration methods?
- 16 How CORBA differs from Java RMI?
- 17 How we can use a serializable object in a remote method invocation?
- 18 What is a JTabbedPane?
- 19 How Label control differs from JLabel?
- 20 What is NetBean?
- 21 Why are swing components said to be lightweight components?

III Long Answer Type Questions:

- 1 Explain the RMI architecture.
- 2 How Swing control differs from AWT? Explain giving examples.
- 3 Discuss in detail the key bean concepts.
- 4 Discuss the steps to be followed to create a new project in the NetBeans IDE.
- 5 How many public packages are there in Swing API? Discuss any four of them.
- 6 Discuss how to program the Client and Server using Remote Objects. Give sample code also.
- 7 What is JFC? What are the differences between Swing and AWT? How would you create a button with rounded edges?
- 8 Explain the Swing architecture in detail.
- 9 What is introspection API in Java Beans? Explain.
- 10 Explain the various types of properties of Java Beans in detail.
- 11 What is RMI? What is the basic principle of RMI architecture?
- 12 What is meant by binding in RMI? What is the difference between using bind() and rebind() methods of Naming Class?
- 13 What are the services in RMI?
- 14 What advantage do Java's layout managers provide over traditional windowing systems? What is the default layout manager for Java swings? Explain.
- 15 Why are component architectures useful? Discuss in context with Java Beans.
- 16 What is RMI? Explain steps involved in developing an RMI object.
- 17 Write short notes on (1) comparison of Swing with AWT (2) JFC
- 18 What is Java Bean? Explain its architecture and packing beans the manifest and the jar.
- 19 What is Swing? Explain the advanced controls of Swing.
- 20 What is the difference between AWT and Swings. Explain.
- 21 Design a form using Swings for student registration.
- 22 Create a java bean to preview image files. The bean should have properties: file name, width and height for generating the preview. The bean should use these properties to generate the preview of the image file.

- 23 Write a RMI application to query the availability of a product in a product store. The reference to the product store object is to be made available remotely to the client application.

QUESTION BANK

THEORY OF COMPUTATION

MCA 201

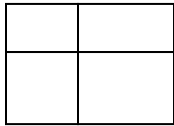
QUESTION BANK
THEORY OF COMPUTATION - MCA 201
MCA III

UNIT - I

I Test Your Skills:

(a) State Whether the Following Statements are True or False:

- 1 The complete graph K_7 is non-planar.
- 2 The graph given below is bipartite.



- 3 The cube graph Q_3 is planar.
- 4 A finite connected graph is Eulerian if and only if each vertex has even degree.
- 5 In the induction, since k is arbitrary, we can prove $P(6)$ assuming $P(5)$ holds.
- 6 To find $\delta(q,a)$ of DFA, find all states reached from some state q by reading one or more a 's in NFA.
- 7 The set consisting of the initial state of NFA is the initial state of corresponding DFA.
- 8 In conversion of NFA to DFA, when the transitions for all the states of DFA are identified, the DFA will be obtained.
- 9 $abab$ is generated by $\{S \rightarrow aX, X \rightarrow bX, X \rightarrow a\}$.
- 10 A regular grammar generates the empty string.
- 11 A regular language is also context free.
- 12 A regular language can be generated by a unique grammar.

Ans. (1)(T), (2)(T), (3)(F), (4)(T), (5)(F), (6)(T), (7)(T), (8)(T), (9)(F), (10)(F), (11)(T), (12)(F)

(b) Multiple Choice Questions:

- 1 A Hamiltonian cycle in a Hamiltonian graph of order 24 has
 - (a) 12 edges.
 - (b) 24 edges
 - (c) 23 edges
 - (d) None of above

- 2 A spanning tree for a simple graph of order 24 has
 - (a) 12 edges
 - (b) 6 edges
 - (c) 23 edges
 - (d) None of above.

- 3 If G is a simple connected 3-regular planar graph where every region is bounded by exactly 3 edges, then the edges of G is
- 3
 - 4
 - 6
 - 5
- 4 If G is a connected planar graph of v vertices e edges and r regions then
- $v-e+r=2$
 - $e-v+r=2$
 - $v+e-r=2$
 - None of above.
- 5 A Hamiltonian cycle in a Hamiltonian graph of order 24 has
- 12 edges.
 - 24 edges
 - 23 edges
 - None of above.
- 6 A spanning tree for a simple graph of order 24 has
- 12 edges
 - 6 edges
 - 23 edges
 - None of above.
- 7 If G is a simple connected 3-regular planar graph where every region is bounded by exactly 3 edges, then the edges of G is
- 3
 - 4
 - 6
 - 5
- 8 If G is a connected planar graph of v vertices e edges and r regions then
- $v-e+r=2$
 - $e-v+r=2$
 - $v+e-r=2$
 - None of above.
- 9 The following grammar
 $G = (N, T, P, S)$
 $N = \{S, A, B\}$
 $T = \{a, b, c\}$
 $P : S \rightarrow aSa$
 $S \rightarrow aAa$

$A \rightarrow bB$
 $B \rightarrow bB$
 $B \rightarrow c$ is

- (a) is type 3
- (b) is type 2 but not type 3
- (c) is type 1 but not type 2
- (d) is type 0 but not type 1

10 The following grammar

$G = (N, T, P, S)$
 $N = \{S, A, B, C, D, E\}$
 $T = \{a, b, c\}$
 $P : S \rightarrow aAB$
 $AB \rightarrow CD$
 $CD \rightarrow CE$
 $C \rightarrow aC$
 $C \rightarrow b$
 $bE \rightarrow bc$ is

- (a) is type 3
- (b) is type 2 but not type 3
- (c) is type 1 but not type 2
- (d) is type 0 but not type 1

11 The following grammar

$G = (N, T, P, S)$
 $N = \{S, A, B, C\}$
 $T = \{a, b, c\}$
 $P : S \rightarrow aS$
 $A \rightarrow bB$
 $B \rightarrow cC$
 $C \rightarrow a$ is

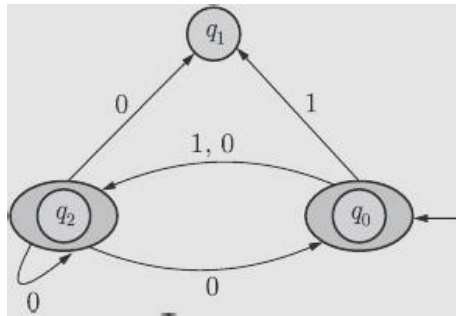
- (a) is type 3
- (b) is type 2 but not type 3
- (c) is type 1 but not type 2
- (d) is type 0 but not type 1

12 P, Q, R are three languages. If P & R are regular and if $PQ=R$, then

- (a) Q has to be regular
- (b) Q cannot be regular
- (c) Q need not be regular
- (d) Q has to be a CFL

- 13 Which of the following is true with respect to Kleene's theorem?
- 1 A regular language is accepted by a finite automaton.
 - 2 Every language is accepted by a finite automaton or a Turing machine.
- (a) 1 only
 - (b) 2 only
 - (c) Both 1 and 2 are true statements
 - (d) None is true
- 14 Automaton accepting the regular expression of any number of a's is:
- (a) a^*
 - (b) ab^*
 - (c) $(a/b)^*$
 - (d) a^*b^*c
- 15 Grammars that can be translated to DFAs:
- (a) Left linear grammar
 - (b) Right linear grammar
 - (c) Generic grammar
 - (d) All of these
- 16 Two strings x and y are indistinguishable if:
- (a) $\delta^*(s, x) = \delta^*(s, y)$, i.e. the state reached by a DFA M on input x is the same as the state reached by M on input y
 - (b) if for every string $z \in \Sigma^*$ either both xz and yz are in language A or both xz and yz are not in A
 - (c) Both above statements are true
 - (d) None of the above
- 17 Consider the following two statements:
- S1 : $\{0^{2n} \mid n \geq 1\}$ is a regular language
- S2 : $\{0^m 1^n 0^{m+n} \mid m \geq 1, n \geq 1\}$ is a regular language
- Which of the following statements is incorrect?
- (a) Only S1 is correct
 - (b) Only S2 is correct
 - (c) Both S1 and S2 are correct
 - (d) None of S1 and S2 is correct
- 18 Given an arbitrary non-deterministic finite automaton NFA with N states, the maximum number of states in an equivalent minimized DFA is at least:
- (a) N^2
 - (b) 2^N
 - (c) $2N$
 - (d) $N!$

- 19 Regular expressions are
- Type 0 language
 - Type 1 language
 - Type 2 language
 - Type 3 language
- 20 The regular expression $0^*(10)^*$ denotes the same set as
- $(1^*0)^*1^*$
 - $0+(0+10)^*$
 - $(0+1)^*10(0+1)^*$
 - None of the above
- 21 Consider the NFA M shown below. Let the language accepted by M be L . Let $L1$ be the language accepted by the NFA $M1$, obtained by changing the accepting state of M to a non-accepting state and by changing the non-accepting state of M to accepting states.

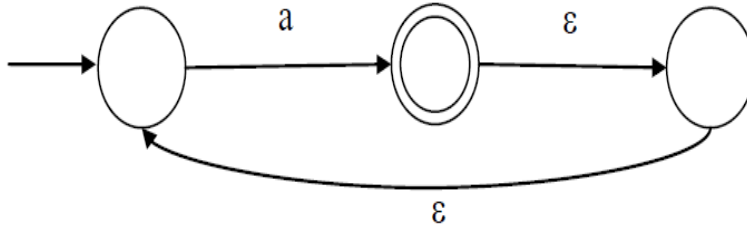


- Which of the following statements is true?
- $L1 = \{0,1\}^* - L$
 - $L1 = \{0,1\}^*$
 - $L1$ is a subset of L
 - $L1 = L$
- 22 Which of the statements is true:
- The complement of a regular language is always regular.
 - Homomorphism of a regular language is always regular.
 - Both of the above are true statements
 - None of the above
- 23 The regular sets are closed under:
- Union
 - Concatenation
 - Kleene closure
 - All of the above
- 24 Any given transition graph has an equivalent:
- regular
 - DFSM (Deterministic Finite State Machine)

- (c) NDFSM
(d) All of them
- 25 A language is regular if and only if
(a) Accepted by DFA
(b) Accepted by PDA
(c) Accepted by LBA
(d) Accepted by Turing machine
- 26 Which of the following is not a regular expression?
(a) $[(a+b)^*(aa+bb)]^*$
(b) $[(0+1)^*(0b+a1)^*(a+b)]^*$
(c) $(01+11+10)^*$
(d) $(1+2+0)^*(1+2)^*$
- 27 Consider the regular language $L = (111+11111)^*$. The minimum number of states in any DFA accepting this language is
(a) 3
(b) 5
(c) 8
(d) 9
- 28 How many strings of length less than 4 contains the language described by the regular expression $(x+y)^*y(a+ab)^*$?
(a) 7
(b) 10
(c) 12
(d) 11
- 29 Which of the following is TRUE?
(a) Every subset of a regular set is regular
(b) Every finite subset of a non-regular set is regular
(c) The union of two non-regular sets is not regular
(d) Infinite union of finite sets is regular
- 30 The minimum state automaton equivalent to the above FSA has the following number of states
(a) 1
(b) 2
(c) 3
(d) 4
- 31 Which one of the following languages over the alphabet $\{0,1\}$ is described by the regular expression: $(0+1)^*0(0+1)^*0(0+1)^*$?
(a) The set of all strings containing the substring 00.
(b) The set of all strings containing at most two 0's.

- (c) The set of all strings containing at least two 0's.
- (d) The set of all strings that begin and end with either 0 or 1.

32 What is the complement of the language accepted by the NFA shown below?



- (A) \emptyset
- (B) $\{\epsilon\}$
- (C) a^*
- (D) $\{a, \epsilon\}$

33 Let w be any string of length n in $\{0,1\}^*$. Let L be the set of all substrings of w . What is the minimum number of states in a non-deterministic finite automaton that accepts L ?

- (a) $n-1$
- (b) n
- (c) $n+1$
- (d) $2n-1$

34 Which of the following are regular sets?

- I. $\{a^n b^{2m} \mid n \geq 0, m \geq 0\}$
- II. $\{a^n b^m \mid n = 2m\}$
- III. $\{a^n b^m \mid n \neq m\}$
- IV. $\{xcy \mid x, y \in \{a,b\}^*\}$

- (a) I and IV only
- (b) I and III only
- (c) I only
- (d) IV only

35 A minimum state deterministic finite automation accepting the language $L = \{W \mid W \in \{0,1\}^*, \text{ number of 0s and 1s in } W \text{ are divisible by 3 and 5, respectively}\}$ has

- (a) 15 states
- (b) 11 states
- (c) 10 states
- (d) 9 states

36 Let P be a regular language and Q be context-free language such that $Q \in P$. (For example, let P be the language represented by the regular expression

p^*q^* and Q be $\{pnqn|n \in \mathbb{N}\}$. Then which of the following is ALWAYS regular?

- (a) $P \cap Q$
- (b) $P - Q$
- (c) $\Sigma^* - P$
- (d) $\Sigma^* - Q$

37 Let $L_1 = \{w \in \{0,1\}^* \mid 1 = \text{number of occurrences of } (110)\text{'s in } w\}$ as $(011)\text{'s}$. Let $L_2 = \{w \in \{0,1\}^* \mid 2 = \text{number of occurrences of } (000)\text{'s in } w\}$ as $(111)\text{'s}$. Which one of the following is TRUE?

- (a) L_1 is regular but not L_2
- (b) L_2 is regular but not L_1
- (c) Both L_1 and L_2 are regular
- (d) Neither L_1 nor L_2 are regular

38 Given a Non-deterministic Finite Automation (NFA) with states p and r as initial and final states respectively and transition table as given below:

	A	B
P	-	Q
q	R	S
r	R	S
s	R	S

The minimum number of states required in Deterministic Finite Automation (DFA) equivalent to NFA is

- (a) 5
- (b) 4
- (c) 3
- (d) 2

39 Which one of the following statement is true for a regular language L over $\{a\}$ whose minimal finite state automation has two states?

- (a) L must be either $\{a^n \mid n \text{ is odd}\}$ or $\{a^n \mid n \text{ is even}\}$
- (b) L must be $\{a^n \mid n \text{ is odd}\}$
- (c) L must be $\{a^n \mid n \text{ is even}\}$
- (d) L must be $\{a^n \mid n = 0\}$

40 The is said to be ambiguous if there exist at least one word of its language that can be generated by the different production tree .

- (a) CFL
- (b) CFG

- (c) GTG
 (d) None of the given
- 41 If s is a string over $(0 + 1)^*$ then let $n_0(s)$ denote the number of 0's in s and $n_1(s)$ the number of 1's in s . Which one of the following languages is not regular?
 (a) $L = \{s \in (0 + 1)^* \mid n_0(s) \text{ is a 3-digit prime}\}$
 (b) $L = \{s \in (0 + 1)^* \mid \text{for every prefix } s' \text{ of } s, |n_0(s') - n_1(s')| \leq 2\}$
 (c) $L = \{s \in (0 + 1)^* \mid |n_0(s) - n_1(s)| \leq 4\}$
 (d) $L = \{s \in (0 + 1)^* \mid n_0(s) \bmod 7 = n_1(s) \bmod 5 = 0\}$
- 42 A FSM can be considered, having finite tape length without rewinding capability and unidirectional tape movement
 (a) Turing machine
 (b) Pushdown automata
 (c) Context free languages
 (d) Regular languages
- 43 The minimum state automaton equivalent to the above FSA has the following number of states
 (a) 1
 (b) 2
 (c) 3
 (d) 4
- 44 Any given transition graph has an equivalent
 (a) Regular
 (b) DFSM (Deterministic Finite State Machine)
 (c) NDFSM
 (d) All of them
- 45 Which of the following are decidable ?
 (1) Whether the intersection of two regular language is infinite.
 (2) whether a give context free language is regular
 (3) whether two push down automata accept the same language.
 (4) whether a given grammar is context free
 (a) 1 and 2
 (b) 1 and 4
 (c) 2 and 3
 (d) 2 and 4

- 46 Which of the following is true for the language $\{a^p : p \text{ is prime}\}$?
- (a) It is not accepted by a turing machine
 - (b) It is regular but not context free
 - (c) It is context free but not regular
 - (d) It is neither regular nor context free but accepted by a turing machine
- 47 Given an arbitrary non-deterministic finite automaton (NFA) with N states, the maximum number of states in an equivalent minimized DFA is at least.
- (a) N^2
 - (b) $N!$
 - (c) $2N$
 - (d) 2^N
- 48 Which of the following statements is true?
- (a) If a language is context free it can always be accepted by a deterministic push-down automaton
 - (b) The union of two context free languages is context free
 - (c) The intersection of two context free languages is context free
 - (d) The complement of a context free language is context free
- 49 Which one of the following is FALSE?
- (a) Every NFA can be converted to an equivalent PDA.
 - (b) Complement of every context-free language is recursive.
 - (c) Every nondeterministic PDA can be converted to an equivalent deterministic PDA.
 - (d) There is a unique minimal DFA for every regular language.
- 50 Consider the following two statements:
 S1: $\{0^{2n} \mid n \geq 1\}$ is a regular language
 S2: $\{0^m 0^n 0^{(m+n)} \mid m \geq 1 \text{ and } n \geq 2\}$ is a regular language
 Which of the following statements is correct?
- (a) Only S1 is correct
 - (b) Only S2 is correct
 - (c) Both S1 and S2 are correct
 - (d) None of S1 and S2 is correct

Ans. (1)(b), (2)(c), (3)(c), (4)(a), (5)(b), (6)(c), (7)(c), (8)(a), (9)(b), (10)(c), (11)(a), (12)(c), (13)(c), (14)(a), (15)(b), (16)(c), (17)(a), (18)(c), (19)(a), (20)(b), (21)(a), (22)(c), (23)(d), (24)(d), (25)(a), (26)(b), (27)(d), (28)(d), (29)(b), (30)(b), (31)(c), (32)(b), (33)(c), (34)(a), (35)(a), (36)(c), (37)(d), (38)(c), (39)(a), (40)(b)

(c) Fill in the Blanks:

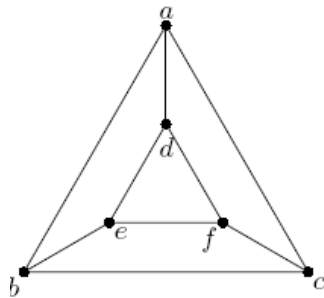
- 1 The sum of the degree of the vertices of a graph G is equal to _____ the number of _____ of G.
- 2 A finite connected graph is Eulerian if and only if each vertex has _____ degree.
- 3 A graph is said to k- regular if every vertex has degree _____.
- 4 G is a _____ graph with p vertices and q edges, where $p \geq 3$ if $q \geq 3p - 6$.
- 5 _____ corresponds to the set of strings consisting of zero or more a's followed by one or more b's followed by zero or more a's.
- 6 If L_1 and L_2 are regular languages then their union $L_1 \cup L_2$ is _____.
- 7 Regular expression corresponding to the language of strings of even lengths over the alphabet of { a, b } _____.
- 8 _____ is the shortest string that is not in the language represented by the regular expression $a^*(ab)^*b^*$.
- 9 A _____ language is regular.
- 10 In a DFA all states have the _____ number of transitions.
- 11 The next state is _____ for a given input.

Ans. (1)(twice, edges), (2)(even), (3)(K), (4)(connected planar), (5)($a^*b^+a^*$), (6)(regular), (7)($aa + ab + ba + bb$)*, (8)(ba), (9)(finite), (10)(same), (11)(unique)

II Short Answer Type Questions / Practical Questions:

- 1 Consider a graph with vertices a, b, c, d, e and f and edges a b, b c, c d, d a, a e, b e, c f, d f and e f.
 - (a) Draw a diagram showing the vertices and edges of this graph.
 - (b) Is this graph regular?
 - (c) Is this graph complete?
 - (d) Is this graph regular?
 - (e) Does this graph have an Eulerian circuit? If so, give an example.
 - (f) Does this graph have a Hamiltonian circuit? If so, give an example.
 - (g) Is this graph a tree?
 - (h) Does this graph have a spanning tree? If so, give an example.
[Briefly justify all your answers above.]

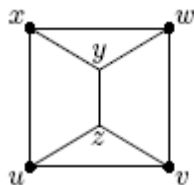
- 2 Consider the graph (representing the vertices and edges of an octohedron) which consists of 6 vertices, which we shall label as a, b, c, d, e and f, and the following 12 edges: ab, bc, cd, da, ae, be, ce, de, af, bf, cf, and df.
- Write down an incidence and adjacency matrices for this graph, where the vertices and edges are ordered as they are listed in the above specification (so that a is the first vertex, b is the second, etc., ab is the first edge, bc is the second etc.).
 - Is this graph connected? [Justify your answer.]
 - Is this graph complete? [Justify your answer.]
 - Does this graph have an Euler circuit? If not, explain why not? If so, specify such a circuit?
 - Give an example of a Hamiltonian circuit in this graph.
 - Give an example of a spanning tree for this graph.



3

Ans: The following questions concerning the graph with vertices a, b, c, d, e and f pictured above. [Justify all your answers].

- Is the graph complete?
- Is the graph regular?
- Is the graph connected?
- Does the graph have an Eulerian circuit?
- Does the graph have a Hamiltonian circuit?
- Give an example of a spanning tree for the graph, specifying the vertices and edges of the spanning tree.
- Given an example of an isomorphism between the graph pictured above and that pictured below. (You should specify the isomorphism as a function between the sets $\{a; b; c; d; e; f\}$ and $\{u; v; w; x; y; z\}$ of vertices of the two graphs.)



- 4 Complete graph has n vertices, how many edges does it have? (Justify your answer.)

Find all strings of lengths 5 or less in the regular set represented by the following (5-9):

- 5 $a(a+b)^*ab$
- 6 a^*b+b^*a
- 7 $(01+1)^*(11+0)$
- 8 $0^*+(10+1)^*$
- 9 $(ab^*+ba^*)^*b$

Find regular expression representing following set(10-14):

- 10 $\{a,b,c,d\}$
- 11 $\{w \mid w \in \{0,1\}^* \text{ \& } w \text{ has only one } 0\}$.
- 12 The set of all strings beginning with a & having substring ba in it over $\{a,b\}$.
- 13 The set of all strings with 3 consecutive o's over $\{0,1\}$.
- 14 Set of all strings starting with a ending with b and having atmost one pair of consecutive symbols over $\{a,b\}$.

For each language below write a regular expression (15-19):

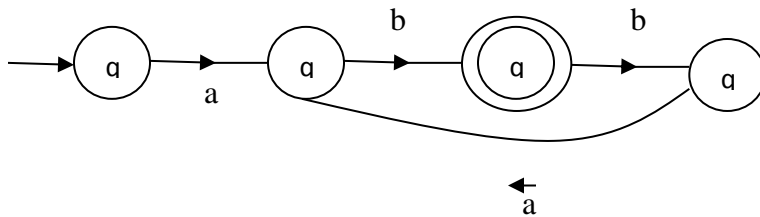
- 15 The set of strings over $\sigma = \{0,1\}$ ending in 00
- 16 The set of strings over $\sigma = \{0,1\}$ that contain three consecutive ones.
- 17 The set of strings over $\sigma = \{a,b,c\}$ that contains the empty string and strings that have a length that is a multiple of three with every block of three containing one a, one b and one c (implied, is in any order).
- 18 (a) Devise a regular grammar to generate the language over the alphabet $\{a, (, 0, 1\}$ consisting of all strings such as $a(001)$ and $a(1001010)$ in which the initial substring $a($ is followed by a non-empty string of binary digits, which is followed by the character $)$.

(b) Devise a finite state acceptor that accepts (i.e., determines) the language described in (a). You should specify the states of the machine, the start state, the finishing state(s), and the transition table that defines the machine

- a. Devise a context-free grammar to generate the language over the alphabet $\{0, 1\}$ consisting of the strings $01, 0011, 000111, 00001111, \dots$ (i.e., consisting of m zeros, for some non-negative integer m , followed by m ones). You should specify the non terminals of the grammar, the start symbol and the productions of the grammar.
- b. Define ϵ -NFA.
- c. Define ϵ - closure
- d. Construct a finite automata that accepts $\{0,1\}^+$
- e. Give the DFA accepting the language over the alphabet $0,1$ that have the set of all strings ending in 00.

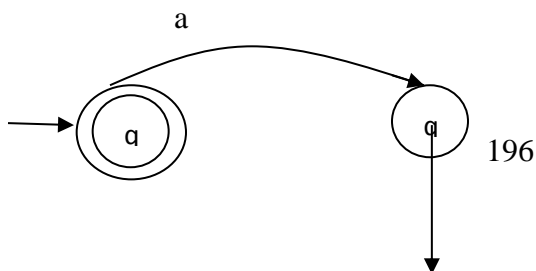
- f. Give the DFA accepting the language over the alphabet 0,1 that have the set of all strings with three consecutive 0's.
- g. Give the DFA accepting the language over the alphabet 0,1 that have the set of all strings with 011 as a substring.
- h. Give the DFA accepting the language over the alphabet 0,1 that have the set of all strings whose 10th symbol from the right end is 1.
- i. Give the DFA accepting the language over the alphabet 0,1 that have the set of all strings such that each block of 5 consecutive symbol contains at least two 0's.
- j. Give the DFA accepting the language over the alphabet 0,1 that have the set of all strings that either begins or end(or both) with 01.
- k. Give the DFA accepting the language over the alphabet 0,1 that have the set of all strings such that the no of zero's is divisible by 5 and the no of 1's is divisible by 3
- l. Give regular expression for the following:
 $\{1^{2n+1} : n > 0\}$ and $\{a^n : n \text{ is divisible by } 2 \text{ or } 3 \text{ or } n=5\}$

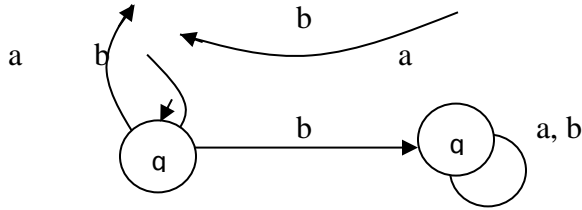
- (a) With the help of schematic diagram explain the function of DFA.
What are the reasons to say it is Deterministic?
- (b) For the NFA given by following state transition diagram



- (a) Check whether the string abbabba is accepted or not
- (b) Give at least two transition paths
- (c) Find equivalent DFA.

- m. (a) Construct the regular expression accepted by following finite automation.





- (b) Construct a DFA for the regular expression $01+(00+11)^*$
- n. Write short note on any two.
- Pumping lemma
 - Kleen's theorem
 - MyhillNerode theorem
 -
- o. Explain Chomsky classification in detail. Explain each classification type with an example.
- p. Define LR(1) parsing method with an example.
- q. What is the basic difference between 2-way FA and TM?
- r. What are the applications of pumping lemma?
- s. Write a regexp for the language that accepts all strings in which 'a' appears tripled over the set $\Sigma = \{a\}$
- t. What are the applications of Regular expressions and Finite automata
- u. Construct a r.e for the language over the set $\Sigma = \{a,b\}$ in which total number of a's are divisible by 3.
- v. What do you mean by ambiguous grammar
- w. What is the use of regular expression in compiler design?
- x. Identify the type of grammar according to Chomsky's classification $S \rightarrow 0SBA \mid 01A \mid AB \rightarrow BA \mid B \rightarrow 10 \mid OA \rightarrow 00$
- y. Define the extended transition function with example.
- z. Can we design a DFA for following language? Justify your answer?
 $L = \{wcwR \mid w \in \{a,b\}^*\}$

III Long Answer Type Questions / Practical Questions:

1 Prove the following by principle of induction

(a) $1 + 4 + 7 + \dots + (3n - 2) = \frac{n(3n - 1)}{2}$

- (b) The Fibonacci numbers are defined in the following way:
 $F(0) = F(1) = 1, F(n+1) = F(n) + F(n-1)$

Prove by induction that

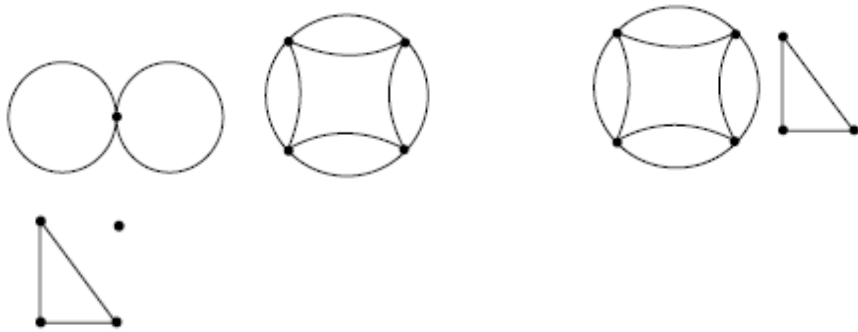
$$F(2n+1) = \sum_{i=0}^n F(2i) \quad n-1$$

$$F(2n+2) = \sum_{i=0}^n F(2i+1) + 1$$

(c) $\sum_{i=0}^n i^3 = \left(\sum_{i=0}^n i\right)^2$

(d) $\sum_{i=0}^n i2 = \frac{n(n+1)(2n+1)}{6}$

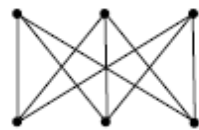
2 Consider the following collection of graphs:



(a) (b) (c) (d)



(e) (f) (g) (h)



- (a) Which graphs are simple?
 (b) Suppose that for any graph, we decide to add a loop to one of the vertices.
 (c) Does this affect whether or not the graph is Eulerian?
 (d) Which graphs are connected?
 (e) Which graphs is Eulerian? Trace out an Eulerian circuit or explain why

- (f) An Eulerian circuit is not possible.
- (g) Are there any graphs above that are not Eulerian, but have an Eulerian trail?
- (h) Give necessary conditions for a graph to be Eulerian.
- (i) Give necessary conditions for a graph to have an Eulerian trail

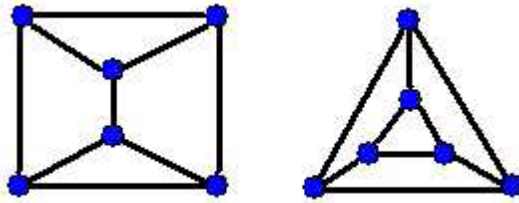
3 A graph G is Eulerian if and only if it has at most one nontrivial component and its vertices all have even degree.

4 Explain Königsberg Bridge problem?

5 Let G be a directed graph (or multigraph) with V vertices and N edges. Then

$$N = \sum_{v \in V} \text{indeg}(v) = \sum_{v \in V} \text{outdeg}(v)$$

6 Are these two graphs isomorphic?

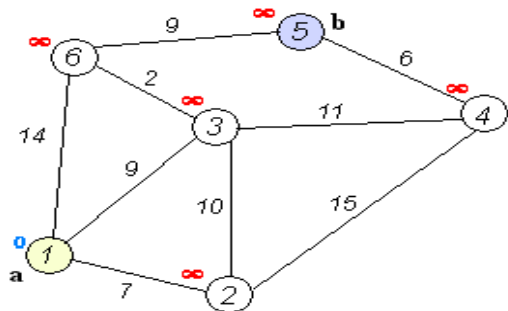


7 For any connected planar graph $G = (V, E)$, the following formula holds $V - F - E = 2$

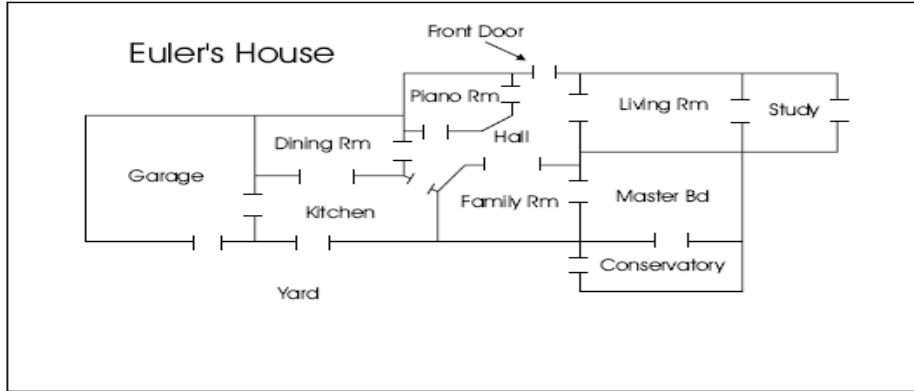
Where F stands for the number of faces or regions .

8 Show that the component of a graph partition its vertex set. (In other words, show that every vertex belongs to exactly one component.)

9 Find minimum spanning tree of the following graph using Dijkstra's algorithm



10 Euler's House. Baby Euler has just learned to walk. He is curious to know if he can walk through every doorway in his house exactly once, and return to the room he started in. Will baby Euler succeed? Can baby Euler walk through every door exactly once and return to a different place than where he started? What if the front door is closed?



- 11 Give the state diagrams of DFAs recognizing the following languages:
- (a) $\{w \mid w \text{ begins with an } a \text{ and ends with a } b\}$ (over the alphabet $\Sigma = \{a,b\}$)
 - (b) $\{\text{please, play, grr, epsilon}\}$ (over the alphabet $\Sigma = \{a,b,\dots,z\}$). Here epsilon denotes the empty word.
- 12 Give the formal description of the DFA constructed in problem (11a.) above.
- 13 Give the state diagram of the DFA described by:
 $M = (\{q_1, q_2, q_3\}, \{0,1\}, \delta, q_2, \{q_3\})$, where delta is given by the following table:

	0	1
q1	q1	q1
q2	q1	q3
q3	q2	q3

What language is recognized by the DFA M above?

- 14 Build a state diagram of a DFA recognizing the language of all base-10 numbers that are divisible by 3 (use the alphabet $\{0, 1, \dots, 9\}$).
- 15 Build a state diagram of a DFA recognizing the language of all binary numbers that are divisible by 3 (use the alphabet $\{0,1\}$).
- 16 Show that the class of regular languages is closed under the intersection operation. In your solution, use only material that we learned before introducing non-determinism (in particular, do not use the equivalence of NFAs and DFAs).
- 17 Give the state diagrams of NFAs for the star of the following languages (i.e., NFAs recognizing L_1^* and for L_2^*).
- $L_1 = \{w \mid w \text{ contains at least two } 0\text{s and at most one } 1\}$.
- $L_2 = \text{the empty set.}$
- 18 Let Σ be a finite alphabet, and U, V be subsets of Σ^* (in other words, U and V are languages over Σ). Prove or disprove the following statements (a yes/no answer is not enough, you have to prove your answer).
- (a) If V is a subset of U then V^* is a subset of U^* .
 - (b) If U is a subset of $(V \circ U)$ then ϵ (the empty word) is in V .

- (c) $V^* = (V^*)^*$
- 19 Consider the context free-grammar over the alphabet $\{x, y, (,)\}$ with non terminals $\langle S \rangle$ and $\langle A \rangle$, start symbol $\langle S \rangle$ and productions $\langle S \rangle \rightarrow \langle A \rangle \langle A \rangle$, $\langle A \rangle \rightarrow (\langle S \rangle)$, $\langle A \rangle \rightarrow x$, $\langle A \rangle \rightarrow ! y$. Show that the string $(x(yx))y$ belongs to the language over the alphabet $\{x, y, (,)\}$ generated by this grammar. Does the string $(x(xy$ belong to this language? [Briefly justify your answer.]
- 20
- (a) Devise a regular grammar to generate the language over the alphabet $\{x, y, z\}$ consisting of all strings $xyz, xyzxyz, xyzxyzxyz, xyzxyzxyzxyz, \dots$ that are the concatenation of n copies of the string xyz for some positive integer n .
- (b) Devise a finite state acceptor that accepts (i.e., determines) the language described in (a). You should specify the states of the machine, the start state, the finishing state(s), and the transition table that defines the machine
- 21
- (a) Describe the formal language over the alphabet $\{0, 1\}$ generated by the context-free grammar whose only non-terminal is $\langle S \rangle$ whose start symbol is $\langle S \rangle$ and whose productions are the following:
 $\langle S \rangle \rightarrow 0$
 $\langle S \rangle \rightarrow 0 \langle S \rangle$
 $\langle S \rangle \rightarrow \langle S \rangle 1$
 Is this context-free grammar a regular grammar?
- (b) Devise a regular grammar to generate the language over the alphabet $\{a; b; c\}$ consisting of all finite strings, such as $ab, aabbb, aaaaab, abc, aabbbc$, that consist of one or more occurrences of the character a , followed by one or more occurrences of the character b , optionally followed by a single occurrence of the character c .
- (c) Give the definition of a finite state acceptor that accepts (or determines) the language described in (b). You should specify the states of the machine, the start state, the finishing state or states, and the transition table that defines the machine

Construct DFA for the following languages:

- 22 Set of all strings not having 'abc' as substring over $(a,b,c)^*$
- 23 $L = L_1 \cap L_2$ where
 $L_1 =$ All strings over $\{0,1\}^*$ not having consecutive 0's and 1's.
 $L_2 =$ All strings starting with 0 & having substring '110' in it.
- 24 $L = L_1 \cap L_2$ where
 $L_1 = \{a^n b^{2n+1} / n \geq 0\}$
 $L_2 =$ All strings containing atmost two a's over $\{a,b\}$

25 If L is accepted by an NFA with ϵ -transition then show that L is accepted by an NFA without ϵ -transition.

26 Construct a DFA equivalent to the NFA. (8)

$M = (\{p, q, r\}, \{0, 1\}, \delta, p, \{q, s\})$

Where δ is defined in the following table.

δ	0	1
p	{q,s}	{q}
q	{r}	{q,r}
r	{s}	{p}
s	-	{p}

27 Construct a DFA equivalent to the NFA given below:

	0	1
p	{p,q}	P
q	r	R
r	s	-
s	s	S

28 Let L be a set accepted by a NFA then show that there exists a DFA that accepts L.

29 Define NFA with ϵ -transition. Prove that if L is accepted by an NFA with ϵ -transition then L is also accepted by a NFA without ϵ -transition.

30 Construct a NFA accepting all string in $\{a,b\}^+$ with either two consecutive a's or two consecutive b's.

31 Give the DFA accepting the following language:

Set of all strings beginning with a 1 that when interpreted as a binary integer is a multiple of 5.

32 Let L be a set accepted by an NFA. Then prove that there exists a deterministic finite automaton that accepts L. Is the converse true? Justify your answer.

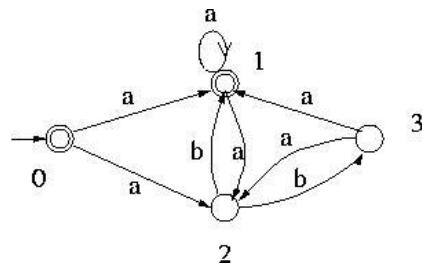
33 Prove that a language L is accepted by some ϵ -NFA if and only if L is accepted by some DFA.

34 Convert the following NFA to its equivalent DFA.]

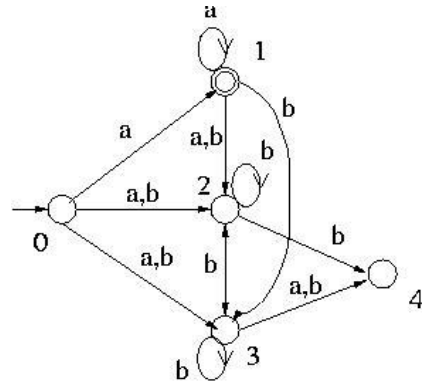
	0	1
p	{p,q}	{p}
q	{r}	{r}
r	{s}	ϕ
*s	{s}	{s}

Convert the following NFA to DFA.

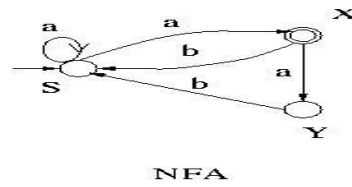
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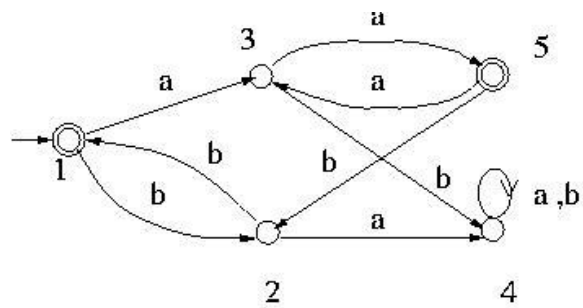
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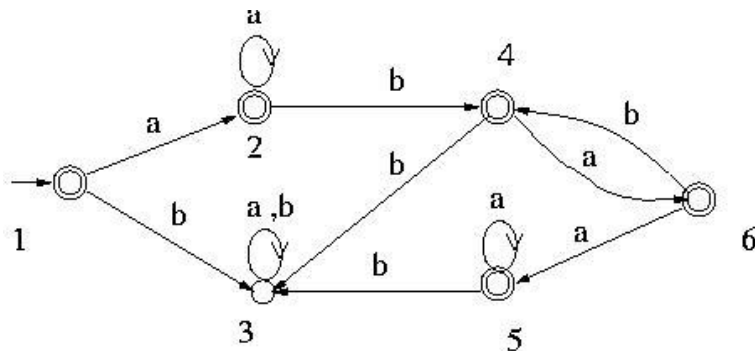


38 Minimize the number of states of the following DFA.



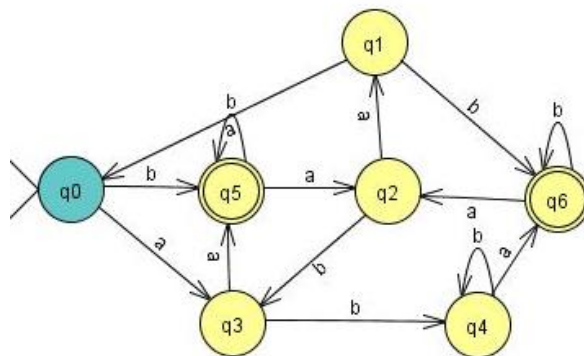
DFA Example 1

39 Minimize the number of states of the following DFA.



DFA Example 2

- 40 State and prove pumping lemma for regular languages.
- 41 Show that the set $L = \{a^p \mid p \text{ is prime}\}$ is not a regular.
- 42 Design a DFA to accept the following language:
 $L = \{w \mid w \in \{0, 1\}^* \text{ and } w \text{ when interpreted as a number is not divisible by } 3.\}$
- 43 Prove that, if L is accepted by an NFA with null transitions, then L is accepted by an NFA without null transitions.
- 44 Draw a Mearly machine that output 1 when string over alphabets $\Sigma = \{a, b\}$ contains even number of a's and the machine outputs 0 otherwise.
- 45 Draw a DFA for language defined on set of symbols $\{1, 2, 3\}$ such that the DFA accepts any string that begins with 1 / 3 and terminates with 2.
- 46 Minimize the following DFA.



- 47 Describe Chomsky's classification of grammar
- 48 What do you mean by ambiguous grammar
- 49 What is the use of regular expression in compiler design?
- 50 Show that CFG G with following productions $S \rightarrow a|Sa|bSS|SSb|SbS$ is an ambiguous grammar. Can you convert it to an unambiguous grammar?
- 51 Convert the given grammar into GNF:
 $S \rightarrow AA \mid a$

- A \rightarrow SS | b
- 52 Prove that if L is a regular set then L is generated by some left linear grammar and right linear grammar.

UNIT - II

I Test Your Skills:

(a) State Whether the Following Statements are True or False:

- 1 Every regular grammar is context free.
- 2 Every CFG can be transformed into equivalent CNF.
- 3 If L in N(M) for name PDA M, then L is a CFL.
- 4 NFA to DFA is not possible algorithmically.
- 5 PDA machine represents Type 2.
- 6 $\{S \rightarrow aSb, S \rightarrow ab\}$ generates a CFL that is not regular.
- 7 A PDA is a finite automaton with a pushdown stack.
- 8 A language is context-free if and only if it is accepted by a PDA.
- 9 $\{S \rightarrow aS, S \rightarrow bS, aSb \rightarrow bX, X \rightarrow a, S \rightarrow b\}$ is context-free.
- 10 Any number of non-terminals can appear on the right side of a production of a CFG.

Ans. (1)(T), (2)(T), (3)(T), (4)(F), (5)(T) (6)(T), (7)(T), (8)(T), (9)(F), (10)(T)

(b) Multiple Choice Questions:

- 1 The final notation for grammar is _____
 - (a) (V_N, P, S)
 - (b) (V_N, Σ, P, S)
 - (c) (V_N, Σ^*, P, S)
 - (d) None
- 2 Type-1 Grammar is known as _____
 - (a) CFG
 - (b) CSG
 - (c) REGULAR
 - (d) All
- 3 If G is " $S \rightarrow a S/a$ ", then $L(G) = ?$
 - (a) a^*
 - (b) \wedge
 - (c) $\{a\}^+$
 - (d) Both (a) & (c)
- 4 " $S \rightarrow a S$ ", what is the type of this production?
 - (a) Type 0
 - (b) Type 1
 - (c) Type 2

- (d) Type 3
- 5 $A \rightarrow abA$ a type _____ productions
- Type 0
 - Type 1
 - Type 2
 - Type 3
- 6 Consider the following language
 $L = \{a^n b^n c^n d^n | n \geq 1\}$
 L is
- CFL but not regular
 - CSL but not CFL
 - Regular
 - Type 0 language but not type 1
- 7 Consider the following language
 $L = \{a^n b^n | n \geq 1\}$
 L is
- CFL but not regular
 - CSL but not CFL
 - Regular
 - Type 0 language but not type 1
- 8 Consider the following language
 $L = \{a^n b^m c^p d^q | n, m, p, q \geq 1\}$
 L is
- CFL but not regular
 - CSL but not CFL
 - Regular
 - Type 0 language but not type 1
- 9 The following CFG is in
- $S \rightarrow AB$
 $B \rightarrow CD$
 $B \rightarrow AD$
 $B \rightarrow b$
 $D \rightarrow AD$
 $D \rightarrow d$
 $A \rightarrow a$
 $C \rightarrow a$
- Chomsky normal form but not strong Chomsky normal form
 - Weak Chomsky normal form but not Chomsky normal form
 - Strong Chomsky normal form
 - Greibach normal form

- 10 The language accepted by a Push down Automata:
- Type0
 - Type1
 - Type2
 - Type3
- 11 Let $L1 = \{0^n + m1^n 0^m \mid n, m \geq 0\}$, $L2 = \{0^n + m1^n + m0^m \mid n, m \geq 0\}$, and $L3 = \{0^n + m1^n + m0^n + m \mid n, m \geq 0\}$. Which of these languages are NOT context free?
- L1 only
 - L3 only
 - L1 and L2
 - L2 and L3
- 12 Which of the following problems is undecidable?
- Membership problem for CFGs
 - Ambiguity problem for CFGs
 - Finiteness problem for Finite state automata FSAs
 - Equivalence problem for FSAs
- 13 Which one of the following statement is FALSE?
- context-free languages are closed under union
 - context-free languages are closed under concatenation
 - context-free languages are closed under intersection
 - context-free languages are closed under Kleene closure
- 14 Which of the following statement is wrong?
- Any regular language can be generated by a context-free grammar
 - Some non-regular languages cannot be generated by any CFG
 - the intersection of a CFL and regular set is a CFL
 - All non-regular languages can be generated by CFGs.
- 15 Which of the following strings is not generated by the following grammar? $S \rightarrow SaSbS \mid \epsilon$
- aabb
 - abab
 - aababb
 - aaabb
- 16 Which of the following regular expression identity is true?
- $r^* = r^*$
 - $(r^*s^*)^* = (r + s)^*$
 - $(r + s)^* = r^* + s^*$
 - $r^*s^* = r^* + s^*$

- 17 Consider the following right-linear grammar $G = (N, T, P, S)$ $N = \{S\}$
 $P : S \rightarrow aS|aA$ $T = \{a, b\}$
 $A \rightarrow bA|b$

Which of the following regular expression denotes $L(G)$?

- (a) $(a + b)^*$
 - (b) $a(ab)^*b$
 - (c) aa^*bb^*
 - (d) a^*b^*
- 18 A language L is accepted by a FSA iff it is
- (a) CFL
 - (b) CSL
 - (c) Recursive
 - (d) Regular
- 19 Consider the following CFG
- $S \rightarrow aB$ $S \rightarrow bA$
 $B \rightarrow b$ $A \rightarrow a$
 $B \rightarrow bS$ $A \rightarrow aS$
 $B \rightarrow aBB$ $A \rightarrow bAA$

Consider the following derivation

$S \Rightarrow aB$
 $\Rightarrow aaBB$
 $\Rightarrow aaBb$
 $\Rightarrow aabSb$
 $\Rightarrow aabbAb$
 $\Rightarrow aabbab$

This derivation is

- (a) A leftmost derivation
 - (b) A rightmost derivation
 - (c) Both leftmost and rightmost derivation
 - (d) Neither leftmost nor rightmost derivation
- 20 Consider the following language
 $L = \{anbncndn | n \geq 1\}$
 L is
- (a) CFL but not regular
 - (b) CSL but not CFL
 - (c) Regular
 - (d) Type 0 language but not type 1

- 21 A language is represented by a regular expression $(a)^*(a + ba)$. Which of the following strings does not belong to the regular set represented by the above expression?
- (a) aaa
 - (b) aba
 - (c) ababad. aa
 - (d) aaaaaaba
- 22 Which of the following denotes Chomskian hierarchy?
- (a) $REG \subset CFL \subset CSL \subset type0$
 - (b) $CFL \subset REG \subset type0 \subset CSL$
 - (c) $CSL \subset type0 \subset REG \subset CFL$
 - (d) $CSL \subset CFL \subset REG \subset type0$
- 23 The concept of FSA is much used in this part of the compiler
- (a) Lexical analysis
 - (b) Parser
 - (c) Code generation
 - (d) Code optimization
- 24 Consider the following language:
 $L = \{a^n b^n c^n d^n | n \geq 1\}$
 L is
- (a) CFL but not regular
 - (b) CSL but not CFL
 - (c) Regular
 - (d) Type 0 language but not type 1
- 25 The following grammar
 $G = (N, T, P, S)$
 $N = \{S, A, B, C, D, E\}$
 $T = \{a, b, c\}$
 $P : S \rightarrow aAB$
 $AB \rightarrow CD$
 $CD \rightarrow CE$
 $C \rightarrow aC$
 $C \rightarrow b$
 $bE \rightarrow bc$ is
- (a) is type 3
 - (b) is type 2 but not type 3
 - (c) is type 1 but not type 2
 - (d) is type 0 but not type 1
- 26 The following CFG is in
- $S \rightarrow aBB$
 - $B \rightarrow bAA$
 - $A \rightarrow a$

- $B \rightarrow b$
- (a) Chomsky normal form but not strong Chomsky normal form
 (b) Weak Chomsky normal form but not Chomsky normal form
 (c) Strong Chomsky normal form
 (d) Greibach normal form
- 27 Which of the following statements is wrong?
 (a) The regular sets are closed under intersection
 (b) The class of regular sets is closed under substitution
 (c) The class of regular sets is closed under homomorphism
 (d) Context Sensitive Grammar(CSG) can be recognized by Finite State Machine
- 28 Context free grammar is not closed under
 (a) Product operation
 (b) Union
 (c) Complementation
 (d) kleene star
- 29 Let the class of language accepted by finite state machine be L_1 and the class of languages represented by regular expressions be L_2 then
 (a) L_1
 (b) $L_1 \supseteq L_2$
 (c) $L_1 \cup L_2 = \cdot^*$
 (d) $L_1 = L_2$
- 30 Which of the following statement is wrong?
 (a) Any regular language has an equivalent context-free grammar.
 (b) Some non-regular languages can't be generated by any context-free grammar
 (c) Intersection of context free language and a regular language is always context-free
 (d) All languages can be generated by context- free grammar
- 31 $S \rightarrow aSa \mid bSb \mid a \mid b$;The language generated by the above grammar over the alphabet $\{a,b\}$ is the set of
 (a) All palindromes
 (b) All odd length palindromes
 (c) Strings that begin and end with the same symbol
 (d) All even length palindromes

- 32 Consider the languages $L1=\{0^i1^j \mid i \neq j\}$, $L2=\{0^i1^j \mid i = j\}$, $L3 = \{0^i1^j \mid i = 2j+1\}$, $L4 = \{0^i1^j \mid i \neq 2j\}$. Which one of the following statements is true?
- Only L2 is context free
 - Only L2 and L3 are context free
 - Only L1 and L2 are context free
 - All are context free

- 33 Consider the language L1,L2,L3 as given below.

$$L1=\{0^p1^q \mid p,q \in \mathbb{N}\}$$

$$L2=\{0^p1^q \mid p,q \in \mathbb{N} \text{ and } p=q\}$$

$$L3=\{0^p1^q \mid p,q,r \in \mathbb{N} \text{ and } p=q=r\}$$

Which of the following statements is NOT TRUE?

- Push Down Automata (PDA) can be used to recognize L1 and L2
 - L1 is a regular language
 - All the three languages are context free
 - Turing machine can be used to recognize all the three languages
- 34 Let $L = L1 \cap L2$, where L1 and L2 are languages as defined below:
- $$L1 = \{ambmcanbn \mid m, n \geq 0\}$$
- $$L2 = \{aibjck \mid i, j, k \geq 0\}$$
- Then L is
- Not recursive
 - Regular
 - Context free but not regular
 - Recursively enumerable but not context free.

- 35 Grammar that produce more than one Parse tree for same sentence is:

- Ambiguous
- Unambiguous
- Complementation
- Concatenation

- 36 The language accepted by a Push down Automata:

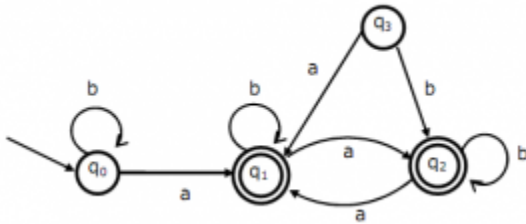
- Type 0
- Type 1
- Type 2
- Type 3

- 37 Which of the following languages over $\{a, b, c\}$ is accepted by a deterministic PDA?

- $\{wbwR \mid w \in \{a, c\}^*\}$
- $\{wwR \mid w \in \{a, b, c\}^*\}$

- (c) $\{a^n b^n c^n | n \geq 1\}$
 (d) $\{w | w \text{ is a palindrome over } \{a, b, c\}\}$
38. The PDA is called non-deterministic PDA when there are more than one outgoing edges from..... state:
 (a) START or READ
 (b) POP or REJECT
 (c) READ or POP
 (d) PUSH or POP
39. Let L be a language defined over an alphabet Σ , then the language of strings, defined over Σ , not belonging to L denoted by \bar{L} or L^c is called :
 (a) Non regular language of L
 (b) Complement of the language L
 (c) None of the given
 (d) All of above
40. All NonNull words of the CFL can be generated by the corresponding CFG which is in CNF i.e the grammar in CNF will generate the same language except the:
 (a) String
 (b) Regular language
 (c) Null string
 (d) None of the above
41. Let $L = \{w \in \{0, 1\}^* | w \text{ has even number of 1s}\}$, i.e. L is the set of all bit strings with even number of 1s. Which one of the regular expression below represents L?
 (a) $(0^*10^*1)^*$
 (b) $0^*(10^*10^*)^*$
 (c) $0^*(10^*1^*)^*0^*$
 (d) $0^*1(10^*1)^*10^*$
42. Consider the language L_1, L_2, L_3 as given below. $L_1 = \{0^p 1^q | p, q \in \mathbb{N}\}$ $L_2 = \{0^p 1^q | p, q \in \mathbb{N} \text{ and } p=q\}$ $L_3 = \{0^p 1^q 1^r | p, q, r \in \mathbb{N} \text{ and } p=q=r\}$. Which of the following statements is NOT TRUE?
 (a) Push Down Automata (PDA) can be used to recognize L_1 and L_2
 (b) L_1 is a regular language
 (c) All the three languages are context free
 (d) Turing machine can be used to recognize all the three languages

43. Consider the following Finite State Automaton



The language accepted by this automaton is given by the regular expression

- (a) $b^*ab^*ab^*ab$
 - (b) $(a+b)^*$
 - (c) $b^*a(a+b)^*$
 - (d) b^*ab^*ab
44. Let L_1 be a recursive language. Let L_2 and L_3 be languages that are recursively enumerable but not recursive. Which of the following statements is not necessarily true?
- (a) $L_2 - L_1$ is recursively enumerable
 - (b) $L_1 - L_3$ is recursively enumerable
 - (c) L_2 intersection L_1 is recursively enumerable
 - (d) L_2 union L_1 is recursively enumerable
45. Let L denotes the language generated by the grammar $S \rightarrow OSO/00$. Which of the following is true?
- (a) $L = O$
 - (b) L is regular but not O
 - (c) L is context free but not regular
 - (d) L is not context free
46. Let S and T be language over $\{a,b\}$ represented by the regular expressions $(a+b^*)^*$ and $(a+b)^*$, respectively. Which of the following is true?
- (a) $S \subset T$ (S is a subset of T)
 - (b) $T \subset S$ (T is a subset of S)
 - (c) $S = T$
 - (d) $S \cap T = \emptyset$
47. Which of the following pairs have DIFFERENT expressive power?
- (a) Deterministic finite automata (DFA) and Non-Deterministic finite automata(NFA)
 - (b) Deterministic push down automata (DPDA) and Non-deterministic pushdown automata
 - (c) Deterministic single-tape Turing machine and Non-deterministic single-tape Turing Machine

(d) Single-tape Turing machine and multi-tape Turing machine

48. Match all items in Group 1 with correct options from those given in Group 2.

List I

P. Regular Expression

Q. Push down automata

R. Dataflow analysis

S. Register allocation

List II

1. Syntax analysis

2. Code Generation

3. Lexical analysis

4. Code optimization

(a) P-4, Q-1, R-2, S-3

(b) P-3, Q-1, R-4, S-2

(c) P-3, Q-4, R-1, S-2

(d) P-2, Q-1, R-4, S-3

49. Which of the following languages is regular?

(a) $\{WW^R \mid W \in \{0,1\}^+\}$

(b) $\{WW^R X \mid X W \in \{0,1\}^+\}$

(c) $\{WW^R \mid X W \in \{0,1\}^+\}$

(d) $\{XWW^R \mid X W \in \{0,1\}^+\}$

50. A minimum state deterministic finite automation accepting the language $L = \{W \mid W \in \{0,1\}^*, \text{ number of 0's and 1's in } W \text{ are divisible by 3 and 5 respectively}\}$ has

(a) 15 states

(b) 11 states

(c) 10 states

(d) 9 states

Ans. (1)(b), (2)(b), (3)(c), (4)(d), (5)(b), (6)(b), (7)(a), (8)(c), (9)(c), (10)(c), (11)(d), (12)(b), (13)(c), (14)(d), (15)(d), (16)(b), (17)(c), (18)(d), (19)(d), (20)(b), (21)(c), (22)(a), (23)(a), (24)(b), (25)(c), (26)(d), (27)(d), (28)(c), (29)(d), (30)(d), (31)(b), (32)(d), (33)(c), (34)(c), (35)(a), (36)(c), (37)(a), (38)(c), (39)(b), (40)(c), (41)(b), (42)(c), (43)(c), (44)(b), (45)(b), (46)(c), (47)(b), (48)(b), (49)(c), (50)(a)

(c) **Fill in the Blanks:**

(a) The language generated by the following grammar $S \rightarrow OSI/OAI, A \rightarrow IAO/10$ is _____.

(b) Grammar generates strings with any number of 1's.

(c) The language $L = \{ WW^R/WE(a,b)^* \}$ is _____.

(d) The given CFG $S \rightarrow as/bs/a/b$ is equivalent to _____.

(e) The language $L = \{a^n b^n / n = 1, 2, \dots\}$ can be generated by the CFG is _____.

Ans. (1) $(0^{n1mA} 1^m O^n/n, m \geq 1)$, (2) $(S \rightarrow 1S, S \rightarrow \wedge)$, (3)(Context Free), (4) $([(a + b)^*$
or $(a + b)])$, (5) $(S \rightarrow ab/aSb)$

II Short Answer Type Questions:

- 52 Define context free grammar.
- 53 What is the difference between derivations and productions? (Hint-are they different?)
- 54 “Some grammars are ambiguous in nature.” Explain the statement.
- 55 How can ambiguity be removed? Explain using an example.
- 56 Explain inherent ambiguity.
- 57 Give the steps used to simplify CFG.
- 58 If $G_1 = (V_N, \Sigma, P, S)$ is a CFG then we can define a CFG G_1 having no null productions such that $L(G_1) = L(G) - \{\wedge\}$. Prove that.
- 59 If G is a CFG, we can find a CFG G_1 which has no null productions or unit productions such that $L(G_1) = L(G)$. Prove this theorem.
- 60 Define and explain CNF.
- 61 Define and explain GNF.
- 62 Find $L(G)$ where $G = (\{S\}, \{0,1\}, \{S \rightarrow 0S1, S \rightarrow \varepsilon\}, S)$.
- 63 Define derivation tree for a CFG (or) Define parse tree.
- 64 Construct the CFG for generating the language $L = \{a^n b^n / n \geq 1\}$.
- 65 Let G be the grammar $S \rightarrow aB/bA, A \rightarrow a/aS/bAA, B \rightarrow b/bS/aBB$. for the string $aaabbabbba$ find the left most derivation.
- 66 Let G be the grammar $S \rightarrow aB/bA, A \rightarrow a/aS/bAA, B \rightarrow b/bS/aBB$. obtain parse tree for the string $aaabbabbba$.
- 67 For the grammar $S \rightarrow aCa, C \rightarrow aCa/b$. Find $L(G)$.
- 68 Show that $id+id*id$ can be generated by two distinct leftmost derivation in the grammar $E \rightarrow E+E \mid E^*E \mid (E) \mid id$.
- 69 For the grammar $S \rightarrow A1B, A \rightarrow 0A \mid \varepsilon, B \rightarrow 0B \mid 1B \mid \varepsilon$, give leftmost and rightmost derivations for the string 00101 .
- 70 Find the language generated by the CFG $G = (\{S\}, \{0,1\}, \{S \rightarrow 0/1/ \varepsilon, S \rightarrow 0S0/1S1\}, S)$.
- 71 Obtain the derivation tree for the grammar $G = (\{S,A\}, \{a,b\}, P, S)$ where P consist of $S \rightarrow aAS / a, A \rightarrow SbA / SS / ba$.
- 72 Show that $id+id*id$ can be generated by two distinct leftmost derivation in the grammar $E \rightarrow E+E \mid E^*E \mid (E) \mid id$.
- 73 Convert the grammar $S \rightarrow aSb \mid ab$ into Chomsky normal form.
- 74 Show that CFG G with following productions $S \rightarrow a|Sa|bSS|SSb|SbS$ is an ambiguous grammar. Can you convert it to an unambiguous grammar?
- 75 Convert the given grammar into GNF:
 $S \rightarrow AA \mid a$
 $A \rightarrow SS \mid b$
- 25 Prove that if L is a regular set then L is generated by some left linear grammar and right linear grammar.
- 26 Give an example of a CFL that is not regular.
- 27 Show that the CF languages are closed under union, concatenation and kleen closure.

- 28 Show that CFG G with following productions $S \rightarrow a|Sa|bSS|SSb|SbS$ is an ambiguous grammar. Can you convert it to an unambiguous grammar?
- 29 Convert the given grammar into GNF:
 $S \rightarrow AA | a$
 $A \rightarrow SS | b$
- 30 Prove that if L is a regular set then L is generated by some left linear grammar and right linear grammar.

III Long Answer Type Questions:

- 1 State and prove Pumping Lemma for CFL.
- 2 Give the applications of CFG in detail. Give limitations.
- 3 Define PDA. How is it different from NDPA? Explain using examples.
- 4 Prove the following theorem:
 If L is a CFL, then we can construct a PDA. A accepting L by stack i.e. $L = NCA$.
- 5 Prove the following theorem:
 "If $A = \{\theta, \Sigma, \lceil, \Sigma, q_0, z_0, \rceil\}$ is a PDA then there exists a CFG G such that $LCG = NCA$).
- 6 Write short notes on
 (a) DCFL
 (b) DPDA
- 7 Prove the CFL is closed under Union Concatenation and * (Star).
- 8 Is CFL closed under intersection and complementation, and reversal?
- 9 State and prove Ardens Theorem.
- 10 Explain linear grammar, Sequential Language, and Bounded Language.
 (a) Show that the language $L = \{0^{3x}1^{2y} / x > y > 0\}$ is not regular using pumping lemma.
 (b) Find CFG with no useless symbols equivalent to : $S \rightarrow AB | CA, B \rightarrow BC | AB, A \rightarrow a, C \rightarrow aB | b$.
- 13 Explain in detail about equivalence of pushdown automata and CFG.
- 14 Construct a PDA for the language $L = \{ww^R | w \text{ in } (a+b)^*\}$.
- 15 Construct the following grammar in CNF
 16 $A \rightarrow BCD | b$
 17 $B \rightarrow YC | d$
 18 $C \rightarrow gA | c$
 19 $D \rightarrow dB | a$
 20 $Y \rightarrow f$

IV Practical Questions:

- 1 Find the CFG for each of the language
 (a) $L = \{a^i b^j, ck | i = j + k\}$
 (b) $L = \{a^i b^j | i \leq 2j\}$
- 2 What language is generated by the following CFG

- $G = (\{s\}, \{a, b\}, \{S \rightarrow ss|asb|as|sb|^{\wedge}\}, S)$
- 3 Convert the following CFG into CNF
- (c) $S \rightarrow asa|ssa|a$
- (d) $S \rightarrow axx$
 $X \rightarrow as|bs|a$
- (a) $S \rightarrow bA|aB$
 $A \rightarrow bA|aB$
 $B \rightarrow aBB|bs|b$
- (b) $E \rightarrow E + E$
 $E \rightarrow C * E$
 $E \rightarrow (E)$
 $E \rightarrow 2$
- 4 Show that $L = \{aib^j | j = i^2\}$ is not CFL.
- 5 Convert the following CFG to GNF
- (c) $S \rightarrow asb|ab$
- (d) $S \rightarrow ab|as|aas$
- (e) $S \rightarrow ABI|0, A \rightarrow 00A|B, B \rightarrow 1AI$
- (f) $S \rightarrow 01|OS|OOS$
- 6 Find the equivalent CFG with no useless symbols
- (a) $S \rightarrow ABC|BaB, B \rightarrow bBb|a$
 $A \rightarrow aA|BaC|aaa, C \rightarrow CA|AC$
- (b) $S \rightarrow AB|AC, A \rightarrow aAb|bAa|a$
- 7 Test for ambiguity
- (a) $S \rightarrow a|sa|bss|ssb|sbs$
- (b) $S \rightarrow aA|^{\wedge}, B \rightarrow ab|bB|^{\wedge}$
- 8 Find the PDA to accept each of the following subsets of $\{a, b\}^*$
- (a) Language of even-length palindromes.
- (b) Language of odd-length palindromes.
- 9 Find the PDA for each of the following:
- (a) $\{WE(a,b)^* | n_a(W) = n_b(W)\}$
- (b) $\{a^n b^{n+m+1} | n, m \geq 0\}$
- 10 Find a PDA for the following languages-
 $L = \{ab^*cd^* | n \geq 0\}$
 Is it accepted by final state or by empty stack? Is it possible to construct a PDA of both types for such a language?
- 11 Let G be a CFG and let $a \Rightarrow w$ in G . Then show that there is a leftmost derivation of w .
- 12 Let $G=(V,T,P,S)$ be a Context free Grammar then prove that if $S \Rightarrow \alpha$ then there is a derivation tree in G with yield α .
- 13 Let G be a grammar $s \rightarrow OB|1A, A \rightarrow O|OS|1AA, B \rightarrow 1|1S|OBB$. For the string 00110101 find its leftmost derivation and derivation tree.
- 14 If G is the grammar $S \rightarrow Sbs|a$, Show that G is ambiguous.
- 15 Give a detailed description of ambiguity in Context free grammar.
- 16 Show that $E \rightarrow E+E|E * E / (E) | id$ is ambiguous.

- 17 If L is Context free language then prove that there exists PDA M such that $L=N(M)$.
- 18 Explain different types of acceptance of a PDA. Are they equivalent in sense of language acceptance? Justify your answer.
- 19 Prove that L is $L(M_2)$ for some PDA M_2 if and only if L is $N(M_1)$ for some PDA M_1 .
- 20 Define deterministic Push down Automata DPDA. Is it true that DPDA and PDA are equivalent in the sense of language acceptance is concern? Justify your answer.
- 21 Define Push down automata. Differentiate PDA by empty stack and final state by giving their definitions.
- 22 Obtain PDA to accept all strings generated by the language $\{a^n b^m a^n / m, n \geq 1\}$.
- 23 Convert the following NFA to a DFA.

	0	1
$\rightarrow p$	$\{p, q\}$	$\{p\}$
q	$\{r\}$	$\{r\}$
r	$\{s\}$	ϕ
* s	$\{s\}$	$\{s\}$

- 22 Convert the following Mealy machine into Moore Machine.

Present State	Next State			
	Input a=0		Input a=1	
	State	Input	State	Input
$\rightarrow q_1$	q3	0	q2	0
q2	q1	1	q4	0
q3	q2	1	q1	1
q4	q4	1	q3	0

UNIT - III

I Test Your Skills:

(a) State Whether the Following Statements are True or False:

- 1 The union, intersection, and concatenation of two context-sensitive languages is context-sensitive.

- 2 L-systems were introduced and developed in 1968 by the Hungarian theoretical biologist and botanist from the University of Utrecht, Aristid Lindenmayer (1925–1989).
- 3 The complement of a context-sensitive language is not context-sensitive.
- 4 The concept of context-sensitive grammar was introduced by Noam Chomsky.
- 5 L-systems can not be used to generate self-similar fractals such as iterated function systems.
- 6 A recursive function is one which calls itself.
- 7 The recursive nature of the L-system rules leads to self-similarity and thereby fractal-like forms which are easy to describe with an L-system.

Ans. (1)(T), (2)(T), (3)(F), (4)(T), (5)(F), (6)(T), (7)(T)

(b) Multiple Choice Questions:

- 1 Any Language generated by an unrestricted grammar is:
 - (a) Recursive
 - (b) Recursively Enumerable
 - (c) Not Recursive
 - (d) None of the above

- 2 The Family of recursive language is not closed under which of the following operations:
 - (a) Union
 - (b) Intersection
 - (c) Complementation
 - (d) None of the above.

- 3 PCP is:
 - (a) Decidable
 - (b) Undecidable
 - (c) Sometimes Decidable
 - (d) None of the

- 4 If PCP is decidable then MPCP is
 - (a) Decidable
 - (b) Undecidable
 - (c) Can't Say
 - (d) None of the

- 5 Consider a language L for which there exists a Turing machine T^M , T, that accepts every word in L and either rejects or loops for every word that is not in L. The language L is
 - (a) NP hard
 - (b) NP complete
 - (c) Recursive

- (d) Recursively enumerable
- 6 Consider the following statements
- I. Recursive languages are closed under complementation
 - II. Recursively enumerable languages are closed under union
 - III. Recursively enumerable languages are closed under complementation
- Which of the above statement are TRUE?
- (a) I only
 - (b) I and II
 - (c) I and III
 - (d) II and III
- 7 Which of the following statement is wrong?
- (a) Any regular language can be generated by a context-free grammar
 - (b) Some non-regular languages cannot be generated by any CFG
 - (c) the intersection of a CFL and regular set is a CFL
 - (d) All non-regular languages can be generated by CFGs.
- 8 Recursively enumerable languages are not closed under
- (a) Union
 - (b) homomorphism
 - (c) complementation
 - (d) concatenation
- 9 Which of the following problem is undecidable?
- (a) Membership problem for CFL
 - (b) Membership problem for regular sets
 - (c) Membership problem for CSL
 - (d) Membership problem for type 0 languages
- 10 Recursive languages are
- (a) A proper superset of CFL
 - (b) Always recognized by PDA
 - (c) Are also called type 0 languages
 - (d) Always recognized by FSA
- 11 Consider the following problem x . Given a Turing machine M over the input alphabet Σ , any state q of M . And a word $w \in \Sigma^*$, does the computation of M on w visit the state q ? Which of the following statements about x is correct?
- (a) X is decidable
 - (b) X is undecidable but partially decidable
 - (c) X is undecidable and not even partially decidable
 - (d) X is not a decision problem
- 12 If a language is denoted by a regular expression $L = (x)^*(x|yx)$, then which of the following is not a legal string within L ?
- (a) yx

- (b) xyx
 (c) x
 (d) $xyxyx$
- 13 If L be set of strings from alphabet, then kleen closure of L is given as
- (a) $L^+ = \bigcup_{i=0} L^i$
 (b) $L_0 = \bigcup_{i=0} L^i$
 (c) $L^* = \bigcup_{i=0}^{\infty} L^i$
 (d) $L^+ = \bigcup_{i=1} L^i$
- 14 If e_1 and e_2 are the regular expressions denoting the languages L_1 and L_2 respectively, then which of the following is wrong?
- (a) $(e_1) | (e_2)$ is a regular expression denoting $L_1 \cup L_2$
 (b) $(e_1).(e_2)$ is a regular expression denoting $L_1.L_2$
 (c) ϕ is not a regular expression
 (d) $\{ex\}$ is a regular expression denoting L_1^*
- 15 Consider the following problem x . Given a Turing machine M over the input alphabet Σ , any state q of M . And a word $w \in \Sigma^*$, does the computation of M on w visit the state q ? Which of the following statements about x is correct?
- (a) x is decidable
 (b) x is undecidable but partially decidable
 (c) x is undecidable and not even partially decidable
 (d) x is not a decision problem
- 16 Let $L_1 = \{0^n + m^1 n^0 m \mid n, m \leq 0\}$, $L_2 = \{0^n + m^1 n^+ m^0 \mid n, m \leq 0\}$, and $L_3 = \{0^n + m^1 n^+ m^0 n^+ m \mid n, m \leq 0\}$. Which of these languages are NOT context free?
- (a) L_1 only
 (b) L_3 only
 (c) L_1 and L_2
 (d) L_2 and L_3
- 17 Define languages L_0 and L_1 as follows
 $L_0 = \{\langle M, w, 0 \rangle \mid M \text{ halts on } w\}$
 $L_1 = \{\langle M, w, 1 \rangle \mid M \text{ does not halt on } w\}$
 Here, $\langle M, w, t \rangle$ is a triplet, whose first component M is an encoding of a Turing Machine, second component, w is a string, and third component, t is a bit. Let $L = L_0 \cup L_1$. Which of the following is true?
- (a) L is recursively enumerable, but $(L)'$ is not
 (b) $(L)'$ is recursively enumerable, but L is not
 (c) Both L and $(L)'$ are recursive
 (d) Neither L nor $(L)'$ is recursively enumerable

- 18 Given $A = \{0,1\}$ and $L = A^*$. If $R = (0^n 1^n, n > 0)$, then language $L \cup R$ and R are respectively
- Regular, regular
 - Not regular, regular
 - Regular, not regular
 - Context free, not regular
- 19 If L_1 and L_2 are context free language and R a regular set, then which one of the languages below is not necessarily a context free language?
- $L_1 L_2$
 - $L_1 \cap L_2$
 - $L_1 \cap R$
 - $L_1 \cup L_2$
- 20 The logic of pumping lemma is a good example of
- Pigeon-hole principle
 - Divide-and-conquer technique
 - Recursion
 - Iteration
- 21 For two regular languages $L_1 = (a + b)^* a$ and $L_2 = b (a + b)^*$, the intersection of L_1 and L_2 is given by
- $(a + b)^* ab$
 - $ab (a + b)^*$
 - $a (a + b)^* b$
 - $b (a + b)^* a$
- 22 Pumping lemma is generally used for proving that
- Given grammar is regular
 - Given grammar is not regular
 - Whether two given regular expressions are equivalent or not
 - None of these
- 23 What is the highest type number which can be applied to the following grammar?
- $S \rightarrow Aa, A \rightarrow Ba, B \rightarrow abc$
- Type 0
 - Type 1
 - Type 2
 - Type 3
- 24 Following syntax-directed translation scheme is used with a shift reduction (bottom up) parser that perform the action in braces immediately after a reduction by the corresponding production
- $A \rightarrow aB$ {print "(1)" } $A \rightarrow c$ {print "1"},
 $B \rightarrow Ab$ {print "2"}.

- When parser is aaacbbb, then string printed
- (a) 0202021
 - (b) 1202020
 - (c) 1020202
 - (d) None of these
- 25 FSM can recognize
- (a) Any grammar
 - (b) Only CG
 - (c) Both (a) and (b)
 - (d) Only regular grammar
- 26 Which of the following definitions below generates the same language as L, where
 $L = \{x^n y^n \text{ such that } n \geq 1\}$?
- I. $E \rightarrow xEy \mid xy$
 - II. $xy \mid (x+xyy+)$
 - III. $.x+y+$
- (a) I only
 - (b) I and II
 - (c) II and III
 - (d) II only
- 27 Following context free grammar
 $S \rightarrow aB \mid bA$
 $A \rightarrow b \mid aS \mid bAA$
 $B \rightarrow b \mid bS \mid aBB$
 generates strings of terminals that have
- (a) Equal number of a's and b's
 - (b) Odd number of a's and odd number b's
 - (c) Even number of a's and even number of b's
 - (d) Odd number of a's and even number of a's
- 28 Define for the context free language $L \subseteq \{0;1\}$ $\text{init}(L) = \{u \mid uv \in L \text{ for some } v \text{ in } \{0, 1\}^*\}$. If $L = \{w \mid w \text{ is nonempty and has an equal number of 0's and 1's}\}$, then $\text{init}(L)$ is set of all binary strings
- (a) With unequal numbers of 0's and 1's.
 - (b) Including the null string.
 - (c) Both (a) and (b)
 - (d) None of these
- 29 Basic limitation of FSM is that it
- (a) Cannot remember arbitrary large amount of information

- (b) Sometimes fails to recognize grammars that are regular
 - (c) Sometimes recognizes grammars are not regular
 - (d) None of these
- 30 The CFG $s \rightarrow as \mid bs \mid a \mid b$ is equivalent to regular expression
- (a) $(a + b)$
 - (b) $(a + b)(a + b)^*$
 - (c) $(a + b)(a + b)$
 - (d) None of these
31. Which of the following are decidable?
- 1) Whether the intersection of two regular language is infinite.
 - 2) Whether a given context free language is regular.
 - 3) Whether two push down automata accept the same language.
 - 4) Whether a given grammar is context free.
- (a) 1 and 2
 - (b) 1 and 4
 - (c) 2 and 3
 - (d) 2 and 4
- 32 If L and L^c are recursively enumerable, then L is
- (a) Regular
 - (b) Context free
 - (c) Context sensitive
 - (d) Recursive
- 33 Which of the following problems is undecidable?
- (a) Membership problem for CFGs
 - (b) Ambiguity problem for CFGs.
 - (c) Finiteness problem for FSAs.
 - (d) Equivalence problem for FSAs.
- 34 Fred created a new automaton model which is a push down automaton but with two stacks and the added ability of having commands which do not read input tape but which can pop from one stack and push into the other. This new automaton can recognize (choose strongest result)
- (a) Context Free Language
 - (b) Context sensitive language
 - (c) Regular language
 - (d) Languages recognizable by Turing machine
- 35 Which of the following statements is/are FALSE?
- (1) For every non-deterministic Turing machine, there exists an

- equivalent deterministic Turing machine.
- (2) Turing recognizable languages are closed under union and complementation.
- (3) Turing decidable languages are closed under intersection and complementation
- (4) Turing recognizable languages are closed under union and intersection.
- (a) 1 and 4 only
 (b) 1 and 3 only
 (c) 2 only
 (d) 3 only
- 36 Consider a string s over $(0+1)^*$. The number of 0's in s is denoted by $no(s)$ and the number of 1's in s is denoted by $n1(s)$. The language that is not regular is
- (a) $L = \{s \in (0+1)^* \mid \text{for every prefix } s' \text{ of } s, |no(s') - n1(s')| \leq 2\}$
 (b) $L = \{s \in (0+1)^* \mid no(s) \bmod 7 = n1(s) \bmod 5 = 0\}$
 (c) $L = \{s \in (0+1)^* \mid no(s) \text{ is a 3 digit prime}\}$
 (d) $L = \{s \in (0+1)^* \mid |no(s) - n1(s)| \leq 4\}$
- 37 Which one of the following is true regarding FOTRAN?
- (a) It is a context free language
 (b) It is a context sensitive language
 (c) It is a regular language
 (d) None of the above
- 38 The following Context free Grammar (CFG)
- $$S \rightarrow aB \mid bA$$
- $$A \rightarrow a \mid aS \mid bAA$$
- $$B \rightarrow n \mid bS \mid aBB$$
- will generate
- (a) Odd number of a's and odd number of b's
 (b) Even number of a's and even number of b's
 (c) Equal number of a's and b's
 (d) Different number of a's and b's
- 39 Which statement is true?
- (a) The PDA must have one accept state and one reject state
 (b) The PDA must have one accept state and two reject state
 (c) The PDA must have two accept state and two reject state
 (d) There is no reject state in the PDA.
- 40 TM is more powerful than FSM because
- (a) The tape movement is confined to one direction

- (b) It has no finite state control
(c) It has the capability to remember arbitrary long sequences of input symbols
(d) None of these
- 76 A PDM behaves like a TM when the number of auxiliary memory it has is
(a) Zero
(b) One or more
(c) Two or more
(d) None of these
- 77 Which of the following permanent database that has an entry for each terminal symbol ?
(a) Literal Table
(b) Identifier table
(c) Terminal table
(d) Source table
- 43 Let SHAM3 be the problem of finding a Hamiltonian cycle in a graph $G=(V,E)$ with V divisible by 3 and DHAM3 be the problem of determining if a Hamiltonian cycle exists in such graphs. Which one of the following is true?
(a) Both DHAM3 and SHAM3 are NP-hard
(b) SHAM3 is NP-hard, but DHAM3 is not
(c) DHAM3 is NP-hard, but SHAM3 is not
(d) Neither DHAM3 nor SHAM3 is NP-hard
- 44 Consider the following statements about the context free grammar $G = \{S \rightarrow SS, S \rightarrow ab, S \rightarrow ba, S \rightarrow \epsilon\}$
- I. G is ambiguous
II. G produces all strings with equal number of a's and b's
III. G can be accepted by a deterministic PDA.
- Which combination below expresses all the true statements about G ?
(a) 1 only
(b) 1 and 3
(c) 2 and 3
(d) 1,2 and 3
- 45 Consider the regular language $L=(111+11111)^*$. The minimum number of states in any DFA accepting this languages is:
(a) 3
(b) 5
(c) 8
(d) 9

- 46 Consider the following two problems on undirected graphs:
 α : Given $G(V,E)$, does G have an independent set of size $|V|-4$?
 β : Given $G(V,E)$, does G have an independent set of size 5?
 Which one of the following is TRUE?
- (a) α is in P and β is NP-complete
 (b) α is NP complete and β is in P
 (c) Both α and β are NP-complete
 (d) Both α and β are in P
- 47 Give a production grammar for the language $L = \{x/x \in (a,b)^*, \text{ the number of } a\text{'s in } x \text{ is multiple of } 3\}$.
- (a) $\{S \rightarrow bS, S \rightarrow b, S \rightarrow aA, S \rightarrow bA, A \rightarrow aB, B \rightarrow bB, B \rightarrow aS, S \rightarrow a\}$
 (b) $\{S \rightarrow aS, S \rightarrow bA, A \rightarrow bB, B \rightarrow bBa, B \rightarrow bB\}$
 (c) $\{S \rightarrow aaS, S \rightarrow bbA, A \rightarrow bB, B \rightarrow ba\}$
 (d) None of the above
- 48 The production Grammar is $\{S \rightarrow aSbb, S \rightarrow abb\}$ is
- (a) type-3 grammar
 (b) type-2 grammar
 (c) type-1 grammar
 (d) type-0 grammar
- 49 Regular expression $(x/y)(x/y)$ denotes the set
- (a) $\{xy, xy\}$
 (b) $\{xx, xy, yx, yy\}$
 (c) $\{x, y\}$
 (d) $\{x, y, xy\}$
- 50 The regular expression have all strings in which any number of 0's is followed by any number of 1's followed by any number of 2's is :
- (a) $(0+1+2)^*$
 (b) $0^*1^*2^*$
 (c) $0^* + 1 + 2$
 (d) $(0+1)^*2^*$

Ans. (1)(a), (2)(d), (3)(b), (4)(c), (5)(d), (6)(b), (7)(d), (8)(c), (9)(d), (10)(a), (11)(a), (12)(d), (13)(b), (14)(c), (15)(a), (16)(d), (17)(b), (18)(d), (19)(b), (20)(a), (21)(d), (22)(b), (23)(c), (24)(a), (25)(d), (26)(a), (27)(a), (28)(b), (29)(a), (30)(b), (31)(b), (32)(d), (33)(b), (34)(d), (35)(c), (36)(d), (37)(b), (38)(c), (39)(d), (40)(b), (41)(c), (42)(c), (43)(a), (44)(d), (45)(d), (46)(b), (47)(a), (48)(b), (49)(b), (50)(b)

(c) **Fill in the Blanks:**

- 1 An _____ is a parallel rewriting **system**.
- 2 The _____ is the simplest example of a well-defined total **function** which is computable but not primitive recursive.
- 3 Every _____ language is context-sensitive.
- 4 A _____ is a string rewriting system that uses grammar-like rules to operate on strings of symbols.

Ans. (1) (L-system or Lindenmayersystem), (2) (Ackermann function), (3) (context-free), (4) (Markov algorithm)

II Short Answer Type Questions:

- 1 Why should one study un-decidability?
- 2 Write short note on PCP.
- 3 Write Short Note on MPCP.
- 4 Write Short Note on Reducibility.
- 5 Write Short Note on Halting Problem.
- 6 Compare L- Systems with Turing Machine.
- 7 Compare and Contrast CSG and CFG.
- 8 Give a Brief description about Markov Algorithm.
- 9 Define Recursively Enumerable Languages.
- 10 What is r- Recursive Function?
- 11 State Pumping lemma and its advantages.
- 12 What are useless symbols in a grammar
- 13 When a recursively enumerable language is said to be recursive.
- 14 Is it true that the language accepted by a non deterministic Turing Machine is different from recursively enumerable language?
- 15 Give two properties of recursively enumerable sets which are undecidable.
- 16 Is it true that complement of a recursive language is recursive? Justify your answer.
- 17 When a language is said to be recursive or recursively enumerable?
- 18 When a language is said to be recursive? Is it true that every regular set is not recursive?
- 19 Define recursively enumerable language.
- 20 Give an example for a non recursively enumerable language.
- 21 What is reducibility?
- 22 Design A PDA that accepts EVEN Palindrome over {a,b}.
- 23 Given $G = (\{S,A\}, \{a,b\}, P, S)$ where $P = \{S \rightarrow AaS | S | SS, A \rightarrow SbA | ba\}$, S-Start symbol. Find the left most and right most derivation of the string $w = aabbaaa$.
- 24 Let $G = (\{S,C\}, \{a,b\}, P, S)$ where P consists of $S \rightarrow aCa$, $C \rightarrow aCa | b$. Find $L(G)$.
- 25 Specify the two types of moves in PDA.
- 26 Find the grammar for the language $L = \{a^2nbc, \text{ where } n > 1\}$
- 27 What are the different types of language acceptances by a PDA and define them.

- 28 What is the significance of PDA?
- 29 Write the grammar for following language. $L = \{w \mid w \text{ starts with "a" and } w \in \{a,b\}^*\}$
- 30 Show that “If a language L and its complement \bar{L} are both recursively enumerable, then both languages are recursive”.
- 31 Show that L_n is recursively enumerable.
- 32 Differentiate between recursive and recursively enumerable languages.
- 33 Define the classes P and NP.
- 34 Differentiate between a phrase structure grammar and a matrix grammar.

III Long Answer Type Questions:

- 1 Show that the collection of recursively enumerable (Turing-recognizable) languages is closed under the union operation.
- 2 Show that the collection of recursively enumerable (Turing-recognizable) languages is closed under the concatenation operation.
- 3 A useless state in a Turing machine is one that is never entered on any input string. Consider the problem of testing whether a Turing machine has any useless states. Formulate this problem as a language and show that it is undecidable.
- 4 Show that the following problem is unsolvable. Given two Turing machine T and T_1 is
 $L(T) \cap L(T_1) = \text{Null?}$
- 5 Construct CFG for $L = L_1 \cup L_2$ where
 $L_1 = \{anbm \mid n \geq m, m > 0\}$
 $L_2 = \text{An strings not having } 01 \text{ as a substring over } (0,1)$
- 6 Construct context free grammar for language L where
 $L = \{a^n b m c^n \mid n \geq 1, m \geq 0\}$
- 7 Construct context free grammar for L where
 $L = \{0^i 1^j 2^k \mid i, j, k \geq 1, i \neq j \text{ or } j \neq k\}$
- 8 Construct CFG for a language $L = L_1 \cap L_2$ where
 $L_1 = \{anb \mid n \geq 1\}$
 $L_2 = \text{An strings having odd length over } \{a,b\}$
- 9 Construct CFG for $L = L_1^*$ where $L_1 = \{an bcn \mid n \geq 1\}$
- 10 Construct context free grammar for $L = L_1 L_2$ where
 $L_1 = \{anb \mid n \geq 0\}$
 $L_2 = \{bmc \mid m \geq 0\}$
 $B \rightarrow 1B \mid \epsilon$
 $C \rightarrow 1$
- 78 Show that if L and \bar{L} are recursively enumerable then L and \bar{L} recursive.
- 79 Show that union of recursive languages is recursive.
- 80 Show that union of recursive languages is recursive.
- 81 Discuss the properties of Recursive and Recursively enumerable languages.

- 82 Show that the characteristic function of the set of all even numbers is recursive.
- 83 Find whether the following languages are recursive or recursively enumerable.
- Union of two recursive languages.
 - Union of two recursively enumerable languages.
 - L if L and complement of L are recursively enumerable.
- 84 Show that “If a language L and its complement \bar{L} are both recursively enumerable, then both languages are recursive”.
- 85 Show that L^n is recursively enumerable.
- 86 Differentiate between recursive and recursively enumerable languages.
- 87 Define the classes P and NP.
- 88 Differentiate between a phrase structure grammar and a matrix grammar.
- 89 In context of primitive functions state the initial functions and the rules of primitive recursive and composition.
- 90 State and Prove pumping lemma for CFG.
- 91 Define instantaneous description of a PDA.
- 92 Write short note on:
- The P and NP complexity classes
 - Probabilistic computation.
- 93 Discuss in detail about universal Turing machine.
- 94 Prove that halting problem is undecidable.
- 95 Show that AMBIGUITY problem is un-decidable.
- 96 When a recursively enumerable language is said to be recursive? Is it true that the language accepted by a non-deterministic Turing machine is different from recursively enumerable language?
- 97 Explain how a TM can be used to determine the given number is prime or not?
- 98 Prove that if a language L and its complement are both recursively enumerable, then L is recursive.
- 99 Prove that if $L=N(P_N)$ for some PDA $P_N=(Q, \Sigma, \Gamma, \delta_N, q_0, Z_0)$, then there is a PDA P_F such that $L=L(P_F)$.
- 100 Show that every regular set accepted by a finite automation with n states is accepted by a deterministic pda with one state and n pushdown symbols.
- 101 What do you mean by Parser? Explain SLR(1) parsing method.
- 102 Design PDA (Push Down Automata) for the language given below, $(ba)^n(a)^n$ $n = 1,2,3,\dots$
- 103 Use the pumping lemma to prove that the language $A = \{ 0^n 2^n 1^n 3^n 0^n \mid n \geq 0 \}$ is not context free.
- 104 Consider the following CFG $G = (V, \Sigma, R, S)$, where $V = \{S, T, X\}$, $\Sigma = \{a, b\}$, the start variable is S , and the rules R are $S \rightarrow aT Xb$ $T \rightarrow XT S \mid \epsilon$ $X \rightarrow a \mid b$ Convert G to an equivalent PDA

UNIT - IV

I Test Your Skills:

(a) State Whether the Following Statements are True or False:

- 1 Chomsky normal forms are good for parsing and proving theorems.
- 2 It is very easy to find the Chomsky normal form for any context-free grammar
- 3 All models of computation are equivalent
- 4 The set of primitive recursive functions is un-countable
- 5 There is a function that is not primitive recursive
- 6 Post systems are not good for proving mathematical statements from a set of Axioms

Ans. (1) (T), (2) (T), (3) (T), (4) (F), (5) (T), (6) (F)

(b) Multiple Choice Questions:

- 1 Suppose that a problem A is known to have a polynomial-time verification algorithm. Which of the following statements can be deduced.
 - (a) A is in NP.
 - (b) A is in NP but not P
 - (c) A is in both NP and P.
 - (d) A is NP-complete.
- 2 Which of the following assertions about Turing Machines is true? Blank symbol(s) may occur in the input. At any stage of a computation, there are only finitely many non-blank Symbols on the tape.
 - (a) Assertions (a) and (b) are both true.
 - (b) Neither (a) nor (b) is true.
 - (c) Both False
 - (d) None of above
- 3 A PC not connected to a network is equivalent to
 - (a) A Deterministic Finite-State Automaton,
 - (b) A Turing Machine,
 - (c) A Push-Down Automaton,
 - (d) None of the above.
- 4 Consider the following two languages:
 $A = \{a^n b^m c^n d^m \mid m, n \geq 0\}$
and
 $B = \{a^n b^m c^m d^n \mid m, n \geq 0\}$
Which of the following is true?
 - (a) Both A and B are context-free.
 - (b) A is context-free and B is context-sensitive.
 - (c) A is context-sensitive and B is context-free.
 - (d) Nether A nor B is context-sensitive.

- 5 Recursively enumerable languages are not closed under:
- Union
 - Intersection
 - Complementation
 - Concatenation
- 6 Let L_1 be a recursive language, and let L_2 be a recursively enumerable but not a recursive language. Which one of the following is TRUE?
- $(L_1)'$ is recursive and $(L_2)'$ is recursively enumerable
 - $(L_1)'$ is recursive and $(L_2)'$ is not recursively enumerable
 - $(L_1)'$ and $(L_2)'$ are recursively enumerable
 - $(L_1)'$ is recursively enumerable and $(L_2)'$ is recursive
- 7 Let S be an NP-complete problem, Q and R be two other problems not known to be in NP. Q is polynomial-time reducible to S and S is polynomial-time reducible to R . Which one of the following statements is true?
- R is NP-complete
 - R is NP-hard
 - Q is NP-complete
 - Q is NP-hard
- 8 For $s \in (0+1)^*$ let $d(s)$ denote the decimal value of s (e.g. $d(101) = 5$). Let $L = \{s \in (0+1)^* \mid d(s) \bmod 5 = 2 \text{ and } d(s) \bmod 7 \neq 4\}$. Which one of the following statements is true?
- L is recursively enumerable, but not recursive
 - L is recursive, but not context-free
 - L is context-free, but not regular
 - L is regular
- 9 A FSM can be considered, having finite tape length without rewinding capability and unidirectional tape movement
- Turing machine
 - Pushdown automata
 - Context free languages
 - Regular languages
- 10 Which of the following statement is true?
- All languages can be generated by CFG
 - The number of symbols necessary to simulate a Turing Machine(TM) with m symbols and n states is mn .
 - Any regular languages have an equivalent CFG.
 - The class of CFG is not closed under union.
- 11 Recursively enumerable languages are not closed under

- (a) Complementation
 - (b) Union
 - (c) Intersection
 - (d) None of the above
- 12 The following CFG is in
 $S \rightarrow aBB$
 $B \rightarrow bAA$
 $A \rightarrow a$
 $B \rightarrow b$
- (a) Chomsky normal form but not strong Chomsky normal form
 - (b) Weak Chomsky normal form but not Chomsky normal form
 - (c) Strong Chomsky normal form
 - (d) Greibach normal form
- 13 The languages ----- are the examples of non regular languages.
- (a) PALINDROME and PRIME
 - (b) PALINDROME and EVEN-EVEN
 - (c) EVEN-EVEN and PRIME
 - (d) FACTORIAL and SQUIRE
- 14 Let L be any infinite regular language, defined over an alphabet Σ then there exist three strings x, y and z belonging to Σ such that all the strings of the form XY^nZ for $n=1,2,3, \dots$ are the words in L called
- (a) Complement of L
 - (b) Pumping Lemma
 - (c) Kleene's theorem
 - (d) None in given
- 15 Languages are proved to be regular or non regular using pumping lemma.
- (a) True
 - (b) False
 - (c) Not always true
 - (d) can't say anything
- 16 _____ states are called the halt states.
- (a) ACCEPT and REJECT
 - (b) ACCEPT and READ
 - (c) ACCEPT AND START
 - (d) ACCEPT AND WRITE
- 17 The part of an FA, where the input string is placed before it is run, is called _____
- (a) State
 - (b) Transition

- (c) Input Tape
 - (d) Output Tape
- 18 The PDA is called non-deterministic PDA when there are more than one outgoing edges from..... state
- (a) START or READ
 - (b) POP or REJECT
 - (c) READ or POP
 - (d) PUSH or POP
- 19 If an effectively solvable problem has answered in yes or no, then this solution is called
- (a) Decision procedure
 - (b) Decision method
 - (c) Decision problem
 - (d) Decision making
- 20 The symbols that can't be replaced by anything are called -----
- (a) Productions
 - (b) Terminals
 - (c) Non-terminals
 - (d) All of above
- 21 Left hand side of a production in CFG consists of:
- (a) One terminal
 - (b) More than one terminal
 - (c) One non-terminal
 - (d) Terminals and non-terminals
- 22 Choose the incorrect statement:
- (a) $(a+b)aa(a+b)$ generates Regular language.
 - (b) A language consisting of all strings over $\Sigma=\{a,b\}$ having equal number of a's and b's is a regular language
 - (c) Every language that can be expressed by FA can also be expressed by RE
 - (d) None of these
- 23 Choose the incorrect statement.
- (a) A Mealy machine generates no language as such
 - (b) A Mealy machine has no terminal state
 - (c) For a given input string, length of the output string generated by a

- Moore machine is not more than the length of the output string generated by that of a Mealy machine
- (d) All of these
- 24 In FA, if one enters in a specific state but there is no way to leave it, then that specific state is called
- (a) Dead State
 (b) Waste Basket
 (c) Davey John Locker
 (d) All of these
- 25 Which statement is true?
- (a) The tape of turing machine is infinite.
 (b) The tape of turing machine is finite.
 (c) The tape of turing machine is infinite when the language is regular
 (d) The tape of turing machine is finite when the language is nonregular.
- 26 If $r_1 = (aa + bb)$ and $r_2 = (a + b)$ then the language $(aa + bb)(a + b)$ will be generated by
 Select correct option:
- (a) $(r_1)(r_2)$
 (b) $(r_1 + r_2)$
 (c) $(r_2)(r_1)$
 (d) (r_1)
- 27 Which of the following will be used for text searching application-?
- (a) NFA
 (b) DFA
 (c) PDA
 (d) None of these
- 28 Context free grammar is used for-
- (a) Lexical analyzer
 (b) Document type definition (DTD)
 (c) Text pattern searching
 (d) Both a & c
- 29 The set strings of 0's and 1's with atmost one pair consecutive one's-
- (a) $(0+1)^*(01)(10)(0+1)^*$
 (b) $(0+1)^*(01)^*(10)(0+1)^*$
 (c) $(0+1)^*(01)(10)^*(0+1)^*$
 (d) $(0+!)(01)^*(10)^*(0+1)$
- 30 TM is more powerful than FSM because
- (a) The tape movement is confined to one direction

- (b) It has no finite state control
 - (c) It has the capability to remember arbitrary long sequences of input symbols
 - (d) None of these
- 31 The problem 3-SAT and 2-SAT are
- (a) Both in P
 - (b) Both NP complete
 - (c) NP-complete and in P respectively
 - (d) Undecidable and NP-complete respectively
- 32 Which of the following instances of the post correspondence problem has a viable sequence (a solution)?
- (a) $\{(b, bb), (bb, bab), (bab, abb), (abb, babb)\}$
 - (b) $\{(ab, aba), (baa, aa), (aba, baa)\}$
 - (c) $\{(ab, abb), (ba, aaa), (aa, a)\}$
 - (d) none of the above
- 33 Let FHAM be the problem of finding a Hamiltonian cycle in a graph G and DHAM be the problem of determining if a Hamiltonian cycle exists in a graph. Which one of the following is TRUE?
- (a) Both FHAM and DHAM are NP-hard
 - (b) FHAM is NP hard, but DHAM is not
 - (c) DHAM is NP hard, but FHAM is not
 - (d) Neither FHAM nor DHAM is NP hard
- 34 Consider three problems P₁, P₂ and P₃. It is known that P₁ has polynomial time solution and P₂ is NP-complete and P₃ is in NP. Which one of the following is true.
- (a) P₃ has polynomial time solution if P₁ is polynomial time reducible to P₃
 - (b) P₃ is NP complete if P₃ is polynomial time reducible to P₂
 - (c) P₃ is NP complete if P₂ is reducible to P₃
 - (d) P₃ has polynomial time complexity and P₃ is reducible to P₂
- 35 Which one of the following is the strongest correct statement about a finite language L over a finite alphabet Σ ?
- (a) L is undecidable
 - (b) L is recursive
 - (c) L is a CSL
 - (d) L is a regular set
- 36 Which one of the following is not decidable?
- (a) given a Turing machine M, a string s, and an integer k, M accepts s with k steps

- (b) equivalence of two given Turing machines
 - (c) language accepted by a given DFSA is nonempty
 - (d) language generated by a CFG is nonempty
- 37 Which of the following statements are TRUE?
- (1) The problem of determining whether there exists a cycle in an undirected graph is in P.
 - (2) The problem of determining whether there exists a cycle in an undirected graph is in NP.
 - (3) If a problem A is NP-Complete, there exists a non-deterministic polynomial time algorithm to solve A.
- (a) 1, 2 and 3
 - (b) 1 and 2 only
 - (c) 2 and 3 only
 - (d) 1 and 3 only
- 38 Consider a graph $G = (V, E)$ where $|V|$ is divisible by 3. The problem of finding a Hamiltonian cycle in a graph is denoted by SHAM3 and the problem of determining if a Hamiltonian cycle exists in such graph is denoted by DHAM3. The option, which holds true, is
- (a) Only DHAM3 is NP-hard
 - (b) Only SHAM3 is NP-hard
 - (c) Both SHAM3 and DHAM3 are NP-hard
 - (d) Neither SHAM3 nor DHAM3 is NP-hard
- 39 Which of the following statement is false for a turing machine?
- (a) There exists an equivalent deterministic turing machine for every non-deterministic turing machine
 - (b) Turing decidable languages are closed under intersection and complementation
 - (c) Turing recognizable languages are closed under union and intersection
 - (d) Turing recognizable languages are closed under union and complementation
- 40 Two persons X and Y have been asked to show that a certain problem p is NP-complete. X shows a polynomial time reduction from the 3-SAT problem to p and Y shows a polynomial time reduction from p to 3-SAT. From these reduction it can be inferred that
- (a) P is NP-complete
 - (b) P is NP-hard but not NP-complete
 - (c) P is in NP but not NP-complete
 - (d) P is neither NP-hard nor in NP

- 41 3-SAT and 2-SAT problems are
 (a) NP-complete and in P respectively
 (b) Undecidable and NP-complete
 (c) Both NP-complete
 (d) Both in P
- 42 Let n be the positive integer constant and L be the language with alphabet $\{a\}$. To recognize L the minimum number of states required in a DFA will be
 (a) $2k + 1$
 (b) $k + 1$
 (c) $2n + 1$
 (d) $n + 1$
- 43 Consider a stack, which is limited to 10 items. The language accepted by a push-down automaton in such stack is best described as
 (a) Regular
 (b) Deterministic context free
 (c) Context free
 (d) Recursive
- 44 State table of an FSM is given below. There are two states A And B, one input and one output.

Present State A	Present State B	Input	Next State A	Next State B	Output
0	0	0	0	0	1
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	1	0	0
0	0	1	0	1	0
0	1	1	0	0	1
1	0	1	0	1	1
1	1	1	0	0	1

Let the initial state be $A = 0$ and $B = 0$. To take the machine to the state $A = 0$ and $B = 1$ with output = 1 the minimum length of input string required will be

- (a) 2
 (b) 7
 (c) 4
 (d) 3

- 45 Out of the three decision problems P1, P2 and P3, P1 is decidable and P2 is undecidable. The statement that holds true is
- (a) P3 is decidable if P3 is reducible to compliment of P2
 - (b) P3 is decidable if P1 is reducible to P3
 - (c) P3 is undecidable if P1 is reducible to P3
 - (d) P3 is undecidable if P2 is reducible to P3

- 46 The set which is not countable if we have $\Sigma = \{a, b\}$, is
- (a) Set of all languages over Σ accepted by turing machine
 - (b) Set of all regular languages over Σ
 - (c) Set of all strings over Σ
 - (d) Set of all languages over Σ

- 47 How many states are present in the minimum state finite automaton that recognizes the language represented by the regular expression $(0+1)(0+1)\dots N$ times?
- (a) $n+1$
 - (b) $n+2$
 - (c) n
 - (d) $2n$

- 48 Consider the state table of a finite state machine that has input x and a single output z. The shortest input sequence to reach the final state C if the initial state is unknown is

Present State	Next state, z	
	X=1	X=0
A	D, 0	B, 0
B	B, 1	C, 1
C	B, 0	D, 1
D	B, 1	C, 0

- (a) 10
 - (b) 01
 - (c) 101
 - (d) 110
- 49 The set that can be recognized by a deterministic finite state automaton is
- (a) The set $\{1, 101, 11011, 1110111, \dots\}$
 - (b) The set of binary string in which the number of 0's is same as the number of 1's
 - (c) $1, 2, 4, 8, \dots, 2^n, \dots$ written in binary
 - (d) $1, 2, 4, 8, \dots, 2^n, \dots$ written in unary

50 Which one of the following is true regarding FOTRAN?

- (a) It is a context free language
- (b) It is a context sensitive language
- (c) It is a regular language
- (d) None of the above

Ans. (1)(b), (2)(c), (3)(a), (4)(b), (5)(c), (6)(b), (7)(a), (8)(d), (9)(a),(10)(c), (11)(a), (12)(d), (13)(a), (14)(b), (15)(a), (16)(a), (17)(c), (18)(c), (19)(a), (20)(b), (21)(d), (22)(d), (23)(c), (24)(d), (25)(a), (26)(a), (27)(c), (28)(b), (29)(d), (30)(b), (31)(c), (32)(c), (33)(a), (34)(c), (35)(d), (36)(b), (37)(a), (38)(c), (39)(d), (40)(a), (41)(a), (42)(d), (43)(a), (44)(d), (45)(d), (46)(d), (47)(b), (48)(a), (49)(c), (50)(b)

(c) Fill in the Blanks:

- 1 A language is recursively enumerable if and only if an _____ generates it.
- 2 _____ is the number of steps during a computation.
- 3 _____ is Space used during a computation.
- 4 The _____ problems have exponential time algorithms
- 5 Basic Primitive Recursive Functions are _____, _____, and _____.

Ans. (1)(Extended Lindenmayer-Systems), (2)(Time Complexity), (3)(Space Complexity), (4)(NP-complete), (5)(Zero function, Successor Functions, Projection functions)

II Short Answer Type Questions:

- 1 Define a Turing Machine.
- 2 Mention any two problems which can only be solved by TM.
- 3 State Pumping lemma and its advantages.
- 4 What do you mean by universal Turing Machine?
- 5 What is the role of checking off symbols in a Turing Machine?
- 6 Explain the Basic Turing Machine model and explain in one move. What are the actions take place in TM?
- 7 Explain how a Turing Machine can be regarded as a computing device to compute integer functions.
- 8 Describe the non deterministic Turing Machine model. Is it true the non deterministic Turing Machine model's are more powerful than the basic Turing Machines? (In the sense of language Acceptance).
- 9 Explain the multi tape Turing Machine mode. Is it more power than the basic turing machine? Justify your answer.
- 10 Show that the collection of recursively enumerable (Turing-recognizable) languages is closed under the union operation.
- 11 Prove the following theorem: Let P and R be two problems. If P reduces to R and R is polynomial, then P is polynomial.
- 12 When a problem is said to be decidable or undecidable? Give an example of an undecidable.

- 13 What do you mean by universal Turing Machine?
- 14 When a problem is said to be undecidable? Give an example of an undecidable problem.
- 15 Mention any two undecidability properties for recursively enumerable language.
- 16 Give an example for an undecidable problem.
- 17 Define multitape Turing Machine.
- 18 Explain the Basic Turing Machine model and explain in one move. What are the actions take place in TM?
- 19 Explain how a Turing Machine can be regarded as a computing device to compute integer functions.
- 20 What is meant by a Turing Machine with two way infinite tape?
- 21 Define instantaneous description of a Turing Machine.
- 22 Mention any two problems which can only be solved by TM.
- 23 Design a Turing Machine that accept the Language $L = \{w : na(w) = nb(w), w \in \{a,b\}^*\}$.
- 24 Write short note on Church –Turing Thesis.
- 25 Does PCP with two lists $x = (b, b, ab^3, ba)$ and $y = (b^3, ba, a)$ have a solution?.

- 26 Explain L and NL complexity.
- 27 What is an intractable problem? Give two examples.
- 28 What is multiple track Turing machine?
- 29 Design PDA for the language $L = \{a^n b^n \mid n \geq 0\}$ and simulate its action on the input string aaaaaabb.
- 30 Show that the language L and its complement L' are both recursively enumerable then L is recursive.
- 31 Explain post correspondence problem with an example.
- 32 What do you mean by saying that the halting problem of TM is undecidable?
- 33 What is the difference between recursive language and a recursively enumerable language?
- 34 Show that the grammar $S \rightarrow 0A^2, A \rightarrow 1A1, A \rightarrow 1$ is not an LR(0).
- 35 Construct the computation sequence for the input 1b11 for the turing machine that recognizes all strings consisting of an even number of 1's.
- 36 Design a TM that reads a string in $\{0,1\}^*$ and erases the rightmost symbol.

III Long Answer Type Questions:

- 2 Explain in detail Universal Turing Machine.
- 3 Write in Detail about Turing Machines and Turing Thesis in detail.
- 4 Program a DTM to shift its input words right by one cell, placing a blank in the leftmost cell.
- 5 Let $\Sigma = \{a, b\}$ and $L = \{ba^i b \mid i \geq 0\}$. Construct a DTM to decide L.
- 6 Construct a DTM to accept the language $L = \{x^i y^j \mid x, y \in \{0,1\}^+ \text{ and } x \neq y\}$.
- 7 Construct a Turing machine with one tape, that gets as input an integer $x \geq 1$, and returns as output the integer $x - 1$. Integers are represented in binary.

- 8 Construct a Turing machine with three tapes that gets as input two nonnegative integers x and y , and returns as output the number $x+y$. Integers are represented in binary.
- 9 When we say a problem is decidable? Give an example of un-decidable problem?
- 10 Explain the various techniques for Turing machine construction.
- storage in finite control
 - multiple tracks
 - checking off symbols
 - shifting over
 - Subroutines
- 11 Explain how a TM can be used to determine the given number is Prime or Not?
- 12 Define L_d and prove that L_d is undecidable.
- 13 Prove that the halting problem is undecidable
- 14 Design a Turing Machine to compute $f(m+n)=m+n, \forall m,n \geq 0$ and simulate their action on the input 0100.
- 15 Define Turing machine for computing $f(m,n)=m-n$ (proper subtraction).
- 16 Design a Turing Machine to accept the language $L=\{0^n 1^n | n \geq 1\}$
- 17 Explain how the multiple tracks in a Turing Machine can be used for testing given positive integer is a prime or not.
- 18 Construct a Turing Machine that recognizes the language $\{wcw/w \text{ in } \{a+b\}^+\}$
- 19 Show that the following language is not decidable $L=\{\langle M \rangle \mid M \text{ is a TM that accepts the string } aaab\}$.
- 20 Does PCP with two lists $x=(b, b^3, ba)$ and $y=(b^3, ba, a)$ have a solution?.
- 21 Show that “finding whether the given CFG is ambiguous or not” is undecidable by reduction technique.
- 22 Find an L-System that generates $L(aa)^*$.
- 23 Prove that Halting Problem of Turing machine is undecidable. Explain reducibility.
- 23 Differentiate NP complete and NP hard problems.
- 24 Explain NP complete and NP hard problems with some examples.
- 25 Prove that a Boolean expression E is a tautology if and only if $\neg E$ is unsatisfiable.
- 26 State and prove savich theorem.
- 27 Show that every language accepted by a standard TM M is also accepted by a TM M_1 with the following conditions:
- M_1 's head never moves to the left of its initial position.
 - M_1 will never write a blank.
- 28 Show there exist ATM for which the halting problem is unsolvable.
- 29 Prove that a problem p_2 cannot be solved in polynomial time can be proved by the reduction of a problem p_1 , which is under class p_1 to p_2 .
- 30 Show that the addition function $f_1(x, y)$ is Turing-computable.

- 31 Show that the union of two recursively enumerable languages is recursively enumerable and the union of two recursive languages is recursive.
- 32 Design a Turing machine that converts a binary string into its equivalent unary string.
- 33 Design a Turing machine to test whether a given input on $\{a,b\}$ contains equal number of symbols a and b .
- 34 Comment on the following: "We have developed an algorithm so complicated that no Turing machine can be constructed to execute the algorithm no matter how much (tape) space and time is allowed."