LECTURE PLAN

MCA

SEMESTER II

FOR PRIVATE CIRCULATION

LECTURE PLAN

DATA AND FILE STRUCTURES

MCA-102

COURSE OUTLINE
MCA – II SEMESTER
DATA AND FILE STRUCTURES - MCA 102

L – 3   P - 1 Credit - 04

OBJECTIVE:

The purpose of this course is to enable the students to have a clear description of the data structures. A data structure is a way of storing and retrieving data efficiently and effectively. In this course the basic terminologies related to data structures and the concepts will be taught with examples. A detailed study of data organization and certain data structures will be covered along with understanding of different operations which are applied on these data structures. In this course various data structures will be implemented using C programming language.

INTERNAL ASSESSMENT AND ASSIGNMENT   **25 marks**
1. Class Test-I – (Written Test)   15 marks
3. Class Assessment + Attendance   10 marks

COURSE CONTENTS:

UNIT - I   **(08 Hours)**
1. Fundamentals of algorithm analysis:
- Big 'O' notations
- Time and space complexity of algorithms
- Elementary data structures and their applications Arrays
- Ordered lists
- Representation of arrays
- Linked lists
- Stacks, queues and deques
- Double stacks, multistacks and multiqueues
- Polynomial arithmetic
- Postfix and prefix arithmetic expression conversion and evaluations.

UNIT – II   **(10 Hours)**
2.Trees:
- Binary trees
- Binary search trees basic operations
- Tree traversals(recursive and stack based non-recursive)
- Heaps and priority queues
- Threaded binary tree
- AVL trees
- B-Tree: need, properties, creation and uses
- B_+ tree, B_* trees

UNIT – III   **(16 Hours)**
3.Graphs:
- Representation(Matrix and Linked)
- Traversal and connected components
- Spanning trees
- Shortest path and transitive closure
- Topological sort
- Activity network, critical path and path enumeration
- Dijkstra's Algorithm
- Floyd Warshall's Algorithm
- Coloring of graphs
- Minimum Spanning tree algorithms: Kruskal's and Prim's Algorithm.
- Binary search
- Hash function & Hash table
- Search tree
- Internal sort: Radix sort and Insertion sort
- Selection sort
- Quick sort
- Shell sort
- Merge sort

UNIT – IV   **(08 Hours)**
4. Files
- Sequential file organization
- Creating, updating and retrieving from sequential files
- Advantages and disadvantages of sequential file organization
- Data representation and density
- Parity and error control techniques
- Devices and channels
- Double buffering and block buffering
- Handling sequential files in C language
- Seeking, positioning, reading and writing binary files in C
- External sorting
- Merging files k way and polyphase merge

STUDY MATERIAL FOR THE SUBJECT

Following will be the study material for topics of data structures and students are advised to go through the material for thorough understanding of the subject.

➢ **MAIN TEXT BOOK**

1. **Author's Name(s):** Schaum's outline series.
   Title: Data Structures
   Edition: Ninteenth**Year:** 2014(Reprint)
   Publisher: Tata McGraw Hill   (ibid 1)

➢ **REFERENCE BOOKS**

1. **Author's Name(s) :**S.K. Srivastava
   Title: Data Structures through C in Depth
   Edition: II **Year**: 2014(Reprint)
   Publisher: BPB Publication   (ibid 2)

2. **Author's Name(s) :**R. B. Patel
   Title: Expert data structures with C
   Edition: III **Year:** 2012
   Publisher: Khanna Book Publishing Co. Pvt. Ltd.   (ibid 3)

3. **Author's Name(s):** Mark Allen Weiss
   Title: Data Structure and Algorithm Analysis in C
   Edition: II **Year:** 2014
   Publisher: Pearson   (ibid 4)

4. **Author's Name(s):** E. Horowitz and S. Sahani
   Title: Fundamentals of Data Structures in C
   Edition: II **Year:** 2008
   Publisher: Universities Press   (ibid 5)

➢ **PERIODICALS**

1. Partial Evaluation and Program Manipulation (PEPM'11), Proceedings ACM Press, 2011, http://www.iai.uni-bonn.de/~jv/pepm11.pdf.
2. Oceans,October,2012,http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber =6404783&url=http%   3A%2F%2Fieeexplore.ieee.org%2Fstamp%2Fstamp.jsp%3Farnumber %3 D6404
3. National Journal of System & Information Technology, Vol. 5 No. 2, December 2012
4. International Journal of Computer Applications, November 2012, Volume 57, No. 11, http://www.ijcaonline.org/archives/volume57/number11/9156-2056.
5. SIGACT News, Vol. 44, No. 3, September 2013.

6.   IUP Journal of Computer Science, Vol. 7, No. 2, April 2013

7.   IUP Journal of Information Technology, Vol. 9, No.1, March 2013

8.   International Journal of Computing and Applications, Vol. 8, No.2, July-December 2013

9.   TENCON 2013 -IEEE Region 10 Conference, http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=6719008&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D6719008

10.   International Conference Recent Trends in Engineering & Technology (ICRET'2014), Feb 13-14, 2014, http://eprints2.utem.edu.my/11670/1/2014 Conf._13Feb_ICRET2014_BATAM_(1).pdf

11.   International Journal of Advanced Research in Computer Science and Software Engineering, February 2014,http://www.ijarcsse.com/docs/papers/Volume_4/2_February2014/V4I2-0170.pdf

12.   ERIM Report Series, September 2014, http://ssrn.com/abstract=2491023

13.   Operations Research Proceedings 2014, http://link.springer.com/chapter/10.1007/ 978-3-319-07001-8_25

14.   Computer Graphics and Applications, IEEE, December 2016, https://www.computer.org/cga/

15.   Data Structures and Algorithms / by E.W.Dijkstra.

UNIT 1: FUNDAMENTALS OF ALGORITHM ANALYSIS

LECTURES 1-3

ARRAYS

OBJECTIVE:

The objective of these lectures is to make student familiar with one of the data structure called array which is used to store multiple values in one variable.

CONTENTS:

- ➢ Complexity of Algorithms
- ➢ Big 'O' notations
- ➢ Introduction to Data Structures
- ➢ Classification of Data Structures
  - • Logical Data Structures
  - • Primitive and Simple Structures
  - • Linear and Nonlinear Structures
- ➢ Concept of Arrays
- ➢ Linear Arrays
- ➢ Traversing Linear Arrays
- ➢ Insertion and Deletion in arrays
- ➢ Multidimensional Arrays
- ➢ Two-Dimensional Arrays
- ➢ Representation of a 2-D array in memory
- ➢ Matrices
- ➢ Algebra of Matrices
- ➢ Sparse Matrices
- ➢ Triangular Array
- ➢ Tridiagonal Array

ASSIGNMENTS FROM QUESTION BANK:

1   Refer Unit 1 Section II: Q 7, 16, 19, 45,46,47
2   Refer Unit 1 Section III: Q 18, 26, 31,32

OTHER ASSIGNMENTS:

1   ibid 1, Page No.2.31, Q 2.1, 2.2, 2.3, 2.4
2   ibid 2, Page No.4.39 Q4.1, 4.3, 4.15

SUGGESTED READINGS:

TEXT BOOK:

1 ibid 1, Page No. 2.1-2.28

REFERENCE BOOKS:

1 ibid 2, Page No. 4-9
2 ibid 3, Page No. 47-59
3 ibid 4, Page No. 31-55
4 ibid 5, Page No. 21-23

WEBSITE:

1 http://cpp.datastructures.net/presentations/Analysis.pdf

ARTICLE:

1 Pirenne B., Guillemot E. ,"Beyond Data Management: How to foster data exploitation and better Science", Oceans, October, 2012,http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumbe r=6404783& url=http%3A%2F%2Fieeexplore.ieee.org%2Fstamp%2Fstamp.jsp%3Farnumber%3D6404783

LECTURES 4-6

SIMPLE DATA STRUCTURE – STACK AND LINKED LIST

OBJECTIVE:

Data processing frequently involves storing and processing data organized into lists. One way is to store in arrays which is covered in above lecture and other way is in lists which students will learn in these following lectures. These lectures will focus on the concept of stacks and linked lists.

CONTENTS:

- ➢ Definitions
- ➢ Singly and doubly linked list
- ➢ Array Representation of Stack
- ➢ Linked representation of Stack
- ➢ Double stacks
- ➢ Multistacks
- ➢ Application of Stacks
  - • Polish Notation
  - • Evaluation of a Postfix Expression

- Algorithm of postfix expression
- Transforming Infix Expressions into Postfix Expressions
- Quick sort
- Concept of Recursion

ASSIGNMENTS FROM QUESTION BANK:

1   Refer Unit1 Section II: Q 6, 8-13, 18, 20, 32, 34, 41, 42, 43,44, 45
2   Refer Unit1 Section III:Q 1, 5, 6, 8, 10, 14-16, 19, 25, 36, 37, 38-42

OTHER ASSIGNMENTS:

1   ibid 1, Page No.5.51, Supplementary Problem Q 5.1, 5.2
2   ibid 2, Page No.105 Q 6,12,34,38 page no 146 Q18 (ii, iii), 19(iii), 20, 22
3   ibid 3, Page No.276 Q 5.1, 5.4, 5.5, 5.6, 5.8, 5.9 Page No 314 Q 6.1, 6.3, 6.4, 6.8, 6.9
4   ibid 5, Page No. 32

SUGGESTED READINGS:

TEXT BOOK:

1   ibid 1, Page No 5.2-5.41, 6.2-6.17

REFERENCE BOOKS:

1   ibid 2, Page No. 48-104,108-113,133-145
2   ibid 3, Page No. 188-299
3   ibid 4, Page No. 57-77

ARTICLES:

1   Debjit Roy, Akash Gupta," Optimal Stack Layout in a Sea Container Terminal with Automated Lifting Vehicles", ERIM Report Series, September 2014, http://ssrn.com/abstract=2491023
2   MikkelThorup, "Efficient Algorithms and Data Structures",   www.di.ku.dk/english/research /apl-group/eads/project.pd
3   Joao Paulo Fernandes, Joao Saraiva, Daniel Seidel, and Janis Voigtländer, "Strictification of Circular Programs", Partial Evaluation and Program Manipulation (PEPM'11), Proceedings.
  ACM Press, 2011

WEBSITES:

1   http://cpp.datastructures.net/presentations/Stacks.pdf
2   http://www.di.ku.dk/english/research/apl-group/eads/project.pdf

LECTURES 7-8

SIMPLE DATA STRUCTURE - QUEUE

OBJECTIVE:

These lecture focuses on a data structure Queue, a linear list of elements in which deletion can take place only at one end called from and insertion can take place only at other end called rear .

CONTENTS:

- ➢ Definition
- ➢ Representation of Queues
- ➢ Algorithm for insertion and deletions in queues
- ➢ Types of Queues
  - • Dequeue
    - o Input-restricted dequeue
    - o Output-restricted dequeue
  - • Priority Queues
  - • One-Way List Representation of a Priority Queue
  - • Array Representation of a Priority Queue
  - • Multiqueues

ASSIGNMENTS FROM QUESTION BANK:

1   Refer Unit1 Section I: Q 1, 2, 3, 4, 5, 35
2   Refer Unit1 Section II:Q 11, 14, 17, 20

OTHER ASSIGNMENTS:

1   ibid 1, Page No.6.61 Supplementary problem Q 6.3 – 6.12
2   ibid 2, Page No. 145 Q7, 13
3   ibid 3, Page No. 314 Q6.5, 6.7

SUGGESTED READINGS:

TEXT BOOK:

1   ibid 1, Page No- 6.36-6.43

REFERENCE BOOKS:

1   ibid 2, Page No. 114-132
2   ibid 3, Page No. 301-313
3   ibid 4, Page No. 78-101

ARTICLE:

1   Frank Gurski, JochenRethmann, " Moving Bins from Conveyor Belts onto Pallets using FIFO",Operations Research Proceedings 2014, pp 185-191, http://link.springer.com/chapter/10.1007/978-3-319-07001-8_25

WEBSITE:

1   http://cpp.datastructures.net/presentations/Queues.pdf

UNIT II: TREES

LECTURES 9-13

INTRODUCTION TO TREES

OBJECTIVE:

In these lectures students will get to learn about a non linear data structure tree which is mainly used to represent data containing hierarchical relationship between elements.

CONTENTS:

- ➢ General trees
- ➢ Binary search trees
- ➢ Properties of tree
- ➢ Tree traversal
    - Pre-order
    - Post-order
    - In-order
- ➢ Representation of trees
- ➢ Selection trees
- ➢ Applications of trees:
    - External sort
    - Priority queues
        - o Merge
        - o Add
        - o Delete
    - Heaps sort
        - o Adding an element
        - o Deleting an element
- ➢ Height biased leftist tree
    - Definition
    - Merging Height biased leftist tree
    - Time complexity

➢ Weight biased leftist tree

ASSIGNMENTS FROM QUESTION BANK:

1   Refer Unit II Section I: Q 1-8, 13-21, 23, 24, 30
2   Refer Unit II Section II: Q 1, 4, 6

OTHER ASSIGNMENTS:

1   ibid 2, Page No.1
2   ibid 3, Page No. 419, Q 7.1

SUGGESTED READINGS:

TEXT BOOK:

1   ibid 1, Page 7.1-7.30

REFERENCE BOOKS:

1   ibid 2, Page No. 176-185
2   ibid 3, Page No. 240-255
3   ibid 4, Page No. 105-107

ARTICLES:

1   NitinArora, Pradeep Kumar Kaushik, Satendra Kumar "Iterative Method for Recreating a Binary Tree from its Traversals", International Journal of Computer Applications, November 2012, Volume 57, No. 11, pp 6-13, http://www.ijcaonline.org/archives/volume57/number11/9156-2056

2   R. Pagh. Locality-sensitive hashing without false negatives. In Proceedings of the Twenty Seventh Annual ACM-SIAM Symposium on Discrete Algorithms, SODA 2016, Arlington, VA, USA, January 10-12, 2016, pages 1–9, 2016.

WEBSITE:

1   http://cpp.datastructures.net/presentations/Trees.pdf

LECTURES 14-18

BINARY TREES

OBJECTIVE:

These lectures will explain the concept of one of the most important data structures in computer science, a binary search tree. This is important to study as it searches an element in log n time.

The basic purpose is to store information into a desired tree pattern where searching and sorting will take less time and solve as many as problem.

CONTENTS:

- ➢ Definition
- ➢ Binary Tree Traversal (recursive and non-recursive)
  - • Preorder
  - • Postorder
  - • Inorder
- ➢ Data Structures for Binary Trees
  - • Arrays
  - • Pointer based
- ➢ Binary search tree basic operations
  - • Definition
  - • Search in BST
  - • Insertion in BST
  - • Deletion in BST
- ➢ Threaded binary trees
  - • Definition
  - • Insertions and deletions
- ➢ AVL Trees
  - • Definition
  - • Maximum Height of an AVL Tree
  - • Rotation in BST
  - • Insertions and Deletions
- ➢ The family of B-trees
  - o B* - trees
  - o B$^+$- trees
  - o Prefix B$^+$- trees
- • Need, properties, creation and uses

ASSIGNMENTS FROM QUESTION BANK:

1 Refer Unit II Section I: Q 7, 9, 10, 15 – 30
2 Refer Unit II Section II: Q 1, 2, 3, 5, 7-10, 11, 12, 13, 35, and 36,40,41,42
3 Refer Unit II Section III: Q 14,15

OTHER ASSIGNMENTS:

1 ibid 1, Page No.7.92, Supplementary Problem Q 7.1-7.5 and 7.9 – 7.14
2 ibid 2, Page No. 322, Q4, 9, 27,34,38,39
3 ibid 3, Page No. 419, Q 7.2-7.6, 7.8, 7.9, 7.23-7.27, 7.31, 7.32, 7.33

SUGGESTED READINGS:

TEXT BOOK:

1   ibid 1, Page No. 7.31-7.64

REFERENCE BOOKS:

1   ibid 2, Page No. 186-322
2   ibid 3, Page No. 319-418
3   ibid 4, Page No. 111-162

ARTICLES:

1   Joao Paulo Fernandes, Joao Saraiva, Daniel Seidel, and Janis Voigtländer "Stratification of Circular Program", Partial Evaluation and Program Manipulation (PEPM'11), Proceedings ACM Press, 2011, http://www.iai.uni-bonn.de/~jv/pepm11.pdf.
2   Hashing for indexing binary inner products and set containment. In Proceedings of the 24th International Conference on World Wide Web, WWW 2015, Florence, Italy, May 18-22, 2015, pages 981–991, 2015.

WEBSITES:

1   http://cpp.datastructures.net/presentations/BinarySearchTrees.pdf
2   http://cpp.datastructures.net/presentations/AVLTrees.pdf

UNIT III: GRAPHS

LECTURES 19-24

INTRODUCTION TO GRAPHS

OBJECTIVE:

These lectures will help the students to understand one of the most versatile data structure graphs which is like a tree and to study some algorithms used for traversing this data structure. This topic will enhance the knowledge on undirected and directed graph and explain their examples which are oriented from our daily life computation problem.

CONTENTS:

> ➢ Basic concepts and definitions
> ➢ Path
> ➢ Elementary Graph Operations
>> • Depth first Search
>> • Breadth first Search

- Connected Components
- Bi-connected components
- Representation of Graph
  - Matrix representation
  - Linked representation
- Shortest path algorithms
  - Warshall's Algorithm
  - Warshall's Modified Algorithm
  - Dijkstra's Technique
  - Floyd's Technique
- Coloring of graphs

ASSIGNMENTS FROM QUESTION BANK:

1   Refer Unit III Section I: Q 26 – 28, 30 - 33, 36 - 38, 40 – 44, 48, 49, 59-62 ,63
2   Refer Unit III Section II:Q 12, 13, 20, 25, 34, 36,39,40

OTHER ASSIGNMENT:

1   ibid 2, Page No. 416 Q8,9

SUGGESTED READINGS:

TEXT BOOK:

1   ibid 1, Page No.8.1-8.8

REFERENCE BOOKS:

1   ibid 2, Page No. 346-397
2   ibid 3, Page No. 423-48
3   ibid 4, Page No. 299-359

ARTICLES:

1   TengkuNadzion, Amar Faiz, "A Brief Analysis of Gravitational Search Algorithm (GSA) Publication from 2009 to May 2013", International Conference Recent Trends in Engineering & Technology (ICRET'2014), Feb 13-14, 2014,
http://eprints2.utem.edu.my/11670/1/2014_Conf._13Feb_ICRET2014_BATAM_(1).pdf
2   Paul Swoboda, Bjoern Andres, "A Message Passing Algorithm for the Minimum Cost Multicut Problem", https://arxiv.org/abs/1612.05441, Dec 2016.

WEBSITE:

1   http://cpp.datastructures.net/presentations/Graph.pdf

LECTURES 25-28

SPANNING TREES

OBJECTIVE:

In field of graph theory a spanning tree T of a connected, undirected graph G is a tree composed of all the vertices and some (or perhaps all) of the edges of G. In these lecture students will study the algorithms to find the shortest path in these tree like prim's &kruskal algorithm.

CONTENTS:

- ➢ Graph Traversal
- ➢ Spanning Trees
- ➢ Connectivity
  - • Connectivity in undirected Graphs
  - • Connectivity in directed Graphs
- ➢ Transitive closure
- ➢ Topological Sort
- ➢ Activity network
- ➢ Critical path
- ➢ Path enumeration
- ➢ Minimum cost spanning trees
  - • Prim's Algorithm
  - • Kruskal's Algorithm

ASSIGNMENTS FROM QUESTION BANK:

1   Refer Unit II Section I: Q 29, 34, 55, 57,58
2   Refer Unit II Section II: Q 11, 14, 15 – 18, 20, 21, 25
3   Refer Unit III Section III: Q35, 37-40

OTHER ASSIGNMENTS:

1   ibid 1, Page No.8.41 Supplementary problems Q8.1-8.20
2   ibid 2, Page No.414 Q1, Page No. 415 Q4, 5, 7, 8

SUGGESTED READINGS:

TEXT BOOK:

1   ibid 1, Page No. 8.9-8.29

REFERENCE BOOKS:

1   ibid 2, Page No. 326-348,398-414

2   ibid 3 Page No. 469-477

WEBSITE:

1   http://cpp.datastructures.net/presentations/MST.pdf

ARTICLES:

1   Gautama J.Kamani, N N Jain, P V Virparia, "Development of Software Dispatcher based Load Balancing Algorithms for Heterogeneous Cluster based Web Systems", National Journal of System & Information Technology, Vol. 5 No. 2, December 2012, pp. 105-114.
2   R. Spring and A. Shrivastava. Scalable and sustainable deep learning via randomized hashing.CoRR, abs/1602.08194, Nov 2016.

LECTURES 29-32

SEARCHING AND SORTING

OBJECTIVE:

Sorting and searching are the fundamental operations in computer science. These lectures will focus on explaining the various sorting algorithms like insertion, selection, merge sort etc. The purpose of Sorting is to arrange the data according to their values in some specified order, where order can be either ascending or descending.

CONTENTS:

- ➢ Elementary sorting algorithms
  - Insertion sort
  - Selection sort
  - Bubble sort
- ➢ Efficient sorting algorithms
  - Shell sort
  - Heap sort
  - Quick sort
    - o Meaning and algorithm
    - o Implementation of algorithm
    - o Algorithm runs with examples
  - Radix sort
    - o Meaning and algorithm
    - o Implementation of algorithm
    - o Algorithm runs with examples
  - Merge sort
    - o Merging
    - o Iterative merge sort

           o   Recursive merge sort
- Sorting on several keys
- List and table sort
- Internal sorting in brief

ASSIGNMENTS FROM QUESTION BANK:

1   Refer Unit III Section I: Q 1 – 25, 45
2   Refer Unit III Section II: Q 1 – 10, 19, 22, 23
3   Refer Unit I Section III: Q27

OTHER ASSIGNMENTS:

1   ibid 1, Page No.9.25, Q 9.1-9.8
2   ibid 2, Page No.470 ,Q5,10,12,14,15,16,18.

SUGGESTED READINGS:

TEXT BOOK:

1   ibid 1, Page No. 9.1-9.24

REFERENCE BOOKS:

1   ibid 2, Page No. 417-470
2   ibid 4, Page No. 235-265

WEBSITES:

1   http://cpp.datastructures.net/presentations/DivideAndConquer.pdf
2   http://cpp.datastructures.net/presentations/RadixSort.pdf
3   http://cpp.datastructures.net/presentations/QuickSort.pdf
4   http://www.eportfolio.lagcc.cuny.edu/scholars/doc_fa09/eP_fa09/Jariya.%20
     Phongsai/documents/mac%20286/sorting%20algorithms%20research.pdf

LECTURES 33-34

HASHING

OBJECTIVE:

The search time of each algorithm discussed so far depends on the number of elements in collection S of data. These lectures will focus on discussing a searching technique called hashing which is essentially independent of the number of elements in S.

CONTENTS:

- ➢ Hash functions
  - Division
  - Folding
  - Mid Square functions
  - Extraction
  - Radix transformation
- ➢ Collision resolution
  - Open addressing
  - Chaining
  - Bucket addressing
- ➢ Hash functions for extendible files
  - Extendible hashing
  - Linear hashing

ASSIGNMENTS FROM QUESTION BANK:

1 Refer Unit IV Section I: Q 46, 47
2 Refer Unit IV Section II:Q 24
3 Refer Unit III Section III Q36,37,38

OTHER ASSIGNMENT:

1 ibid 2, Page No. 491, Q1-9

SUGGESTED READINGS:

REFERENCE BOOKS:

1 ibid 2, Page No. 472-491
2 ibid 4, Page No. 165-191

ARTICLES:

1 SatyenderNathMandal, "An Innovative Idea to Represent Tree in Huffman Data Compression Algorithm", The IUP journal of Computer Science, Vol. 7, No. 2, April 2013, pp-25-38.
2 R. Spring and A. Shrivastava. Scalable and sustainable deep learning via randomized hashing.CoRR, abs/1602.08194, 2016.

WEBSITE:

1 http://cpp.datastructures.net/presentations/HashTables.pdf

LECTURES 35

STATIC AND DYNAMIC HASHING

OBJECTIVE:

In these lectures student will learn the concept of static hashing where the identifiers are stored in a fixed size table called a hash table and dynamic hashing where hash table grows to handle more items. The associated hash function must change as the table grows.

CONTENTS:

- ➢ The symbol table abstract data type
- ➢ Static hashing
  - Hash tables
  - Hashing functions
  - Overflow handling
  - Theoretical evaluation of overflow techniques
- ➢ Dynamic hashing
  - Motivation for dynamic hashing
  - Dynamic hashing using directories
  - Analysis of directory based dynamic hashing
  - Directory less dynamic hashing

ASSIGNMENTS FROM QUESTION BANK:

1   Refer Unit IV Section I**:** Q 46, 47, 50 – 55, 57, 58, 59
2   Refer Unit IV Section II**:** Q 24, 20, 21, 23, 25, 26

SUGGESTED READINGS:

ARTICLE:

1   Kun Zhao," A Dynamic Hashing Approach to Build the de BruijnGraph for Genome Assembly",   TENCON   2013   -IEEE   Region   10   Conference, http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=6719008&url=http%3A%2F%2Fieee xplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D6719008

WEBSITE:

1   http://cpp.datastructures.net/presentations/HashTables.pdf

UNIT IV: FILES

LECTURES 36-38

INTRODUCTION TO FILES

OBJECTIVE:

These lectures will help in understanding the concept of file organization. A file is a collection of data, usually stored on disk. As a physical entity, a file should be considered in terms of its organization.

CONTENTS:

- ➢ Files, queries and sequential organization
  - • Definition of file
  - • Sample data for employee file
  - • Advantages and disadvantages
- ➢ Storage device types
- ➢ Operation on sequential files
  - • Creation
  - • Updating
  - • retrieval
- ➢ Query types
  - • Mode of update
  - • Number of keys
  - • Mode of retrieval
  - • Alternative sequential interpretation of disk memory
- ➢ Advantages and disadvantages of sequential file organization

ASSIGNMENTS FROM QUESTION BANK:

1   Refer Unit IV Section I**:** Q 1 - 11
2   Refer Unit IV Section II**:** Q 1 - 12
3   Refer Unit IV Section III: Q22, 23

OTHER ASSIGNMENT:

1   ibid 2, Page No.678, Q 10.5

SUGGESTED READINGS:

REFERENCE BOOK:

1   ibid 3, Page No 578-595

LECTURES 39-40

DATA REPRESENTATION AND BUFFERING

OBJECTIVE:

These lectures will acquaint students with the concept of data representation and buffering techniques.

CONTENTS:

- ➢ Data representation and density
- ➢ Error control techniques
  - Parity codes
  - Hamming distance
  - Linear block codes
  - Parity check matrix
- ➢ Devices and channels
- ➢ Double buffering
  - Page flipping
  - Triple buffering
  - Quad buffering
- ➢ Block buffering
  - Line buffering
  - No buffering

ASSIGNMENTS FROM QUESTION BANK:

1   Refer Unit IV Section I**:** Q 12 - 14
2   Refer Unit IV Section II**:** Q 13

SUGGESTED READINGS:

REFERENCE BOOK:

1   ibid 3, Page No.597-615.

WEBSITE:

1   http://cpp.datastructures.net/presentations/Tries.pdf

LECTURES 41-42

FILE HANDLING AND EXTERNAL SORTING

OBJECTIVE:

These lectures will focus on handling of binary files in C language and to explain the various ways involved in external sorting and the algorithms associated with it.

CONTENTS:

- ➢ Handling of binary files
  - Seeking
  - Positioning
  - Reading
  - Writing
- ➢ External sorting
  - Definition
  - Examples
  - K-Way merging
  - K-Way merge with floating buffers
  - Balanced merge sort
  - Polyphase merge sort
  - Buffer handling for parallel operation
  - Optimal merging of runs
    - o Two-way merges
    - o Analysis of Huffman
    - o Construction of a Huffman tree

ASSIGNMENTS FROM QUESTION BANK:

1   Refer Unit IV Section I**:** Q 15 - 20
2   Refer Unit IV Section II**:** Q 14, 15, 17, 12,23

OTHER ASSIGNMENT:

1   ibid 3, Page No. 667, Q 9.21, 9.22, 9.23, 9.24

SUGGESTED READINGS:

REFERENCE BOOKS:

1   ibid 3, Page No. 626-655
2   ibid 4, Page No. 266-277

ARTICLE:

1   Kamlesh Kumar Pandey,Rajesh Kumar Bunkar, "A Comparative Study of Different Types of comparison Based Sorting Algorithms in Data Structure", International Journal of Advanced Research in Computer Science and Software Engineering, February 2014, http://www.ijarcsse.com/docs/papers/Volume_4/2_February2014/V4I2-0170.pdf

LECTURE PLAN

OBJECT ORIENTED PROGRAMMING IN C++

MCA-104

COURSE OUTLINE
MCA-II SEMESTER
OBJECT ORIENTED PROGRAMMING IN C++ - MCA 104

L – 03 T - 01 Credit - 04

OBJECTIVE:

Object-oriented programming languages are playing an increasingly important role in computing science and its applications. With the declining hardware costs, the cost of computing systems is largely dominated by software. Object-oriented analysis and design is an upcoming technology that software professionals have employed in the development of large software projects. The objective is to make students learn object-oriented paradigms, the need for OOPs technology, extending C, C++ at a glance, fundamental constructs of the C++ language, classes and objects, inheritance, polymorphism, generic programming, stream computation , fault tolerant programming with exceptions.

INTERNAL ASSESSMENT AND ASSIGNMENT (40 MARKS)

1. Class Test-I – (Written Test)	15 marks
2. Class Test-II - (Written Test)	15 marks
3. Class Assessment + Attendance	10 marks

COURSE CONTENTS

UNIT I (08 Hours)
- OOP paradigm:
    - Comparison of programming paradigms
    - Characteristics of object-oriented programming languages
    - Object-based programming languages
- C++:
    - Brief history of C++
    - Structure of a C++ program
    - Difference between c and C++ - cin, cout, new, delete operators
    - ANSI/ISO standard C++
    - Comments, working with variables and const qualifiers.
    - Enumeration, arrays and pointer.
- Implementing oops concepts in C++ objects:
    - Classes
    - Encapsulation
    - Data abstraction
    - Inheritance
    - Polymorphism
    - Dynamic binding
    - Message passing
    - Default parameter value

◦   Using reference variables with functions.

UNIT II   **(10 Hours)**

- ➤ Abstract data types:
  - ◦ class component
  - ◦ object & class
- ➤ Constructors default and copy constructor
- ➤ Assignment operator deep and shallow coping
- ➤ Access modifiers – private, public And protected
- ➤ Implementing class functions within class declaration or outside the class declaration
- ➤ Instantiation of objects scope resolution operator
- ➤ Working with friend functions
- ➤ Using static class members.
- ➤ Understanding compile time polymorphism
  - ◦ Function overloading
  - ◦ Rules of operator overloading (unary and binary) as member function/friend function
  - ◦ Implementation of operator overloading of arithmetic operators, overloading output/input
  - ◦ Prefix/ postfix increment and decrement operators, overloading comparison operators
  - ◦ Enumeration, Arrays and Pointer
  - ◦ Assignment, subscript and function call operator , concepts of namespaces

UNIT – III   **(16 Hours)**

- ➤ Inheritance:
  - o Inheritance
  - o Types of Inheritance
  - o Abstract Classes
  - o Ambiguity resolution using scope resolution operator and Virtual base class
  - o Aggregation, composition vs. classification hierarchies
- ➤ Overriding inheritance methods
  - o Constructors and Destructor in derived classes
  - o Multiple Inheritance
- ➤ Polymorphism:
  - o Polymorphism
  - o Type of Polymorphism – compile time and runtime
  - o Understanding Dynamic polymorphism
    - ▪ Pointer to objects
    - ▪ Virtual Functions (concept of VTABLE)
    - ▪ pure virtual functions
    - ▪ Abstract Class
- ➤ Advanced Input/Output, Exception Handling and Manipulating strings:
  - o Using istream /ostream member functions
  - o Using Manipulators

- o Creating Manipulator Functions
- o Understanding Implementation of Files
- o Writing and Reading Objects
- o Understanding of working and implementation of Exception Handling.

UNIT – IV   **(08 Hours)**

- ➢ Generic Programming and mastering STL:
  - o Understanding Generic Functions with implementation of searching sorting algorithm
  - o Overloading of Function Templates
- ➢ Understanding Class Templates using :
  - o Implementation of Generic stack
  - o linked lists: singly and doubly linked lists
  - o Binary Search Tree basic operations
- ➢ Understanding Inheritance with Generic Class
- ➢ Standard Template Library:–
  - o Understanding Components of Standard Template Library
  - o Working of Containers
  - o Algorithms
  - o Iterators and Other STL Elements
- ➢ Implementation of Sequence and Associative containers for different Algorithms using their Iterator
- ➢ Understanding of Algorithms Requiring Operations on the element using function objects
- ➢ Implementing graph algorithm dfs, bfs, minimum spanning tree, dijkastraetc using STL.

STUDY MATERIAL FOR THE SUBJECT

Following will be the study material for topics of Object Oriented Programming and students are advised to go through the material for thorough understanding of the subject.

➢ **TEXT BOOKS:**

1.   **Author's Name(s):** Herbert Schildt
      Title: C++: The Complete Reference
      Edition: IV **Year:** 2012
      Publisher: TataMcGraw-Hill   (ibid 1)

2.   **Author's Name(s):** Venugopal, Rajkumar, Ravishankar
      Title: Mastering C++
      Edition: 1 **Year:** 2013
      Publisher: Tata McGraw Hill Publishing Co. Ltd   (ibid 2)

3.   **Author's Name(s):** Bruce Eckel
      Title: Thinking in C++
      Edition: II **Year:** 2013
      Publisher: Pearson   (ibid 3)

➢ **REFERENCE BOOKS:**

1.   **Author's Name(s):** E Balagurusamy
      Title: Object-Oriented Programming C++
      Edition: V **Year:** 2013
      Publisher: Tata McGraw Hill Publishing Co. Ltd   (ibid 4)

2.   **Author's Name(s):** Robert Lafore
      Title: Object Oriented Programming in C++
      Edition: IV **Year:** 2014
      Publisher: Pearson   (ibid 5)

➢ **PERIODICALS:**

1.   International Journal of Electronics and Computer Science Engineering, 2012, Vol. 1, Issue 4,www.ijecse.org
2.   International Journal of Computer Science and Information Security, 2012 Vol. 10, Issue 5, http://ijcsns.org/
3.   International Journal on Computer Science and Engineering, 2012, Vol. 4, Issue 1, www.ijcse.com/
4.   International Journal of Computers & Technology, 2012, Vol. 2, Issue 1,http://www.cirworld.com/index.php/ijct

5.   International Journal of Computer Science and Information Security, 2012, Vol. 10, Issue4, http://www17.us.archive.org/stream/ProceedingsOfJournal OfComputer Science Vol.10 No.4 April2012/Journal Of Computer Science IjcsisVol.10No.4April2012_djvu.txt.

6.   International Journal of Computer Science and Information Security, 2012, Vol. 10, Issue 5, http://archive.org/stream/ResearchJournalOfComputerScienceAnd InformationSecurity262/JournalOfComputerScienceIjcsisVol.10No.5May2012djv u.txt

7.   International Journal on Computer Science and Engineering, 2012, Vol. 4, Issue 11, http://www.enggjournals.com/ijcse/doc/IJCSE12-04-11-085.pdf

8.   IEEE Transactions on Computers, August 2013, http://www.computer.org/ csdl/trans/tc/preprint/06574862.pdf

9.   IEEE Conference Publications, 2013 50th ACM/EDAC/IEEE, http://www.cs. columbia.edu/~luca/research/bombieri_DAC13.pdf

10.   International Journal of Scientific & Engineering Research , Volume 6, Issue 10 ,October2015,http://www.ijser.org/onlineResearchPaperViewer.aspx?Moving-Object-Detection-and-Extraction-for-Video-Editing.pdf

11.   International Journal of Innovative Research in Science , Engineering and Technology , vol. 4 , Issue 2, February 2015 , pp. 539 -544, http://www.rroij.com/open-access/an-efficient-methodology-for-developing-and-maintaining-consistent-software-using-ooad-tools.pdf

UNIT I

INTRODUCTION TO OOPS AND BASIC TERMS

OBJECTIVE:

The objective is to make students aware of the Object-Oriented Programming popularly called OOPs in the software industry. This topic gives the comparison of OOP with other programming languages.Also these lectures would be emphasizing on solving real life problems using OOP concepts.

CONTENTS:

- OOP paradigm:
    - Comparison of programming paradigms
        - Monolithic programming
        - Procedural programming
        - Structured programming
        - Object–Oriented programming
    - Characteristics of object-oriented programming languages
    - Object-based programming languages

ASSIGNMENTS FROM QUESTION BANK:

1   Unit 1 Section 2 23-27, 45-46
2   Unit 1 Section 3 Q1- 7, 27
3   Unit 1 Section 4 Q-1-10

OTHER ASSIGNMENT:

1   ibid 2, Page No. 31 Q1.1-1.18
2   ibid 3, Page No 22 Q 1-8

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 1,Page No. 256-288
2   ibid 2,Page No. 1-35

REFERENCE BOOKS:

1   ibid 4,Page No. 4-13, 19-30.
2   ibid 5,Page No. 10-22.
3   ibid 2,Page No. 4-25.

WEBSITES:

1   en.wikipedia.org/wiki/Object-oriented_programming

2   http://www.cplusplus.com/doc/tutorial/
3   http://www.tutorialspoint.com/cplusplus/cpp_object_oriented.htm

LECTURES 4-5

C++ AT A GLANCE AND MOVING FROM C TO C++

OBJECTIVE:

The objective is to introduce the basics of the C++ language which is evolved as a result of extension and enhancement of C. It emphasizes on data decomposition rather than algorithm decomposition. These lectures present the first impression of C++ with its features of OOPs.

CONTENTS:

- Introduction to C++ :
    - Brief history of C++
    - Structure of a C++ program
    - Difference between c and C++
        - cin
        - cout
        - new
        - delete operators
    - ANSI/ISO standard C++
    - Comments
    - Working with variables
        - const qualifiers.
    - Enumeration
    - Arrays
    - Pointer

ASSIGNMENTS FROM QUESTION BANK:

1   Unit 1 Section 2 Q 5-21,28-44
2   Unit 1 Section 3 Q 8-18,25-26
3   Unit 1 Section 4 Q 1-12

OTHER ASSIGNMENTS:

1   ibid 2, Page No. 71-72 Q2.1-2.23
2   ibid 4, Page No. 71 Q 3.1 – 3.19
3   ibid 5, Page No. 45 Q 5-25

SUGGESTED READINGS:

TEXT BOOK:

1   ibid 2,Page No. 32 - 67

REFERENCE BOOKS:

1   ibid 4,Page No. 36-42
2   ibid 5, Page No. 22
3   ibid 3, Page No. 50-75

LECTURES 6-8

OBJECT ORIENTED PARADIGM & BASICS C++ CONSTRUCTS

OBJECTIVE:

The objective is to make students understand how OOPs concepts are implemented in C++. Also basic constructs and concept of data types, arithmetic operators, unary operators, relational and logical operators, assignment operators, conditional operators, bit operators, precedence, and associativity of operators would be discussed in detail.

CONTENTS:

➢   Implementing oops concepts in C++ objects:
   ○   Classes
   ○   Encapsulation
   ○   Data abstraction
   ○   Inheritance
   ○   Polymorphism
   ○   Dynamic binding
   ○   Message passing
   ○   Default parameter value
   ○   Using reference variables with functions.

ASSIGNMENTS FROM QUESTION BANK:

1   Unit 1 Section 2 Q 1 – 4, 23-26
2   Unit 1 Section 3 1-7

OTHER ASSIGNMENTS:

1   ibid 2, Page No. 142, Q4.1-4.25
2   ibid 4, Page No. 75, Q 3.1 – 3.6
3   ibid 5, Page No. 28-32

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 2,Page No. 73-95
2   ibid 3,Page No. 23-79
3   ibid 4, Page No. 78-82

REFERENCE BOOKS:

1   ibid 4, Page No. 64-68
2   ibid 5, Page No. 16-21

ARTICLES:

1   Sheeba Praveen , RizwanBeg, "Object oriented Full Function Point Analysis: A Model for Real Time Application", International Journal of Electronics and Computer Science Engineering,2012, Vol. 1, Issue 4, pp 2409-2416 ,http://www.ijecse.org/wp-content/uploads/2012/10/Volume-1Number-4PP-2409-2416.pdf
2   Muck T. , Frohlich A. ," Towards Unified Design of Hardware and Software Components Using C++ ", IEEE Transactions on Computers, August 2013,http://www.computer.org/csdl/trans/tc/preprint/06574862.pdf
3   Shivam , "A Study of Inheritance Using Object Oriented Programming with C++", International Journal of Computer Applications Volume 123, No.1 August 2015 , http://www.ijcaonline.org/research/volume123/number1/amalarethinam-2015-ijca-905226.pdf
4   Gomathi. S, Edith Linda. P, "An Overview of Object Oriented Metrics A complete Survey", International Jounal of Computer Science & Engineering Technology, Vol. 4 No.09 Sep 2013.

LECTURES 9-12

CLASSES, OBJECTS AND CONSTRUCTORS

OBJECTIVE:

The objective of these lectures is to introduce students to the concept of classes and objects. The real need of classes and objects would be discussed and explained. Students would also be made aware of the fact that C++ language offers number of ways to initialize an object. There are constructor and destructor which are used to initialize the value of an object automatically when it is created.

CONTENTS:

- ➤ Abstract data types:
  - ○ Class component
  - ○ Object & Class
- ➤ Passing objects as arguments
  - ○ Passing objects by value
  - ○ Passing objects by reference
  - ○ Passing objects by pointer
- ➤ Constructor
  - ○ Syntax of constructor
  - ○ Parameterized constructors
- ➤ Destructor
  - ○ Syntax of Destructor
- ➤ Constructor overloading
- ➤ Difference between constructor and destructor

- ➢ Order of construction and destruction
- ➢ Constructor with default arguments
- ➢ Copy constructor
  - o Implementation of copy constructor
  - o Usage of copy constructor
  - o Advantage of copy constructor
- ➢ Nameless Objects
- ➢ Const member function and mutable
- ➢ Volatile member functions
- ➢ Deep and shallow coping

ASSIGNMENTS FROM QUESTION BANK:

1   Unit 2 Section 2 Q 1-4, 7, 9-11, 15-19, 23, 27-31
2   Unit 2 Section 3 Q10-18, 20-21
3   Unit 2 Section 4 Q1-11, 13-14, 42 -44

OTHER ASSIGNMENT:

1   ibid 2, Page No. 167 Q5.1-5.16
2   ibid 4, Page No. 150 Q3.1 – 6.13

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 2,Page No. 313- 316, 363- 397
2   ibid 3, Page No. 84-105
3   ibid 4,Page No. 80-83

REFERENCE BOOK:

1   ibid 5, Page No. 216-256

ARTICLES:

1   Mohammad AhmerMunir Khan, Rita Chhikara," Impact of Predicate on Object Oriented Programming", International Journal of Computer Science and Information Security, 2012, Vol. 10, Issue 5, pp 66-68, http://archive.org/stream/ResearchJournalOfComputerScienceAndInformationSecurity_262/JournalOfComputerScienceIjcsisVol.10No.5May2012_djvu.txt
2   Shivam, "A Study on Inheritance Using Object Oriented Programming with C++", International Journal of Advance Research in Computer Science and Management Studies, Vol. 1 Issue 2 July 2013, http://www.ijarcsms.com/docs/paper/volume1/issue2/V1I2-0005.pdf

LECTURES 13-15

ACCESS MODIFIERS AND FRIEND FUNCTION

OBJECTIVE:

These lectures explain various access modifiers by which the data members and member function gain visibility inside and outside the class. It also describes how a function can access private members of a class and the use of making a class or function as static.

CONTENTS:

- ➢ Access modifiers
    - ○ Private
    - ○ Public
    - ○ Protected
- ➢ Implementing class functions
    - ○ Within class declaration
    - ○ Outside the class declaration
- ➢ Instantiation of objects
    - ○ Scope resolution operator
- ➢ Returning objects from function
- ➢ Friend functions and friend classes
- ➢ Static data and member function
    - ○ Static data member definition
        - • Private static data member
        - • Access rules for static data member
    - ○ Static member functions

ASSIGNMENTS FROM QUESTION BANK:

1   Unit 2 Section 2 Q 5-8, 20, 36
2   Unit 2 Section 3 Q 1-8, 22-23

OTHER ASSIGNMENT:

1   ibid 2, Page No. 189-190 Q6.1-6.14

SUGGESTED READING:

TEXT BOOKS:

1   ibid 2, Page No. 317-360
2   ibid 3, Page No. 279-287, 290-299

LECTURES 16-17

COMPILE TIME POLYMORPHISM

OBJECTIVE:

The lectures describe compile time polymorphism explaining function overloading and operator overloading. It explains the conversion between different data types from basic to object and vice-versa.

CONTENTS:

- ➢ Understanding compile time polymorphism
    - ○ Function overloading
    - ○ Rules of operator overloading (unary and binary)
        - ▪ As member function
        - ▪ As friend function
    - ○ Implementation of operator overloading
        - ▪ Arithmetic operators
        - ▪ Overloading output/input operators
- ➢ Conversion between basic data types
- ➢ Conversion between objects and basic data types

ASSIGNMENTS FROM QUESTION BANK:

1   Unit 2 Section 2 Q 22, 37-39, 42-44
2   Unit 2 Section 3 Q24-25

OTHER ASSIGNMENTS:

1   ibid 2, Page No. 361-362 Q10.1-10.8
2   ibid 4, Page No. 136-137 Q5.1-5.7

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 1,Page No. 290-297
2   ibid 2,Page No. 432-438, 464-470
3   ibid 3, Page No. 328- 349
4   ibid 5,Page No. 431-445

REFERENCE BOOKS:

1   ibid 4,Page No. 96-109
2   ibid 5, Page No. 188,320-343

LECTURES 18-21

OPERATOR OVERLOADING

OBJECTIVE:

The objective of the lectures is to demonstrate the use of operator overloading through various operators defined in C ++. It also helps in understanding the concept of namespaces.

CONTENTS:

- ➢ Prefix increment operators
- ➢ Postfix increment operators
- ➢ Prefix decrement operators
- ➢ Postfix overloading operators
- ➢ Comparison operator overloading
- ➢ Assignment operator overloading
- ➢ Subscript operator overloading
- ➢ Function call operator overloading
- ➢ Concepts of namespaces
- ➢ Namespaces
  - • Namespaces fundamentals
  - • Using keyword
  - • Unnamed namespaces
  - • Some namespaces options
- ➢ The std namespace

ASSIGNMENTS FROM QUESTION BANK:

1   Unit 2 Section 2 Q 12-14, 32-35, 40-41
2   Unit 2 Section 3 Q19,26
3   Unit 2 Section 4 Q12,14

OTHER ASSIGNMENTS:

1   ibid 2, Page No. 362 Q10.9-10.20
2   ibid 4, Page No. 137 Q5.8-5.10

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 1, Page No. 298-315
2   ibid 2, Page No. 441-462, 477-488
3   ibid 3, Page No. 512-570

REFERENCE BOOKS:

1   ibid 4,Page No. 115 - 130

2   ibid 5, Page No. 320-343
3   ibid 2, Page No.463-468

LECTURES 22-24

INHERITANCE

OBJECTIVE:

The objective is to make students understand the concepts of inheritance, class hierarchy, and derivation - public, private & protected, Aggregation, composition vs. classification hierarchies.

CONTENTS:

- ➢ Introduction to inheritance
    - o Use of inheritance
    - o Benefits of inheritance
- ➢ Derived class declaration
- ➢ Inheritance and member accessibility
- ➢ Types of Inheritance
    - o Single inheritance
    - o Multilevel inheritance
    - o Multiple inheritance
    - o Hierarchical inheritance
    - o Hybrid inheritance
- ➢ Abstract Classes
- ➢ Ambiguity resolution using scope resolution operator
- ➢ Ambiguity resolution using Virtual base class
- ➢ Aggregation
- ➢ Composition
- ➢ Classification
- ➢ Composition vs. classification hierarchies

ASSIGNMENTS FROM QUESTION BANK:

1   Unit 3 Section 2 Q 1-8
2   Unit 3 Section 3 Q9-11

OTHER ASSIGNMENTS:

1   ibid 2, Page No. 398 Q11.1-11.11
2   ibid 4, Page No. 165-166 Q6.1-6.10

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 1,Page No. 317-324

2   ibid 2,Page No. 499-511, 558-567
3   ibid 3, Page No. 616-654

REFERENCE BOOKS:

1   ibid 4,Page No. 144-162
2   ibid 5, Page No. 372-420

ARTICLES:

1   Sanjay Kumar Dubey, Ajay Rana, "Fuzzy Model for Quantifying Usability of Object Oriented Software System", International Journal of Computer Science and Information Security, 2012, Vol. 10, Issue 4, pp 79-84, http://www17.us.archive.org/stream/Proceedings OfJournalOf Computer ScienceVol.10No.4 April2012/JournalOfComputerScienceIjcsisVol.10No. 4April2012 _djvu.txt
2   Bombieri N., Hung-Yi Liu, Fummi, F., Carloni, L. ," A method to abstract RTL IP blocks into C++ code and enable high-level synthesis ",IEEE Conference Publications , 2013 50th ACM / EDAC / IEEE, http://www.cs.columbia.edu/~luca/research/bombieri_DAC13.pdf
3   Gomathi. S, Edith Linda. P, "An Overview of Object Oriented Metrics A complete Survey", International Jounal of Computer Science & Engineering Technology, Vol. 4 No.09 Sep 2013, http://www.ijcaonline.org/research/volume123/number1/amalarethinam-2015-ijca-905227.pdf

LECTURE 25

CONSTRUCTOR AND DESTRCUTOR IN DERIVED CLASS

OBJECTIVE:

C++ tales the middle ground between languages which support dynamic memory allocation and languages in which all variables are dynamically allocated. The objective of this lecture is to introduce how to dynamically allocate memory using C++.

CONTENTS:

➢ Overriding inheritance methods
   o Constructors in derived classes
   o Destructor in derived classes
➢ Constructor invocation and data member initialization
➢ Overloaded member functions
➢ Multipath inheritance and virtual base class
➢ Inheritance and protected members.
➢ Meaning of overriding
   o Multiple Inheritance

ASSIGNMENTS FROM QUESTION BANK:

1   Unit 3 Section 2 Q 12-13
2   Unit 3 Section 3 Q7, 8, 13

OTHER ASSIGNMENT:

1   ibid 2, Page No. 431 Q12.1-12.12

SUGGESTED READING:

TEXT BOOKS:

1   ibid 1, Page No. 331-359
2   ibid 2, Page No. 516-548

LECTURES 26-28

VIRTUAL FUNCTIONS AND POLYMORPHISM

OBJECTIVE:

The objective is to make students understand the concept of polymorphism, how to implement polymorphism through different techniques in C++.

CONTENTS:

- ➢ Polymorphism:
    - o   Polymorphism
    - o   Type of Polymorphism
        - ▪   Compile time
        - ▪   Runtime
    - o   Understanding Dynamic polymorphism
        - ▪   Pointer to objects
        - ▪   Virtual Functions (concept of VTABLE)
- ➢ Virtual function
    - • Calling a virtual function through a base class reference
- ➢ Virtual attribute is inherited
- ➢ Virtual function are hierarchical
- ➢ Pure virtual function
    - • Abstract classes
- ➢ Using virtual functions
- ➢ Virtual destructors
- ➢ Limitations of virtual constructors
- ➢ Usage of dynamic binding
- ➢ Difference between late binding and early binding.

ASSIGNMENTS FROM QUESTION BANK:

1   Unit 3 Section 2 Q 9-11
2   Unit 3 Section 3 Q10-12

OTHER ASSIGNMENTS:

1   ibid 2, Page No. 568-569 Q14.1-14.21
2   ibid 4, Page No. 243 Q8.1-8.16

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 1, Page No. 420-439
2   ibid 2,Page No. 570-593
3   ibid 3, Page No. 660-716

REFERENCE BOOKS:

1   ibid 4,Page No. 201 – 240
2   ibid 5, Page No. 504-519

ARTICLE:

1   Manik Sharma, Chandni Sharma, AnkurBhardwaj, Navpreet Singh, Lakhbir Singh "Comparative Study of Static Metrics of Procedural and Object Oriented Programming Languages", International Journal of Computers & Technology, 2012, Vol. 2, Issue 1, pp 15-19,http://www.cirworld.com/index.php/ijct/article/view/481/302

LECTURES 29-32

FILE HANDLING

OBJECTIVE:

The objective is to make students understand the usage of file stream classes and their hierarchy. The lectures explain the opening and closing of file along with its manipulation with pointers and accesses.

CONTENTS:

➢ Introduction
  • What is a file
  • What is stream
➢ Hierarchy of file stream classes
  • Filebuf()
  • Fstreambuf()
  • Ifstream
  • Ofstream

- fstream
- Opening and closing of files
  - Opening file using constructor
  - Prototype of file stream class constructor
- Opening and closing files explicitly
  - Opening file in write mode
    - Syntax of opening file in write mode
  - Opening file in read mode
    - Syntax opening file in read mode
- Testing for errors
- File open modes
  - in
  - out
  - ate
  - app
  - trunk
  - nocreate
  - noreplace
  - binary
- File pointer and their manipulation
  - Default actions
  - Functions for manipulation of filepointers
    - seekg()
    - seekp()
    - tellg()
    - tellp()
- Sequential access to a file
- ASCII and binary files
- Saving and retrieving of objects
- File input/output with fstream class
- Random access to a file
- Error handling during file manipulation

ASSIGNMENTS FROM QUESTION BANK:

1   Unit 3 Section 2 Q 20 -25
2   Unit 3 Section 3 Q 13, 20

OTHER ASSIGNMENTS:

1   ibid 2, Page No. 594-595 Q15.1-15.13
2   ibid 4, Page No. 283-289 Q9.1-9.15

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 1,Page No. 446-460
2   ibid 2,Page No. 629-660, 664-691

REFERENCE BOOKS:

1   ibid 4,Page No. 251 - 258
2   ibid 5, Page No. 568-624

ARTICLES:

1   SoumiGhosh, Sanjay Kumar Dubey , Ajay Rana, "Object Oriented Software System based on AHP", International Journal on Computer Science and Engineering, 2012, Vol. 4, Issue 11, pp. 1848-1853, http://www.enggjournals.com/ijcse/doc/IJCSE12-04-11-085.pdf
2   S. Pasupathy , Dr. R. Bhavani, "An Efficient Methodology for Developing and Maintaining Consistent Software Using OOAD Tools", International Journal of Innovative Research in Science , Engineering and Technology , vol. 4 , Issue 2, February 2015 , pp. 539 -544, http://www.rroij.com/open-access/an-efficient-methodology-for-developing-and-maintaining -consistent-software-using-ooad-tools.pdf

LECTURES 33-34

EXCEPTION HANDLING

OBJECTIVE:

In these lectures students will learn about how to handle exception and program them using C++. This explains all the exception handling constructs and their handling option.

CONTENTS:

- ➢ Introduction to exception handling
- ➢ Error handling
- ➢ Exception handling model
- ➢ Exception handling construct
    - Try
    - Catch
    - Throw
- ➢ List of exceptions
    - Syntax of specifying a list of exceptions
- ➢ Raising an unspecified exception
- ➢ Exception in a No-exception function
- ➢ Exception handling options
    - Catch all exceptions
    - Restricting exceptions

- Rethrowing exceptions
➢ Exception in constructors and destructors
➢ Handling uncaught exception
➢ Exceptions in operator overloaded function
➢ Exceptions in inheritance tree
➢ Exceptions in class templates

ASSIGNMENTS FROM QUESTION BANK:

1   Unit 3 Section 2 Q 14-19, 26-29, 30, 31
2   Unit 3 Section 3 Q7, 8, 9, 16, 17
3   Unit 3 Section 4 Q 16

OTHER ASSIGNMENTS:

1   ibid 2, Page No. 497-498 Q13.1-13.20
2   ibid 4, Page No. 196-197 Q7.5-7.15

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 1,Page No. 362-380
2   ibid 2,Page No. 703-742

REFERENCE BOOKS:

1   ibid 4,Page No. 171 – 187
2   ibid 5, Page No. 703-720

LECTURES 35-38

TEMPLATES

OBJECTIVE:

In these lectures students will learn about C++ Programming capability of reusability through generic programming with the help of templates.

CONTENTS:

➢ Introduction to generic programming and templates
➢ Generic functions
- Function with two generic types
- Explicitly overloading a function template
- Using standard parameters with template functions
- Generic function restrictions

- ➢ Applying generic functions
  - A generic sort
  - Compacting an array
- ➢ Generic classes
  - An example with two generic data types
  - Applying templates classes: a generic array class
  - Using default arguments with template classes
- ➢ The power of templates
- ➢ Implementing generic programming using templates
- ➢ Advantages of templates
- ➢ Disadvantages of templates

ASSIGNMENTS FROM QUESTION BANK:

1   Unit 4 Section 2 Q 1-8, 20-22, 26-31
2   Unit 4 Section 3 Q 21, 22, 23

OTHER ASSIGNMENTS:

1   ibid 2, Page No. 627-628 Q16.1-16.12
2   ibid 4, Page No. 376 Q12.1-12.7

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 1,Page No. 462-487
2   ibid 2,Page No. 596-626
3   ibid 3, Page No. 723-779

REFERENCE BOOKS:

1   ibid 4,Page No. 359-374
2   ibid 5, Page No. 682-702
3   ibid 2, Page No.630-642

LECTURES 39 -44

STANDARD TEMPLATE LIBRARY

OBJECTIVE:

The Standard Library is a fundamental part of the C++ Standard. It provides C++ programmers with a comprehensive set of efficiently implemented tools and facilities that can be used for most types of applications. These lectures briefly present the fundamental concepts in the STL.
CONTENTS:

- ➢ Introduction
  - • Overview of STL
  - • STL availability and information
  - • Contents of STL
  - • Use of STL
- ➢ Templates
- ➢ STL collection type and Containers
  - • Vector
  - • List
  - • Dequeue
  - • Map
  - • Set
  - • Multipmap
  - • Multiset
- ➢ STL strings
  - • String()
  - • Wstring()
- ➢ STL stream
  - • Stringstream()
  - • WstringSTream()
- ➢ STL Collections General Class Methods
  - • empty
  - • size
  - • begin
  - • end
  - • rbegin
  - • rend
  - • clear
  - • erase
- ➢ Standard input and output
- ➢ Vector and Dequeue add and remove methods
  - • push_back
  - • push_front.
  - • back
  - • front
  - • pop_back
  - • pop_front
- ➢ Operator []
- ➢ Iterators
  - • iterator (forward iterator through collection)
  - • reverse_iterator (reverse iterator through collection)
  - • random access (used by vector declared as forward and reverse_iterator)
- ➢ Declaring collections
- ➢ Algorithms

- Sequence
- Sorting
- Numeric
➢ The remaining STL components
  - Working of components
  - Vector
  - List
  - Dequeue
  - Iterator
  - Tags
  - Associative Containers

ASSIGNMENTS FROM QUESTION BANK:

1   Unit 4 Section 2 Q 20-22,26-31
2   Unit 4 Section 3 Q11-13, 28-30
3   Unit 4 Section 4 Q 12-14

OTHER ASSIGNMENT:

1   ibid 4, Page No. 423 Q14.1-14.12

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 1, Page No. 626-691
2   ibid 2, Page No. 640-645

REFERENCE BOOKS:

1   ibid 4,Page No. 401-419
2   ibid 5, Page No. 726-794

LECTURE PLAN

OPERATING SYSTEMS

MCA-106

COURSE OUTLINE
MCA-II SEMESTER
OPERATING SYSTEMS - MCA 106

L - 4 Credits - 04

OBJECTIVE:

The objective of the course is to familiarize students with fundamentals of an operating system, developing a competency to recognize its design features and issues associated to each type. Also, the focus is on developing a mature understanding of operating system design and how it impacts application systems design and performance.

INTERNAL ASSESSMENT AND ASSIGNMENT	25 marks
1. Class Test-I – (Written Test)	15 marks
2. Class Assessment + Attendance	10 marks

COURSE CONTENTS:

UNIT - I (10 Hours)

1. **INTRODUCTION TO OPERATING SYSTEMS**
    - What is an Operating System?
    - Multiprogrammed Batches systems
    - Time-Sharing Systems
    - Personal-computer systems Advantages
    - Parallel systems
    - Distributed Systems
    - Real-Time Systems

2. **PROCESSES**
    - Process Concept
    - Process Scheduling
    - Operation on Processes
    - CooperatingProcesses
    - Threads

3. **CPU SCHEDULING**
    - Basic Concepts
    - Scheduling Criteria
    - Scheduling Algorithms
    - Multiple-Processor Scheduling
    - Real-Time Scheduling
    - Algorithm Evaluation

UNIT – II   **(11 Hours)**

4. INTER PROCESS COMMUNICATION & SYNCHRONIZATION
- Background
- The Critical-Section Problem
- Synchronization Hardware
- Semaphores
- Classical Problems of Synchronization
- Critical Regions
- Monitors
- Synchronization in Solaris 2
- Atomic Transactions

5. DEADLOCKS
- System Model
- Deadlock Characterization
- Methods for Handling Deadlocks
- Deadlock Prevention
- Deadlock Avoidance
- Deadlock Detection
- Recovery from Deadlock
- Combined Approach to Deadlock Handling

6. MEMORY MANAGEMENT
- Background
- Logical versus Physical Address space
- Swapping
- Contiguous allocation
- Paging
- Segmentation
- Segmentation with Paging

7. VIRTUAL MEMORY
- Demand Paging
- Page No. Replacement
- Page No.-replacement Algorithms
- Performance of Demand Paging
- Allocation of Frames
- Thrashing
- Demand Segmentation

UNIT – III   **(12 Hours)**

8. DEVICE MANAGEMENT
- Techniques for Device Management
- Dedicated Devices
- Shared Devices
- Virtual Devices
- Device Characteristics-Hardware Consideration
- Input or Output Devices
- Storage Devices
- Channels and Control Units
- Independent Device Operation
- Buffering
- Multiple Paths
- Block Multiplexing
- Device Allocation Consideration

9. SECONDARY-STORAGE STRUCTURE
- Disk Structure
- Disk Scheduling
- Disk Management
- Swap-Space Management
- Disk Reliability
- Stable-Storage Implementation

UNIT – IV   **(10 Hours)**

10. FILE-SYSTEM INTERFACE
- File Concept
- Access Methods
- Directory Structure
- Protection
- Consistency Semantics

11. FILE-SYSTEM IMPLEMENTATION
- File- System Structure
- Allocation Methods
- Free-Space Management
- Directory Implementation
- Efficiency and Performance
- Recovery

12. SECURITY
- The Security problem
  - Goals of protection

- Access matrix
- Authentication
- Program threats
- System threats
- Intrusion detection
- Cryptography

13. Case Study
- Linux Operating System
- Windows XP.

STUDY MATERIAL FOR THE SUBJECT

Following will be the study material for topics of operating systems and students are advised to go through the material for thorough understanding of the subject.

➢ **MAIN TEXT BOOK**

1. **Author's Name(s):** Silbersachatz, Galvin and Gagne
   Title: Operating System Concepts
   Edition: IX **Year:** 2015
   Publisher: Pearson Education   (ibid 1)

➢ **REFERENCE BOOKS**

1. **Author's Name(s):** William Stallings
   Title: Operating Systems
   Edition: VI **Year:** 2012
   Publisher: Prentice Hall of India Pvt. Ltd   (ibid 2)

2. **Author's Name(s):** Andrew S. Tannenbaum
   Title: Operating Systems
   Edition: III **Year:** 2015
   Publisher: Pearson Education   (ibid 3)

➢ **PERIODICALS**

1. Remote Operating System Classification over IPv6, AISec '15 Proceedings of the 8th ACM Workshop on Artificial Intelligence and Security, Pages 57-67, ACM New York, NY, USA,2015.
2. Resource management in a multi-operating environment, https://www.google.com/patents/US8983536, 2015.
3. Recorded history feature in operating system Windowing system, http://www.freepatentsonline.com/y2015/0355825.html, 2015.
4. Booting an operating system of a system using a read ahead technique, https://www.google.com/patents/US9015461, 2015.
5. International Journal of Information and Communication Technology Research, Volume 2 No. 5, May 2012, pp 448-451, http://esjournals.org/journalof technology/archive/vol2no5/vol2no5_5.pdf
6. Journal of Information Science And Engineering, Vol. 28, No. 4, September 2012, http://www.iis.sinica.edu.tw/page/jise/2012/201209_04.pdf
7. EMSOFT'12, October 7–12, 2012, http://www.qucosa.de/fileadmin/data/qucosa/documents/15719/pdftron_pdfa2b_1 149_Bjoern_Doebel.pdf
8. Operating System Review, Vol. 47, No 2, July 2013.
9. Operating System Review, Vol. 47, No. 1, Jan 2013.

10.   Microsoft Research, April 2013, http://research.microsoft.com/en-us/um/people/livshits/papers%5Cpdf%5Chotos13.pdf
11.   Microsoft Research June 2013, http://research.microsoft.com/pubs/194499/YunxinLiuMobiSys20131.pdf
12.   IUP Journal of Computer Science, Vol. 7, No. 1, January 2013.
13.   SIGOPS, Vol 47, No.1, July 2013, pp 66-72.
14.   IUP Journal of Computer Science, Vol. 7, No. 3, July 2013.

LECTURES 1- 3

INTRODUCTION TO OPERATING SYSTEMS

OBJECTIVE:

The objective is to familiarize students with fundamentals of operating system, its need and capabilities. Also, various types of operating systems would be discussed and compared briefly. The focus will be on understanding the major functions and services provided by modern operating systems, what problems those functions were designed to solve, and how to use them effectively.

CONTENTS:

- ➢ Introduction to Operating systems
- ➢ Fundamental goal of an Operating System
- ➢ Need of an Operating System
- ➢ Types of Operating System
  - o Batch Operating System
  - o Multi programming Operating System
  - o Multitasking Operating System
  - o Multi user Operating System
  - o Time Sharing Operating System
  - o Real Time Operating System
  - o Network Operating System
  - o Distributed Operating System

ASSIGNMENTS FROM QUESTION BANK:

1 Unit I , Section II: Q1,2,3,4,23,25
2 Unit I, Section III: Q1,2,3,410,16,17

OTHER ASSIGNMENTS:

1 ibid 1, Page No. 44-45, Q 1.16- 1.23

SUGGESTED READINGS:

TEXT BOOK:

1 ibid 1,Page No. 1-30

REFERENCE BOOKS:

1 ibid 2,Page No. 50-76
2 ibid 3,Page No. 18-20

ARTICLES:

1 BeiWanga,YuxiaChenga, Wenzhi Chena, QinmingHea, Yang Xianga, Mohammad MehediHassanc, AbdulhameedAlelaiwic,"Efficient consolidation-aware VCPU scheduling on multicore virtualization platform", Future Generation Computer Systems, Volume 56, March 2016, Pages 229–237
2 Poster Abstract: XBOS: An Extensible Building Operating System, Proceedings of the 2nd ACM International Conference on Embedded Systems for Energy-Efficient Built Environments, Pages 119-120, 2015

3 Loris D'Antoni, Alan Dunn, Suman Jana, Tadayoshi Kohno, Benjamin Livshits, David Molnar, Alexander Moshchuk, EyalOfek, FranziskaRoesner, Scott Saponas, MargusVeanes, and Helen J Wang, "Operating System Support for Augmented Reality Applications",Microsoft Research, April 2013, http://research.microsoft.com/en-us/um/people/livshits/papers%5Cpdf%5Chotos13.pdf
4 MateusKrepskyLudwich, Antônio Augusto Fröhlich, "On the Formal Verification of Component-based Embedded Operating Systems"SIGOPS, Vol. 47, No. 1, January 2013, pp 28-34

LECTURES 4-6

PROCESS SYNCHRONIZATION

OBJECTIVE:

The objective of the lectures is to make student acquainted with the significance of inter-process communication and synchronization. The usage of semaphores, locks and monitors in inter-process communication and synchronization would be discussed upon. Also, various classical problems of synchronization would be discussed with their solutions.

CONTENTS:

- Processes
    - Two-State Process Model include:
        - Running
        - Not– running
- Various process states are:
  Each process may be in one of following states:
    - New
    - Running
    - Waiting
    - Running
    - Terminated
- Process Control Block (PCB)
    - Program counter
    - CPU state

- CPU scheduling info
- Memory management info
- I/O status info

ASSIGNMENTS FROM QUESTION BANK:

1   Unit I, Section II: Q15, Q20, Q22, Q25,26,27,28,29,30, 31, 33
2   Unit I, Section III: Q12, 13, 14, 23, 31

OTHER ASSIGNMENTS:

1   ibid 1, Page No. 142, Q 3.9
2   ibid 2, Page No. 154, Q 3.1-3.3

SUGGESTED READINGS:

TEXT BOOK:

1   ibid 1, Page No.101-140

REFERENCE BOOKS:

1   ibid 2, Page No. 107-146

LECTURES 7-9

CONTEXT SWITCHING AND SCHEDULERS

OBJECTIVE:

The objective of the lectures is to make students comprehend the creation of high performance system using context switching and scheduling. Thorough understanding of process states and various types of schedulers involved would be conferred with students.

CONTENTS:

- Context
- Context Switching
- Steps in context switch:
- Context switch versus Process switch
- Process Creation
- Scheduling Queues
- Representation of Process Scheduling CPU Scheduler
  - Switches from running to waiting state.
  - Switches from running to ready state
  - Switches from waiting to ready

     o Terminates.
- ➢ Dispatcher
- ➢ Types of Schedulers
  - o Long term schedulers
  - o Short term schedule
  - o Medium term scheduler
- ➢ Cooperating processes
- ➢ Inter process communication

ASSIGNMENTS FROM QUESTION BANK:

1 Unit I, Section II: Q13, 19, 35
2 Unit I, Section III: Q9, 11, 12, 15

OTHER ASSIGNMENT:

1 ibid 1, Page No. 141, Q3, 4

SUGGESTED READINGS:

TEXT BOOK:

1 ibid 1, Page No. 116-128

ARTICLE:

1. G. Siva NageswaraRao, S.V.N Srinivasu, "Task Scheduling for Real TimeApplications using Mean-Difference Round Robin (MDRR) Algorithm with Dynamic Time Slice (MDDRWDTS)" International Journal of Pharmacy & Technology, August 2016.

LECTURES 10-13

CPU SCHEDULING ALGORITHMS

OBJECTIVE:

The objective of the lectures is to explain the students the various scheduling criteria and the various scheduling algorithms based on those criteria. The scheduling criteria would be discussed in detail for concrete understanding on utilization of CPU. Various scheduling algorithms would be compared and contrasted.

CONTENTS:

- ➢ Scheduling Criteria
  - o CPU utilization
  - o Throughput

- o Turnaround time
- o Waiting time
- o Response time
- ➢ Optimization Criteria
  - o Max CPU utilization
  - o Max throughput
  - o Min turnaround time
  - o Min waiting time
  - o Min response time
- ➢ CPU Scheduling
- ➢ Scheduling Algorithms
  - o First-Come, First-Served Scheduling
  - o Shortest-Job-First Scheduling
  - o Priority Scheduling
  - o Round-Robin Scheduling
  - o Multilevel Queue Scheduling
  - o Multilevel Feedback Queue Scheduling

ASSIGNMENTS FROM QUESTION BANK:

1   Unit I, Section II: Q13,14,19,20,22
2   Unit I, Section III: Q 15,22, 28, 29

OTHER ASSIGNMENTS:

1   ibid 1, Page No. 218, Q 5.1-5.9

SUGGESTED READINGS:

TEXT BOOK:

1   ibid 1, Page No. 183-213

REFERENCE BOOK:

 1 ibid 3, Page No. 132-150

ARTICLES:

1   HongxingWeia, ZhenzhouShaob, Zhen Huanga, RenhaiChend, Yong Guanb, JindongTanc, ZiliShaod," RT-ROS: A real-time ROS architecture on multi-core processors ", Future Generation Computer Systems, Volume 56, March 2016, Pages 171–178.
2   R Siyambalapitiya, M Sandirigama, "Performance of a Few Gang Scheduling Algorithms for Multiprocessor Scheduling", The IUP Journal of Computer Sciences, Vol. 7, No.3, July 2013, pp 7-26.

3   Shweta Jain, Dr. Saurabh Jain (2016), "A Review Study on the CPU Scheduling Algorithms", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 5, Issue 8.

4   AndysahPuteraUtamaSiahaan (2016), "Comparison Analysis of CPU Scheduling: CFS, SJF and Round Robin", International Journal of Engineering Development and Research, Volume 4, Issue 3.

LECTURES 14-18

PROCESS SYNCHRONIZATION

OBJECTIVE:

The objective of the lectures is to explain the students the concept of process synchronization and challenges of synchronizing concurrent processes and threads. Various mechanisms to ensure orderly execution of cooperating processes that share logical address space would be discussed comprehensively.

CONTENTS:

- Process Synchronization
- Bounded-Buffer and Producer/Consumer Problem and algorithm
- The critical section problem
- Solution to Critical- Section Problem
    - Mutual Exclusion
    - Progress
    - Bounded Waiting.
- Two-Process Synchronization
- Bakery Algorithm
- Mutual Exclusion with Test- and- Set
- Semaphore

ASSIGNMENTS FROM QUESTION BANK:

1   Unit II, Section II: Q 14, 15, 16 ,17,27, 28, 29, 30
2   Unit II, Section III: Q 8, 9, 10, 11, 13, 16, 17, 19,24,27, 28, 29, 30

OTHER ASSIGNMENT:

1   ibid 1, Page No. 267-268, Q 6.1-6.7

SUGGESTED READINGS:

TEXT BOOK:

1   ibid 1, Page No. 225-231

REFERENCE BOOKS:

1 ibid 2, Page No. 206-216
2 ibid 3, Page No. 124-129

ARTICLES:

1 FengyuanXu, Yunxin Liu, Thomas Moscibroda, Ranveer Chandra, Long Jin, Yongguang Zhang, Qun Li, "Optimizing Background Email Sync on Smartphones", Microsoft Research June 2013, http://research.microsoft.com/pubs/194499/YunxinLiu_MobiSys_2013_1.pdf
2 Mei-Ling Chiang, Hsiang-Yu Hsu, "A Platform for Supporting Dynamic Update and Resource Protection in an Embedded Operating System" Journal of Information Science And Engineering, Vol. 28, No. 4, September 2012, pp 875-893, http://www.iis.sinica.edu.tw/page/jise/2012/201209_04.pdf
3 Mopati B. Kekgathetse, Keletso J. Letsholo, "A SURVEY ON DATABASE SYNCHRONIZATION ALGORITHMS FOR MOBILE DEVICE", Journal of Theoretical and Applied Information Technology, Vol.86. No.1, pp. 1-9.

LECTURES 19-22

SEMAPHORES & CLASSICAL PROBLEMS OF SYNCHRONIZATION

OBJECTIVE:

The objective of the lectures is to introduce the critical-section problem, whose solutions can be used to ensure the consistency of shared data. Also both software and hardware solutions of the critical-section problem would be discussed cogently.

CONTENTS:

- Mutual Exclusion with Semaphores
- Semaphore Implementation
- Semaphore as General Synchronization Tool
- Semaphores as Process Synchronization
- Deadlock and Starvation
- Deadlock
- Two Types of Semaphores
    - Counting semaphore
    - Binary semaphore
    - Implementing S (Semaphore) as a Binary
- Classical Problems of Synchronization
    - Bounded-Buffer Problem
    - Readers and Writers Problem
    - Dining-Philosophers Problem
- Bounded- Buffer Problem
- Readers-Writers Problem

- ➢ Dining- Philosophers Problem
- ➢ Critical Regions
- ➢ Monitors
  - o Monitor Implementation Using Semaphores

ASSIGNMENTS FROM QUESTION BANK:

1 Unit II, Section II: Q 14, 15, 16 , 17,18, 19, 20, 24, 25, 26, 31, 34
2 Unit II, Section III: Q 8, 9, 10, 11, 13, 16, 17, 19, 34

OTHER ASSIGNMENTS:

1 ibid 1, Page No. 269-270, Q 6.11-6.18

SUGGESTED READINGS:

TEXT BOOK:

1 ibid 1, Page No. 234-252

REFERENCE BOOKS:

1 ibid 2, Page No. 219-249
2 ibid 3, Page No. 124-129

LECTURES 23-26

DEADLOCKS IN OPERATING SYSTEMS

OBJECTIVE:

The objective of the lectures is todevelop a description of deadlocks, which prevent sets of concurrent processes from completing their tasks. After the descriptions focus would be on detection, prevention, avoidance and finally recovery from the deadlock. Various techniques would be discussed to deal with deadlocks in a computer system.

CONTENTS:

- ➢ Deadlock - definition
- ➢ Consequences of deadlocks
- ➢ The conditions under which deadlocks can occur in a system:
  - o A deadlock situation can arise if the following four conditions hold simultaneously in a system:
    - ▪ Mutual Exclusion
    - ▪ Hold and Wait

- No Preemption
- Circular Wait
  - o All four conditions must hold for a deadlock to occur.
- ➢ Resource-Allocation Graph
- ➢ Methods for Handling Deadlocks
  - o Deadlocks can be handled in many ways. These are as follows:
    - Deadlock prevention
    - Deadlock Avoidance
    - Deadlock Detection and Recovery
    - Detecting Deadlocks with single unit resources
- ➢ Detecting Deadlocks with multiple unit resources
- ➢ Deadlock Recovery
- ➢ Deadlock Avoidance
- ➢ The Banker's Algorithm for deadlock avoidance
- ➢ Safety Algorithm

ASSIGNMENTS FROM QUESTION BANK:

1 Unit II, Section II: Q 17, 18, 19, 20, 35
2 Unit II, Section III: Q 12,25,26
3 Unit II, Section IV: Q5,6,7

OTHER ASSIGNMENT:

1 ibid 1, Page No. 307-309, Q 7.1-7.14

SUGGESTED READINGS:

TEXT BOOK:

1 ibid 1, Page No. 283-305

REFERENCE BOOKS:

1 ibid 2,Page No. 262-282
2 ibid 3, Page No. 159-184

ARTICLE:

1 Thomas Moore, Daniel Stouch," A Generalized Extended Kalman Filter Implementation for the Robot Operating System ", Intelligent Autonomous Systems 13,Volume 302 of the series Advances in Intelligent Systems and Computing pp 335-348,September 2015
2 Colin Dixon, RatulMahajan, SharadAgarwal,AJ Brush, Bongshin Lee, Stefan Saroiu, ParamvirBahl, "An Operating System for the Home", Microsoft Research, April 2012, http://research.microsoft.com/apps/pubs/default.aspx?id=157701

3 Dr. DeeptiMalhotra (2016), " Different Deadlock Handling Strategies in DistributedEnvironment", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 6, Issue 2, pp. 167-175.

LECTURES 27-31

MEMORY MANAGEMENT

OBJECTIVE:

The objective of these lectures is to provide a detailed description of various ways of organizing memory hardware. The various memory-management techniques, including paging and segmentation would be discussed. Also, a case study of Intel Pentium would be discussed to elaborate pure segmentation and segmentation with paging.

CONTENTS:

- ➢ Introduction to memory management
- ➢ Logical vs. Physical address space
- ➢ Address binding
- ➢ Dynamic loading
- ➢ Dynamic linking and shared libraries
- ➢ Swapping
- ➢ Contiguous allocation
  - ▪ Memory protection
  - ▪ Memory allocation
    - ✓ First fit
    - ✓ Best fit
    - ✓ Worst fit
- ➢ Paging
  - o Basic method
  - o Hardware support
  - o Protection with paging
  - o Structure of the Page No. table
  - o Hierarchical Page No. table
    - ▪ Hashed Page No. table
    - ▪ Inverted Page No. table
    - ▪ Hierarchical paging
    - ▪ Shared Page No's
- ➢ Segmentation
  - o Protection and sharing
  - o Fragmentation
- ➢ Segmentation with paging
- ➢ Intel Pentium case discussion

ASSIGNMENTS FROM QUESTION BANK:

1   Unit II, Section II: Q 4, 5, 6, 7,21,22,23,27
2   Unit II, Section III: Q1, 2, 3, 4, 5, 6, 7,21,22,23,24,25,22, 32
3   Unit II, Section IV: Q1,2,3

OTHER ASSIGNMENTS:

1   ibid 1, Page No. 350-352, Q 8.1-8.3
2   ibid 2, Page No. 336,Q 7.2,7.6-7.8

SUGGESTED READINGS:

TEXT BOOK:

1   ibid 1, Page No. 315-345

REFERENCE BOOKS:

1   ibid 2, Page No. 311-331

LECTURES 32-35

VIRTUAL MEMORY MANAGEMENT

OBJECTIVE:

The objective of the lectures is to describe the benefits of a virtual memory system. To explain the concepts of demand paging, page-replacement algorithms, and allocation of page frames as virtual memory management strategies. Also the principle of the working-set model for efficient paging in virtual memory management would be discussed.

CONTENTS:

- ➢ Introduction to virtual memory
- ➢ Demand Paging
    - o   What is a lazy swapper?
    - o   How does demand paging work?
    - o   Steps in handling a Page No. fault
    - o   Performance of Demand Paging
- ➢ Page Replacement Algorithm
    - o   FIFO Page replacement
    - o   Optimal Page replacement
    - o   LRU Page replacement
    - o   LRU approximation replacement
    - o   Counting based replacement

- o Page buffering algorithm
- ➢ Copy On Write
- ➢ Allocation of Frames
  - o Minimum number of frames
  - o Allocation algorithms
  - o Global Vs local allocation
- ➢ Thrashing
  - o Cause of thrashing
  - o Working set model
  - o Page No. fault frequency
- ➢ Demand Segmentation

ASSIGNMENTS FROM QUESTION BANK:

1 Unit-II, Section II: Q 4, 7
2 Unit II, Section III: Q 1, 4, 5, 6,21, 33, 35
3 Unit II, Section IV: Q4

OTHER ASSIGNMENTS:

1 ibid 1, Page No. 409-411, Q 9.4- 9.5,9.7-9.9,9.17,9.18
2 ibid 2, Page No. 396,Q 8.1-8.12

SUGGESTED READINGS:

TEXT BOOK:

1 ibid 1, Page No. 357-407

REFERENCE BOOKS:

1 ibid 2, Page No. 345-382

ARTICLE:

1 BinghaoBao, Carlos Villarraga , Bernard Schmidt, DominikStoffel, Wolfgang Kunz, "A New Property Language for the Specification of Hardware-Dependent Embedded System Software", Languages, Design Methods, and Tools for Electronic System Design,Volume 361 of the series Lecture Notes in Electrical Engineering pp 83-100, December 2015

LECTURES 36-39

DEVICE MANAGEMENT

OBJECTIVE:

The objective of the lectures is management of I/O devices. The focus would be on functions & techniques of device management. Device characteristics and device allocation strategies would be discussed concisely.

CONTENTS:

- ➢ Techniques for Device Management,
    - o Dedicated Devices
    - o Shared Devices
    - o Virtual Devices
- ➢ Device Characteristics-Hardware Consideration
    - o I/O Devices
    - o Storage Devices
- ➢ Channels and Control Units,
    - o Independent Device Operation
    - o Buffering
    - o Multiple Paths
    - o Block Multiplexing
- ➢ Device Allocation Consideration

ASSIGNMENT FROM QUESTION BANK:

1   Unit III, Section II: Q 23,24,25
2   Unit III, Section III: Q 23, 26

OTHER ASSIGNMENT:

1   ibid 2, Page No. 538, 11.1-11.4

SUGGESTED READINGS:

REFERENCE BOOKS:

1   ibid 2, Page No. 495-506
2   ibid 3, Page No. 269-298

ARTICLE:

1   Michael P Mesnier, "Differentiated Storage Devices", SIGOPS, Vol. 45, No 1, Jan 2011, pp 45-53.

LECTURES 40-44

SECONDARY-STORAGE STRUCUTRE

OBJECTIVE:

The objective of the lectures is to describe the physical structure of secondary and tertiary storage devices and the resulting effects on the uses of the devices. To explain the performance

characteristics of mass-storage devices & discuss operating-system services provided for mass storage, including RAID and HSM.

CONTENTS:

- ➢ Overview of Mass storage (Secondary) structure
    - o Magnetic Disk
    - o Magnetic Tapes
- ➢ Disk Structure
- ➢ Disk Scheduling
    - o FCFS Scheduling
    - o SSTF Scheduling
    - o SCAN Scheduling
    - o C-SCAN Scheduling
    - o LOOK Scheduling
    - o C-LOOK Scheduling
- ➢ Disk Management
    - o Disk Formatting
- ➢ Swap-Space Management
- ➢ Disk Reliability

ASSIGNMENTS FROM QUESTION BANK:

1 Unit III, Section II: Q 1, 10,26,28,29, 30
2 Unit III, Section III:Q 1,2,3,20,21, 24, 25, 27

OTHER ASSIGNMENT:

1 ibid 1, Page No. 545, Q 13.1- 13.11

SUGGESTED READINGS:

TEXT BOOK:

1 ibid 1, Page No. 505-543

REFERENCE BOOK:

1 ibid 2, Page No. 507-525

LECTURES 45-47

FILE SYSTEM MANAGEMENT

OBJECTIVE:

The objective of the lectures is to explain the students the concept of file system which is the most visible aspect of operating systems. It provides the mechanism for online storage of and access to both data and programs of operating system.

CONTENTS:

- File system
  - Field
  - Record
  - File
  - Database
- File Structure
- File System components
  - Device Drivers
  - Basic File System
  - Logical File System
- File Types
- File Access
- File Attributes
- File operations
- Different systems provide different operations to allow storage and retrieval. The few of them of the most common system calls relating to files are:
  - Create
  - Delete
  - Open.
  - Close
  - Read
  - Write
  - Append
  - Get attributes
  - Set attributes
  - Rename
- File Management Systems
- The objectives for a file management system
- File System Architecture
- Functions of File
- Memory-mapped
- Access Methods
  - Sequential Access
  - Direct Access
- Access using an index
- File System Consistency
- File System Mounting

ASSIGNMENTS FROM QUESTION BANK:

1 Unit IV, Section II: Q 1, 2, 3
2 Unit IV, Section III: Q31, 32, 33, 34

OTHER ASSIGNMENT:

1   ibid 1, Page No. 457, Q 10.1- 10.5

SUGGESTED READINGS:

TEXT BOOK:

1   ibid 1, Page No. 421-456

REFERENCE BOOK:

1   ibid 2, Page No. 521-569

ARTICLES:

1   PinakiChakraborty, "Design and Implementation of an Object-Oriented Operating System", The IUP Journal of Computer Sciences, Vol. 7, No.1, Jan 2013, pp 7-36**.**
2   BjörnDöbel Hermann Härtig Michael Engel, "Operating System Support for Redundant Multithreading", EMSOFT'12, October 7-12, 2012, http://www.qucosa.de/fileadmin/data/ qucosa/documents/15719/pdftron_pdfa2b_1149_BjoernDoebel.pdf

LECTURES 48-50

FILE SYSTEM INTERFACE AND IMPLEMENTATION

OBJECTIVE:

The objective of the lectures is to explain the function of file systems, to describe the interfaces to file systems and to discuss file-system design tradeoffs, including access methods, file sharing, file locking, and directory structures. Also, to explore the details of implementing local file systems, directory structures, block allocation and free-block algorithms.

CONTENTS:

- ➢ File-System Structure
- ➢ File Allocation Methods
  - o   Contiguous Allocation
  - o   Linked Allocation
  - o   Hybrid Methods
  - o   Indexed Allocation
- ➢ Free-Space Management
- ➢ Directory Implementations
  - o   Unix
  - o   MS/DOS
- ➢ Directories
  - o   Directory Organization

- o Organization of the file system
- o Directory Structure
  - ▪ Single-Level Directory System
  - ▪ Two-Level Directory
  - ▪ Hierarchical Directory Systems
  - ▪ Tree-Structured Directory
  - ▪ Acyclic-Graph Directory
  - ▪ General-Graph Directory
- ➢ Directory Operations:
  - o Create
  - o Delete
  - o Opendir
  - o Closedir
  - o Readdir
  - o Rename
  - o Link
  - o Unlink
- ➢ Directory Implementations
  - o Linear List
  - o Hash Table

ASSIGNMENTS FROM QUESTION BANK:

1   Unit IV, Section II: Q 4-10, 19, 20
2   Unit IV, Section III: Q 1, 2, 3, 22, 29,30

OTHER ASSIGNMENT:

1   ibid 1, Page No. 499-501, Q12.1-12.12

SUGGESTED READINGS:

TEXT BOOK:

1   ibid 1, Page No. 461-479

REFERENCE BOOK:

1   ibid 2, Page No. 570-579

ARTICLE:

1   BinghaoBao, Carlos Villarraga, Bernard Schmidt, DominikStoffel, Wolfgang Kunz, "A New Property Language for the Specification of Hardware-Dependent Embedded System Software", Languages, Design Methods, and Tools for Electronic System Design,Volume 361 of the series Lecture Notes in Electrical Engineering pp 83-100, December 2015.

LECTURES 51-52
SECURITY

OBJECTIVE:

The objective of the lectures is todiscuss the goals and principles of protection and various security threats and attacks that can hinder the sound working of a modern computer system. The protection domains, an access matrix and how they are used to specify the resources access would be explained briefly. Also, the fundamentals of encryption, authentication, and hashing would be explained. Finally, the various counter measures to security attacks would be described.

CONTENTS:

- ➢ The Security problem
  - o Goals of protection
  - o Access matrix
- ➢ Authentication
  - o Program Threats
  - o System threats
  - o Intrusion Detection
  - o Cryptography
  - o Case studies : LINUX OS and WIN XP

ASSIGNMENTS FROM QUESTION BANK:

1 Unit IV, Section II: Q 4,5,6,7,8,9,10,11,12,13,14,15, 18
2 Unit IV, Section III: Q 1, 2, 3, 22, 24,25,26,27

OTHER ASSIGNMENTS:

1 ibid 1, Page No. 616, Q 14.1-14.4
2 ibid 1, Page No. 666, Q 15.1-15.5

SUGGESTED READINGS:

TEXT BOOK:

1 ibid 1, Page No. 591,598-604

REFERENCE BOOKS:

1 ibid 2, Page No. 635-696

ARTICLES:

1   Ashif S. Harji, Peter A. Buhr, Tim Brecht, "Our Troubles with Linux Kernel Upgrades and Why You Should Care", SIGOPS, Vol 47, No.1, July 2013, pp 66-72.
2   RitikaPandhi, **"**Framework for Security and Integration for GUI-Based Operating System", International Journal of Information and Communication Technology Research, Volume 2 No. 5, May 2012, pp 448-451, http://esjournals.org/journaloftechnology/archive/vol2no5/vol2no5_5.pdf
3   Sardasht M. Mahmood, Bakhtiar M. Amen, Rebwar M. Nabi (2016), "Mobile Application Security Platforms Survey", *International Journal of Computer Applications,*Vol 133, No.2, January 201, pp 40-46.
4   Mubina Malik, Trisha Patel (2016), "Database Security - Attacks and Control Methods",International Journal of Information Sciences and Techniques, Vol.6, No.1/2, March 2016.

LECTURE PLAN

DATABASE MANAGEMENT SYSTEMS

MCA-108

COURSE OUTLINE
MCA –II SEMESTER
DATABASE MANAGEMENT SYSTEMS- MCA 108

L – 3   P - 1 Credit - 04

OBJECTIVE:

Databases and database management systems have become essential for managing business, governments, banks, universities etc. Therefore, the purpose of this course is to enable the students know about the concepts, design, applications of database systems and in depth knowledge of SQL for implementing databases applications.

INTERNAL ASSESSMENT AND ASSIGNMENT	**25 marks**
1. Class Test-I – (Written Test)	15 marks
2. Class Assessment + Attendance	10 marks

UNIT – I   [No. of Hrs. 9]

*   Basic concepts: database & database users, characteristics of the database, database systems.
*   Concepts and architecture, date models, schemas & instances.
*   DBMS architecture & data independence, database languages & interfaces, data modeling using the entity-relationship approach.
*   Overview of hierarchical, Network & Relational Data Base Management Systems**.**

UNIT – II   [No. of Hrs. 12]

*   Relational model, languages & systems: relational data model & relational algebra
*   Relational model concepts, relational model constraints, relational algebra
*   SQL- a relational database language: date definition in SQL
*   View and queries in SQL, specifying constraints and indexes in SQL.

UNIT – III   [No. of Hrs. 10]

*   Oracle Architecture, Logical Data Structures Physical Data Structure,
*   Instances, Table Spaces, Types of Tablespaces,
*   Internal Memory Structure, Background Processes, Data Types, Roles &Privileges,
*   Stored Procedures, User Defined Functions, Cursors, Error Handling, Triggers.

- Relational data base design: function dependencies & normalization for relational databases.
- Functional dependencies, normal forms based on primary keys, (1NF, 2NF, 3NF & BCNF).
- Lossless join and dependency preserving decomposition.
- Concurrency control & recovery techniques: concurrency control techniques, locking techniques, time stamp ordering, granularity of data items.
- Recovery techniques: recovery concepts, database backup and recovery from catastrophic failures.
- Concepts of object oriented database management systems, Distributed Database Management Systems.

STUDY MATERIAL FOR THE SUBJECT

Following will be the study material for topics of Database Management Systems and students are advised to go through the material for thorough understanding of the subject.

TEXT BOOKS:

1
   Author's Name(s): Korth,Silberschatz
   Title: Database System Concepts
   Edition: 6th **Year:** Seventh reprint 2015
   Publisher: Tata McGraw Hill   (ibid 1)

2.
   Author's Name(s): Elmsari and Navathe
   Title: Fundamentals of Database Systems
   Edition: 6th Year: 2014
   Publisher: Pearson Education
                 (ibid 2)

REFERENCE BOOKS:

1.
   Author's Name(s): Date C.J
   Title: An Introduction to Database Systems
   Edition: 8th **Year:** 2013
   Publisher: Narosa Publishing
                 (ibid 3)

2.
   Author's Name(s): Ullman J.D
   Title: Principles of Database Systems
   Edition: 3rd**Year:** 2013
   Publisher: Galgotia Publications
                 (ibid 4)

3.
   Author's Name(s): S.K.Singh
   Title: Database System
   Edition: 2nd**Year:** 2011
   Publisher: Pearson Education
                 (ibid 5)

4.
   Author's Name(s): Tickoo Sham and Raina Sunil
   Title: Learning Oracle 11g: A PL/SQL Approach
   Edition: 1st **Year:** 2014(Reprint)
   Publisher: Pearson Education   (ibid 6)

5.
   Author's Name(s): Ivan Bayross   (ibid 7)
   Title: SQL, PL/SQL
   Edition: 4th Year: 2015(Reprinted)

➢ **PERIODICALS**

1. International Journal of Database Management Systems (IJDMS), AIRCC, VOL. 3, NO. 4, November 2011
2. ACM Transactions on Database Systems, Feb. 2012, Vol. 37, No. 1
3. SIGMOD Record , June 2012, Vol. 41,No. 4
4. ACM Transactions on Database Systems, June 2013 , Vol. 38, No. 2
5. SIGMOD Record, June 2013, Vol. 42, No. 2
6. SIGMOD Record , September 2013, Vol. 42, No. 3
7. ACM Transactions on Database Systems, November 2013, Vol. 38, No. 4
8. SIGMOD Record, December 2013, Vol. 42, No. 4
9. Proceedings of National Seminar: Techno Tryst 2014: Novel Paradigms of Software Engineering and Database Technologies
10. ACM Transactions on Database Systems, May 2014, Vol. 39,   No. 2
11. SIGMOD Record, June 2014, Vol. 43, No. 2
12. SIGMOD Record, September 2014, Vol.43, No. 3
13. ACM Transactions on Database Systems, September 2014, Vol. 39, No. 3
14. PCQUEST, November 2014
15. SIGMOD Record, December 2014, Vol. 44, Number 1
16. SIGMOD Record, March 2014, Vol. 44, Number 1
17. ACM Transactions on Database Systems, March 2015, Vol. 40, No. 1
18. SIGMOD Record, March 2015, Vol. 44, Number 1
19. SIGMOD Record, June 2016, Vol. 45, No. 2

LECTURE-1

UNIT-I

BASIC CONCEPTS OF DATABASE MANAGEMENT SYSTEMS

OBJECTIVE:

The objective is to introduce the basic concepts of database management systems and it also presents a list of capabilities that should be provided by the DBMS software to the DBA, database designers, and users, to help them design, administer and use a database.

CONTENTS:

- ➢ Basics of Database Management Systems
  - Introduction to data, database & database Management Systems
  - Database Users
  - Database applications
  - Advantages of using the Database Approach
  - Characteristics of the Database Approach
  - Types of Databases and Database Applications
  - When Not to Use Databases

ASSIGNMENTS FROM QUESTION BANK:

UNIT I

SHORT ANSWER QUESTIONS: Q1, 2, 3, 5

SUGGESTED READINGS:

TEXT BOOKS:

1 ibid 1, Page No. 1- 14
2 ibid 2, Page No. 3-28

REFERENCE BOOK:

1 ibid 5, Page No. 3-37

ARTICLES:

1 YahiaChabane, Launentd'Orazio, Le Gruen - Wald, Baraa Mohammad, Christophe Reej, "Medical Data Management in the S4Seo Project", SIGMOD Record, June 2013, Vol. 42, No. 2 , pp 48-53.

2   StephaneBressan.Chee Yong Chan, Wynne Hsu, Mong-Li Lee ,Tok –Wang Ling, Beng Chin Ooi, Kian-LeeTan, AnthaonyK.h. Tunj, "Database Research at the National University of Singapore", SIGMOD Record , June 2013, Vol 42, No. 2 , pp 48-53.

3   Accenture Big Success with Big Data Survey, "Big Success with Big Data", PCQUEST, Nov. 2014, pp 11-13.

4   Felix Naumann, "Data Profiling Revisited", SIGMOD Record, December 2013, Vol. 42, No. 4, pp 40-49.

5   Stavros Christodoulakis, Minos Garofalakis, "Data Management Research at the Technical University of Crete", SIGMOD Record, December 2013, Vol. 42, No. 4, pp 61- 69.

6.   Nicolas Anciaux, Luc Bouganim, Thierry Delot, Sergio LLarri, Leila Kloul, Nathalie Mitton, and Philippe Pucheral, " Opportunistic Data Services in Least Developed Countries: Benefits, Challenges and Feasibility Issues, SIGMOD Records, March 2014, Volumn 43, Number 1, pp. 54 -63

7.   Wei Wang, Meihu Zhang, Gang Chen, "Database Meets Deep Learning: Challenges and Opportunities", SIGMOD Record, June 16, Vol. 45, No. 2, Pages 17-22

LECTURES 2-5

CONCEPTUAL DATABASE DESIGN

OBJECTIVE:

The objective is to introduce conceptual modeling which is a very important phase in designing a successful database application.

CONTENTS:

- Data Models and Their Categories
    - Data Model Operations
    - Data Model Structure and Constraints
- History of Data Models
- Schemas, Instances, and States
    - Database Schema
    - Schema Diagram
    - Schema Construct
    - Schemas versus Instances
    - Database Schema vs. Database State
- Three-Schema Architecture
- Data Independence
    - Logical Data Independence
    - Physical Data Independence
- DBMS Languages and Interfaces
    - Data Definition Language (DDL)
    - Data Manipulation Language (DML)
- Database System Utilities and Tools
- Centralized and Client-Server Architectures
    - Centralized DBMS

- o   Two Tier Client-Server Architecture
- o   Three Tier Client-Server Architecture
- ➢ Classification of DBMSs
  - o   Based on the data model used
  - o   Other classifications

ASSIGNMENTS FROM QUESTION BANK:

UNIT I

SHORT ANSWER QUESTIONS: Q2, 3, 4, 6, 7, 18, 19, 24, 25

LONG ANSWER QUESTIONS: Q 1, 2, 3, 4, 5, 8

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 1, Page No. 24-31
2   ibid 2, Page No. 29-53

REFERENCE BOOK:

1   ibid 5, Page No. 53-83

ARTICLES:

1   AdreenGuitte, HabeinHacid, Ceeile Favre, Djamel A. ZIghed, "Information Diffusion In Online Social Networks : Summary", SIGMOD Record, June 2013, Vol 42,No. 2 , pp 17-28.
2   Hyunjung   Park,   Richard   Pang,   AdityaParmeshwaran,   Hector   Garcia-MolinamNeokliesPolyzotes, Jennifer Widom, "An Overview and Query Language; Query Processing and Optimization", SIGMOD Record , June 2012, Vol. 41,No. 4 , pp 22-27.
3   Yael Amsterdamer and Tova Milo, " Foundations of Crowd Data Sourcing", SIGMOD Records, December 2014, Vol. 43, Number 4, PP. 5 -14.
4   Xin Luna Dong, AnastasiosKementsietsidis, Wang- Chiew Tan, " A Time Machine for Information : Looking Back to Look Forward", SIGMOD Record, June 2016, Vol. 45, No. 2, Pages 23-32.

LECTURES 5-8

DATABASE DESIGN

OBJECTIVE:

The objective of these lectures is to understand the Data Modeling Using the Entity-Relationship (ER) Model which is popular high level conceptual data modeling software design it is common

to use data flow diagram, sequence diagram, scenarios and other techniques to specify functional requirements.

CONTENTS:

- ➢ Overview of Database Design Process
  - o Two main activities
    - ▪ Database design
    - ▪ Applications design
  - o Example Database Application (COMPANY)
- ➢ ER Model Concepts
  - o Entities and Attributes
  - o Types of Attributes
- ➢ Entity Types, Value Sets, and Key Attributes
- ➢ Relationships and Relationship Types
  - o Relationship type vs. relationship set
  - o Weak Entity Types
  - o Constraints on Relationships
  - o Many-to-one (N:1) Relationship
  - o Many-to-many (M:N) Relationship Displaying a recursive relationship
  - o Attributes of Relationship types
  - o Notation for Constraints on Relationships
  - o Alternative (min, max) notation for relationship structural constraints
  - o The (min,max) notation for relationship constraints
  - o Relationships of Higher Degree
  - o Discussion of n-ary relationships
- ➢ ER Diagrams - Notation
- ➢ ER Diagram for COMPANY Schema
- ➢ Alternative Notations – UML class diagrams, others
- ➢ Data Modeling Tools

ASSIGNMENTS FROM QUESTION BANK:

UNIT I

SHORT ANSWER QUESTIONS: Q8, 9, 26, 27-36

LONG ANSWER QUESTIONS: Q6, 7, 18, 22

SUGGESTED READINGS:

TEXT BOOKS:

1 ibid 1, Page No. 259-290
2 ibid 2, Page No. 57-91

REFERENCE BOOK:

1   ibid 5, Page No. 237-248

LECTURES 9-11

ENHANCED ER

OBJECTIVE:

The objective of these lectures is to understand the Enhanced Entity-Relationship (EER) Modeling for representing the in depth relation between different entities.

CONTENTS:

- ➢ EER stands for Enhanced ER or Extended ER
- ➢ Formal Definitions of EER Model
- ➢ EER Model Concepts
  - o Includes all modeling concepts of basic ER
  - o Additional concepts:
    - ▪ subclasses/superclasses
    - ▪ Representing Specialization in EER Diagrams
    - ▪ specialization/generalization
    - ▪ categories (UNION types)
    - ▪ attribute and relationship inheritance
    - ▪ Attribute Inheritance in Superclass /Subclass Relationships
    - ▪ Specialization
    - ▪ Generalization
    - ▪ Constraints on Specialization and Generalization
    - ▪ Displaying an attribute-defined specialization in EER diagrams
- ➢ The additional EER concepts are used to model applications more completely and more accurately
  - o EER includes some object-oriented concepts, such as inheritance
- ➢ Alternative diagrammatic notations

ASSIGNMENTS FROM QUESTION BANK:

UNIT I

SHORT ANSWER QUESTIONS: Q8, 9, 26

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 1, Page No. 295-303
2   ibid 2, Page No. 103-131

REFERENCE BOOK:

1 ibid 5, Page No. 275-289

ARTICLES:

1 BarkhaBahl, Vandana Sharma, NavinRajpal, "Topo-Net Spatial Entity Relationship Model for Geographic Information System Applications", International Journal of Database Management Systems(IJDMS), AIRCC, Vol. 3, No. 4, November 2011, ISSN No. -0975-5705, PP 27-38.
2 Alexandre Torres, RenataGalante, Marcelo Pimenta, "ENORM: An Essential Notation for Object-Relational Mapping", SIGMOD Record, June 2014, Vol. 43, No. 2, pp 23-28.
3 ArashTermehchy, Ali Vakilian, YodsawalaiChodpathumwan and Marianne Winslett, "Cost- Effective Conceptual Design for Information Extraction", ACM Transactions on Database Systems, June 2015, Vol. 40, No. 2, Article 12

LECTURES 12-15

UNIT II

RELATIONAL MODEL, LANGUAGES & SYSTEMS

OBJECTIVE:

The objective of these lectures is to discuss the modeling concepts data structures and constraints provided by the relational model of data.

CONTENTS:

- ➢ Relational Model Concepts
    - o Informal Definitions
    - o Example of a Relation
    - o Key of a Relation
    - o The Schema (or description) of a Relation
    - o Formal Definitions – Tuple
    - o Formal Definitions – Domain
    - o Formal Definitions – State
    - o Characteristics Of Relations
- ➢ Relational Model Constraints and Relational Database Schemas
    - o Relational Integrity Constraints
    - o Key Constraints
    - o Relational Database Schema
    - o Entity Integrity
    - o Referential Integrity
    - o Displaying a relational database schema and its constraints
    - o Other Types of Constraints

- ➢ Update Operations and Dealing with Constraint Violations
  - o INSERT a tuple.
  - o DELETE a tuple.
  - o MODIFY a tuple.
  - o Possible violations for each operation

ASSIGNMENTS FROM QUESTION BANK:

UNIT II

SHORT ANSWER QUESTIONS: Q 1,3,5,8

LONG ANSWER QUESTIONS:

SUGGESTED READINGS:

TEXT BOOKS:

1 ibid 1, Page No. 57-104
2 ibid 2, Page No. 146-166

REFERENCE BOOK:

1 ibid 5, Page No. 147-151

ARTICLES:

1 Goetz Graefe, "Efficient Columnar Storage in B-Trees", SIGMOD Record, Vol. 36, No. 1,pp. 3 - 6
2 BarkhaBahl, NavinRajpal, Vandana Sharma, "Triangular Pyramid Framework for Enhanced Object Relational Dynamic Data Model for GIS", IJCSI, Mauritius, Online, 2011, Vol. 8, Issue 1, pp. 320-328.
3. BarkhaBahl, "Paradigms Shift from Conventional to Geographic Information Systems Data Models", Proceedings of National Seminar: Techno Tryst 2014: Novel Paradigms of Software Engineering and Database Technologies, pp 52-57.
4. MichaelBenedikt, Pierre Bourhis and Clemens Ley," Analysis of Schemas with Access Restrictions", ACM Transactions on Database Systems, March 2015, Vol. 40, No. 1, Article 5.

LECTURES 16-18

ER AND EERR-TO-RELATIONAL MAPPING.

OBJECTIVE:

The objective of these lectures is to present the procedure to create a relational schema from an entity relationship or enhanced ER schema.

CONTENTS:

> ➢ ER-to-Relational Mapping Algorithm
>> o Step 1: Mapping of Regular Entity Types
>> o Step 2: Mapping of Weak Entity Types
>> o Step 3: Mapping of Binary 1:1 Relation Types
>> o Step 4: Mapping of Binary 1:N Relationship Types.
>> o Step 5: Mapping of Binary M:N Relationship Types.
>> o Step 6: Mapping of Multivalued attributes.
>> o Step 7: Mapping of N-ary Relationship Types.
> ➢ Mapping EER Model Constructs to Relations
>> o Step 8: Options for Mapping Specialization or Generalization.
>> o Step 9: Mapping of Union Types (Categories).

ASSIGNMENTS FROM QUESTION BANK:

UNIT I

LONG ANSWER QUESTION: Q6

SUGGESTED READINGS:

TEXTBOOK:

1   ibid 2, Page No. 226-239

LECTURES 19-21

RELATIONAL ALGEBRA AND CALCULUS

OBJECTIVE:

The objective of these lectures is to introduce the Relational Algebra and Calculus. It provides a formal foundation for relational model operations and it is used as a basis for implementing and optimizing queries in relational database management systems.

CONTENTS:

> ➢ Relational Algebra
>> o Unary Relational Operations
>>> ▪ SELECT (symbol: σ (sigma))
>>> ▪ PROJECT (symbol: π (pi))
>>> ▪ RENAME (symbol: ρ (rho))
>> o Relational Algebra Operations From Set Theory
>>> ▪ UNION (∪), INTERSECTION (∩), DIFFERENCE (or MINUS, –)
>>> ▪ CARTESIAN PRODUCT (**x**)

- o Binary Relational Operations
    - JOIN (several variations of JOIN exist)
    - DIVISION
- o Additional Relational Operations
    - OUTER JOINS, OUTER UNION
    - AGGREGATE FUNCTIONS (These compute summary of information: for example, SUM, COUNT, AVG, MIN, MAX)
- o Relational Algebra Expressions
- o Examples of Queries in Relational Algebra
- ➢ Relational Calculus
    - o Tuple Relational Calculus
    - o Domain Relational Calculus
- ➢ Example Database Application

ASSIGNMENTS FROM QUESTION BANK:

UNIT II

SHORT ANSWER QUESTION: Q10 - 15

LONG ANSWER QUESTIONS: Q1, 3, 4, 5, 9

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 1, Page No. 217-248
2   ibid 2, Page No. 173-212
3   ibid 5, Page No. 152-169

ARTICLES:

1   RabiaNuray-Turan, Dmitri V. Kalashnikov, SharadMehrotra,"Attribute and Object with Probabilistic Attribute", ACM Transactions on Database Systems, Feb. 2012, Vol. 37, No. 1, pp 3:1-3:41.
2   Guoliang Li, Dong Deng, JianhuaFeng, "A partition Based Method for String Similarity Joins with Edit Distance Constraints", ACM Transactions on Database Systems, June 2013 , Vol. 38, No. 2, pp 9:1- 9:33
3   Hweehwa Pang, Xuhua Ding, "Privacy-Preserving Ad-Hoc Equi-Join on Outsourced Data" , ACM Transactions on Database Systems, September 2014, Vol. 39, No. 3, Article 23, pp 23:1-23:40

LECTURES 22-25

SQL- A RELATIONAL DATABASE LANGUAGE

OBJECTIVE:

The objective of these lectures is to describe the aspects of the SQL database language, the standard for relational databases. it describes the SQL statements for data definition, schema modification, queries, views and updates. It also describes how common constraints such as key and referential integrity are specified.

CONTENTS:

- ➢ Data Definition, Constraints and Schema Changes
  - o Used to CREATE, DROP, and ALTER the descriptions of the tables (relations) of a database
  - o Create table
  - o Drop table
  - o Alter table
  - o CREATE SCHEMA
  - o REFERENTIAL INTEGRITY OPTIONS
  - o Retrieval Queries in SQL:Selection and Projection
  - o Simple SQL Queries
    - ▪ Aliases, * and DISTINCT, Empty WHERE-clause
  - o Use of *
  - o Use of distinct
  - o Set operations
  - o Nesting of queries
  - o Correlated nested queries
  - o The exists function
  - o Nulls in SQL queries
  - o Joined relations feature in sql2
  - o Grouping
  - o The having-clause
  - o Substring comparison
  - o Arithmetic operations
  - o Order by
  - o Specifying updates in SQL
  - o Insert
  - o Delete
  - o Delete
  - o Update
  - o Check examples
  - o SQL triggers
  - o Views in SQL
  - o Specification of views
  - o SQL views: an example

- Using a virtual table
- View using aggregation

ASSIGNMENTS FROM QUESTION BANK:

UNIT I

SHORT ANSWER QUESTION: Q1 - 9

LONG ANSWER QUESTION: Q10-12

SUGGESTED READINGS:

TEXT BOOKS:

1 ibid 1, Page No. 113-150
2 ibid 2, Page No. 245-292
3 ibid 5, Page No. 179-205
4 ibid 7, Page No. 114-243

ARTICLES:

1 Jan Chomkki, Paolo Ciaccia, NiccoloMeneegheette, "Skyline Queries Front and Back", SIGMOD Record , September 2013, Vol. 42, No. 3 , pp 6-17.
2 Larissa R .Lautent, Marcelo M .Scheildt, Carina F- Donneles, " Web Table Taxonomy nad Formalization " , SIGMOD Record , Sept, 2013, Vol. 42, No. 3 , pp 28 – 33.
3 Andrew Eisenberg, "X Query 3.0 is Nearing Completion ", SIGMOD Record, September 2013, Vol. 42, No. 3, pp 34-41.
4 NdapandulaNakashole, GerhandWeibum, FalianSuchanek," Discovery Semantic Relations from the web and Organizing them with PATTY" SIGMOD Record , June 2013, Vol. 42, No. 2, pp 29-35.
5 Ke Yi, Lu Wang, Zhewei Wei, " Indexing for Summary Queries: Theory and Practice", ACM Transactions on Database Systems, January 2014, Vol. 39, No. 1, Article 2, 2:2-2:38
6 BarzanMozafari, Kai Zeng, Loris D'antoni, Carlo Zaniolo, " High-Performance Complex Event Processing over Hierarchical Data", ACM Transactions on Database Systems, November 2013, Vol. 38, No. 4, Article 21, pp 21:1-21:39.
7 Luc Segoufin, Inria and ENS Cachan, " Constant delay enumeration for conjunctive queries", SIGMOD Records, March 2015, Vol. 44, No. 1, PP. 10-17
8 Yihan Wang, Shaoxu Song, Lei Chen, " A Survey on Accessing Data spaces", SIGMOD Record, June 2016, Vol. 45, No. 2, Pages 33-44.
9 Andrew Pavlo, Mathew Aslett, "What's Really New with NewSQL ?", SIGMOD Record, June 2016, Vol. 45, No. @, Pages 45-55.
10 Dan Olteanu, Maximilian Schleich, "Factorized Databases", SIGMOD Record, June 2016, Vol. 45, No. 2, Pages – 5-16.

UNIT III

LECTURES 26-29

ORACLE ARCHITECTURE

OBJECTIVE:

The objective of these lectures is to describe the main components of the ORACLE,DBMSarchitecture and its logical and physical data structures. it also discusses Database Storage, Oracle Software Structures, Shared Database Access Mechanism, and Database Protection.

CONTENTS:

- ➢ Oracle Database Architecture
  - ○ Client/Server Architecture
  - ○ Multier Architecture
  - ○ Physical Database Structure
  - ○ Logical Database Structure
- ➢ Schemas and Common Schema Objects
  - ○ Tables
  - ○ Indexes
  - ○ Views
  - ○ Cursor
  - ○ Triggers
  - ○ Sequences
  - ○ Packages
- ➢ Oracle Databse Features
- ➢ Database Design

ASSIGNMENTS FROM QUESTION BANK:

UNIT III

SHORT ANSWER QUESTION: Q27-31

LONG ANSWER QUESTIONS: Q1-Q3, Q19, Q20-25

SUGGESTED READINGS:

TEXT BOOK:

1 ibid 1, Page No. 1157-1189

REFERENCE BOOKS:

1   ibid 5, Page No. 739-763
2   ibid 6, Page No. 1-2 - 1-13

LECTURES 30-32

OBJECTIVE:

PL/SQL is a programming language that interacts with Oracle database and it is stored directly in the database. In these lectures introduction to PL/SQL will be provided.

CONTENTS:

- ➤ Introduction to PL/SQL
    - o PL/SQL Variables and Data Types
    - o Data Type Conversions
    - o DBMS-OUTPUT Package
    - o PL/SQL Control Structure
    - o Variable Attribute
    - o PL/SQL Composite Data Types

ASSIGNMENTS FROM QUESTION BANK:

UNIT III

LONG ANSWER QUESTIONS: Q4, Q5

SUGGESTED READING:

REFERENCE BOOKS:

1   ibid 6, Page No. 6-2- 6-67.
2   ibid 7, Page No. 338-351.

LECTURES 32-38

OBJECTIVE:

The normal flow of a PL/SQL program is disrupted sometimes due to the occurrence of an abnormal condition while executing a program. These lectures describe how these conditions can be handled. It also explains how cursors can be used to retrieve and manipulate data in a database and how triggers are stored in and managed by the oracle database.

CONTENTS:

- ➢ Exception Handling in PL/SQL
    - o Exception Handling
    - o Exception Section
    - o Types of Exceptions
    - o Pre-defined System Exceptions
    - o Undefined Exceptions
- ➢ Cursors and Triggers
    - o Cursor
    - o Implicit Cursors
    - o Explicit Cursor
    - o Cursor FOR Loop
    - o For UPDATE statement
- ➢ Trigger
    - o Parts of Trigger
    - o Row level Trigger
    - o Statement level Trigger
    - o Before and After Trigger
- ➢ Trigger Syntax
    - o BEFORE INSERT Trigger
    - o AFTER INSERT T Trigger
    - o Deleting Triggers
    - o Trigger Events
- ➢ PL/SQL Subprograms
    - o Subprograms : Advantages and Disadvantages of Subprograms
- ➢ Procedures
    - o Calling a Procedure
    - o Parameter Mode
    - o Deleting a Procedure

- ➢ Functions
    - o Calling a Function
    - o RETURN Statement
    - o Deleting a Function

ASSIGNMENTS FROM QUESTION BANK:

UNIT III

SHORT ANSWER QUESTIONS: Q27 - 31

LONG ANSWER QUESTIONS: Q6-Q10, Q12, Q13, Q14-Q18, Q20-Q25

SUGGESTED READING:

REFERENCE BOOKS:

1   ibid 6, Page No. 7-2 - 9-22
2   ibid 7, Page No. 352-403

UNIT IV

LECTURES 39-42

RELATIONAL DATA BASE DESIGN

OBJECTIVE:

The objective of these lectures is to discuss several pitfalls in relational database design and to describe the normalization process for achieving good designs by testing relations for undesirable types of problematic functional dependencies.

CONTENTS:

- ➤ Informal Design Guidelines for Relational Databases
  - o Semantics of the Relation Attributes
  - o Redundant Information in Tuples and Update Anomalies
    - ▪ Insertion anomalies
    - ▪ Deletion anomalies
    - ▪ Modification anomalies
  - o Null Values in Tuples
    - ▪ Reasons for nulls
  - o Spurious Tuples
- ➤ Functional Dependencies (FDs)
  - o Definition of FD
  - o Inference Rules for FDs
  - o Equivalence of Sets of FDs
  - o Minimal Sets of FDs
  - o Computing the Minimal Sets of FDs
  - o Examples of FD constraints
- ➤ Normal Forms Based on Primary Keys
  - o Normalization of Relations
  - o Practical Use of Normal Forms
  - o Definitions of Keys and Attributes Participating in Keys
  - o First Normal Form
  - o Second Normal Form
  - o Third Normal Form
  - o General Normal Form Definitions (For Multiple Keys)

o BCNF (Boyce-Codd Normal Form)
  ▪ A relation that is in 3NF but not in BCNF

ASSIGNMENTS FROM QUESTION BANK:

UNIT IV

LONG ANSWER QUESTIONS: Q1-Q5, Q9

SUGGESTED READINGS:

TEXT BOOKS:

1 ibid 1, Page No. 323-338
2 ibid 2, Page No. 339-374
3 ibid 5, Page No. 317-350

REFERENCE BOOK:

1 ibid 3, Page No. 269-279,283-310.

LECTURES 43-45

CONCURRENCY CONTROL TECHNIQUES

OBJECTIVE:

The objective of these lectures is to discuss number of concurrency control techniques that are used to ensure the non-interference or isolation property of concurrently executing transactions.

CONTENTS:

➢ Purpose of Concurrency Control
➢ Two-Phase locking
  o Essential components
  o The algorithm
    ▪ Basic
    ▪ Conservative
➢ Dealing with Deadlock and Starvation
  o Deadlock prevention
  o Deadlock detection and resolution
  o Deadlock avoidance
  o Starvation
➢ Timestamp based concurrency control algorithm
  o Timestamp
  o Basic Timestamp Ordering
  o Strict Timestamp Ordering

   o Thomas's Write Rule
➢ Granularity of data items and Multiple Granularity Locking
➢ Limitations of CCMs
➢ Index Locking
➢ Lock Compatibility Matrix
➢ Lock Granularity

ASSIGNMENTS FROM QUESTION BANK:

UNIT IV

SHORT ANSWER QUESTIONS: Q 1,2,3,4,12-14,15,16-20,49-51

LONG ANSWER QUESTIONS: Q14-Q35

SUGGESTED READINGS:

TEXT BOOKS:

1 ibid 1, Page No. 661-708
2 ibid 2, Page No. 644 - 669

REFERENCE BOOK:

1 ibid 6, Page No. 417-437

ARTICLES:

1 Goetz Graefe, "A Survey of B-tree Logging and Recovery Techniques", ACM Transactions on Database Systems, Feb. 2012, Vol. 37, No. 1, pp 1:1-1:35.
2 Fei Li, Hongzhi Wang, Jianzhong Li, "A Survey on Tree Edit Distance Lower Bound Estimation Techniques for Similarity Join on XML Data" SIGMOD Record, December 2013, Vol. 42, No. 4, pp 29-39.

LECTURES 46-48

DATABASE RECOVERY TECHNIQUES

OBJECTIVE:

The objective of these lectures is to discuss some of the techniques that can be used for database recovery from failures such as system crash and transaction errors.

CONTENTS:

➢ Purpose of Database Recovery

- ➢ Types of Failure
  - ○ Transaction failure
  - ○ System failure
  - ○ Media failure
- ➢ Transaction Log
- ➢ Data Updates
  - ○ Immediate Update
  - ○ Deferred Update
  - ○ Shadow update
  - ○ In-place update
- ➢ Data Caching
- ➢ Transaction Roll-back (Undo) and Roll-Forward
  - ○ Write-Ahead Logging
- ➢ Checkpointing
  - ○ Steal/No-Steal and Force/No-Force
- ➢ Recovery schemes
  - ○ Deferred Update (No Undo/Redo)
  - ○ Recovery Techniques Based on Immediate Update and Undo/No-redo Algorithm
  - ○ Shadow Paging
- ➢ ARIES Recovery Scheme
  - ○ The ARIES Recovery Algorithm
- ➢ Recovery in Multidatabase System

ASSIGNMENTS FROM QUESTION BANK:

UNIT IV

LONG ANSWER QUESTIONS: Q10,11,12,13,14

SUGGESTED READINGS:

TEXT BOOKS:

1 ibid 1, Page No. 721-759
2 ibid 2, Page No. 672 – 694

ARTICLES:

1 Ricardo Jorge Santos, Jorge Bernardino, Marco Vieira, "Approaches and Challenges in Database Intrusion Detection", SIGMOD Record, September 2014, Vol.43, No. 3, pp 36-47.
2. Aldelir Fernando Luiz, Lau Cheuk Lung, and Miguel Correia, "MITRA: Byzantine Fault-Tolerant Middleware for Transaction Processing on Replicated Databases", March 2014, Vol. 43, No. 1, pp. 32-38.

LECTURES 49-50

LOSSLESS (NON-ADDITIVE) JOIN DEPENDENCY PRESERVATION

OBJECTIVE:

The objective of these lectures is to discuss several normalization algorithms using additional type of dependencies like multi-valued dependencies, join dependencies etc.

CONTENTS:

- ➢ Designing a Set of Relations
  - o The Approach of Relational Synthesis (Bottomup Design)
- ➢ Properties of Relational Decompositions
  - o Relation Decomposition and Insufficiency of Normal Forms
  - o Dependency Preservation Property of a Decomposition
  - o Lossless (Non-additive) Join Property of a Decomposition
- ➢ Algorithms for Relational Database Schema
- ➢ Multivalued Dependencies and Fourth Normal Form
  - o Inference Rules for Functional and Multivalued Dependencies
- ➢ Join Dependencies and Fifth Normal Form
- ➢ Inclusion Dependencies
- ➢ Other Dependencies and Normal Forms

ASSIGNMENTS FROM QUESTION BANK:

UNIT IV

SHORT ANSWERS QUESTIONS: Q8, 9, 10, 11, 12, 13

SUGGESTED READINGS:

TEXTBOOKS:

1 ibid 1, Page No. 338-367
2 ibid 2, Page No. 382- 410
3 ibid 5, Page No. 329-332

LECTURES 51

CONCEPTS OF OBJECT ORIENTED DATABASE MANAGEMENT SYSTEMS, DISTRIBUTED DATA BASE MANAGEMENT SYSTEMS

OBJECTIVE:

The objective of these lectures is to introduce the Concepts of Object Oriented Database Management Systems, Distributed Data Base Management Systems

CONTENTS:

- ➢ Object-Oriented Data Model
    - o Object Structure
    - o Messages and Methods
    - o Object Classes
    - o Inheritance
    - o Object Identity
    - o Object-Oriented Languages
    - o ODMG(Object Database Management Group) C++ Object Definition Language
    - o ODMG C++ Object Manipulation Language
- ➢ Distributed Databases
    - o Heterogeneous and Homogeneous Databases
    - o Distributed Data Storage
    - o Distributed Transactions
    - o Commit Protocols
    - o Concurrency Control in Distributed Databases
    - o Availability
    - o Distributed Query Processing
    - o Heterogeneous Distributed Databases

ASSIGNMENTS FROM QUESTION BANK:

UNIT I V

SHORT ANSWER QUESTIONS: Q48

LONG ANSWER QUESTION: Q13

SUGGESTED READINGS:

TEXT BOOKS:

1 ibid 1, Page No. 825-875
2 ibid 2, Page No. 703-722, 876-892

REFERENCE BOOK:

1 ibid 4, Page No. 409-443,511-562

ARTICLES:

1 Alexander Thomson, Thaddeus Diamond, Shu-Chun Weng, Kun Ren, Philip Shao, and Daniel J. Abadi, "Fast Distributed Transactions and Strongly Consistent replication for OLTP Database Systems", ACM Transactions on Database Systems, May 2014, Vol. 39, No. 2, Article 11, pp 11:2- 11:39.

2   Magdalena Balazinska, Bill Howe, and Dan Suciu, " The Database Group at the University of
   Washington", SIGMOD Records, March 2014, Vol. 43, No. 1, pp. 39-44.

LECTURE PLAN

SOFTWARE ENGINEERING

MCA-110

COURSE OUTLINE
MCA –II SEMESTER
SOFTWARE ENGINEERING- MCA 110

L - 4   Credits - 04

OBJECTIVE:

The objective of this course is to explain to the student's software engineering concepts for developing software. For developing any software it is necessary to first analyze the requirements of the system. The same can be achieved by following various steps of software development life cycle. This course will cover all the stages for software development viz requirement analysis specification, design, implementation, testing and maintenance.

INTERNAL ASSESSMENT AND ASSIGNMENT   **40 marks**

1. Class Test-I – (Written Test)   15 marks
2. Class Test-II - (Written Test)   15 marks
3. Class Assessment + Attendance   10 marks

COURSE CONTENTS:

A.   **INTRODUCTION TO SOFTWARE ENGINEERING AND REQUIREMENT ANALYSIS**   **(10 Hours)**
- Software Crisis
- Software Processes & Characteristics
- Software life cycle models
    - Waterfall,
    - Prototype,
    - Evolutionary and
    - Spiral Models.
- Requirement engineering
- Requirement elicitation techniques
- Requirements analysis

B.   **SOFTWARE PROJECT PLANNING AND SOFTWARE DESIGN**   **(12 Hours)**
- Size Estimation
- Cost Estimation Models
- Risk Management.
- Cohesion & Coupling
- Function Oriented Design
- Object Oriented Design

C. SOFTWARE METRICS AND SOFTWARE RELIABILITY   (10 Hours)
- Software measurements
- Hardware Reliability & Software Reliability
- Software Reliability models
- Software Quality models
- CMM and ISO 9001

D. SOFTWARE TESTING AND MAINTENANCE   (10 Hours)
- Testing Process
- Black box and White box testing
- Debugging
- Testing tools and standards
- Maintenance models

STUDY MATERIAL FOR THE SUBJECT

Following will be the study material for topics of Software Engineering students are advised to go through the material for thorough understanding of the subject.

➢ **MAIN TEXT BOOKS:**

1. **Author's Name(s):** K.K. Aggarwal&Yogesh Singh
   Title: Software Engineering
   Edition: III **Year:** Reprint 2014
   Publisher: New Age International   (ibid 1)

2. **Author's Name(s):** Roger S. Pressman
   Title: Software Engineering-A Practitioner's Approach
   Edition: VII **Year:** Reprint 2013
   Publisher: Tata McGraw Hill   (ibid 2)

➢ **REFERENCE BOOKS:**

1. **Author's Name(s):** Nasib Singh Gill
   Title:Software Engineering
   Edition: I **Year:** Reprint2013
   Publisher: Khanna Publisher   (ibid 3)

2. **Author's Name(s):** Sommerville
   Title: Software Engineering
   Edition: IX **Year:** Reprint 2012
   Publisher: Pearson   (ibid 4)

3. **Author's Name(s):** Dorothy Graham, Erik Van Veenedaal,
                         Isabel Evans, Rex Black
   Title: Foundation of Software Testing
   Edition: II **Year:** 2012
   Publisher: Cengage Learning   (ibid 5)

➢ **PERIODICALS:**

1. International Journal of Computing & Applications, Vol. 7, No 1, Jan-June 2012.
2. JSET-Journal of Software Engineering & Technology, Vol. 4, No.1 Jan-June 2012.
3. BVICAM's International Journal of Information Technology, Vol. 4 No. 1, Jan-June 2012.
4. ACM SIGSOFT Software Engineering Notes, Vol. 38 No. 5, September 2013.
5. International Journal of Advanced Networking and Applications, Issue 02, Sept-Oct 2014.
6. I-manager's Journal of Software Engineering, Vol. 8, No. 3, Jan-March 2014.
7. International Journal of Advanced Research in Computer Science and Software Engineering Research, Volume 2, Issue 5, May 2012.

8. International Journal of Software Engineering & Applications (IJSEA), Vol.6, No.1, January 2015.
9. International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 1, January 2015.
10. International Journal of Advance Foundation And Research In Science & Engineering (IJAFRSE) Volume 1, Issue 9, February 2015.
11. IJCSNS International Journal of Computer Science and Network Security, VOL.15 No.3, March 2015.
12. IEEE Internet Computing, Volume: 20, Issue: 2, March- April 2016.
13. 38thInternational Conference on Software Engineering Companion, May 2016.

LECTURE 1

INTRODUCTION TO SOFTWARE ENGINEERING

OBJECTIVE:

The objective of this lecture is to introduce the basic concepts of software engineering.

CONTENTS:

- ➢ Basics of Software Engineering
- ➢ History of Software Engineering
- ➢ Software Engineering Definitions
- ➢ Essential characteristics of Software Engineering
- ➢ Goals of Software Engineering
- ➢ Some Terminologies
    - o Deliverables
    - o Milestones
    - o Product and Process

ASSIGNMENTS FROM QUESTION BANK:

1   Unit I, Section 2, Q 3, 22-24, 26
3   Unit I, Section 3, Q 1, 2, 3, 6, 7

OTHER ASSIGNMENTS:

1   ibid 1, Page No. 17-19, Multiple choice Questions 1.1-1.20
2   ibid 1, Page No.19, Exercice Questions 1.1, 1.7-1.10, 1.12-1.25
3   ibid 2, Page No. 49-50, Q 1.1, 1.10
4   ibid 3, Page No. 31-32, Q1,3,4,7,9,10,11,12, 14, 15, 16, 17

SUGGESTED READINGS:

TEXTBOOKS:

1   ibid 1, Page No. 1-16
2   ibid 2, Page No. 33-39

REFERENCE BOOKS:

1   ibid 3, Page No. 3-15
2   ibid 4, Page No. 7-14

LECTURE 2

SOFTWARE CRISIS AND SOFTWARE PROCESS

OBJECTIVE:

The objective of this lecture is to introduce the idea of a software process-a coherent set of activities for software production.

CONTENTS:

- ➢ Software Crisis
    - o Meaning of Software Crisis
    - o Reasons of Software Crisis
- ➢ Software Process
    - o Meaning of Software Process
    - o Characteristics of Software Process
    - o Phases of Software Process
- ➢ Generic view of process
    - o Layers of Software Engineering

ASSIGNMENTS FROM QUESTION BANK:

1   Unit I, Section 2, Q 1, 2, 4, 5, 6, 7, 19, 23, 25, 31
2   Unit I, Section 3, Q 4, 5

OTHER ASSIGNMENTS:

1   ibid 1, Page No. 19, Exercice Questions 1.2-1.6, 1.11
2   ibid 2, Page No. 75, Q 2.6-2.8
3   ibid 3, Page No. 31-32, Q 2, 17, 19, 21

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 1, Page No. 1-16
2   ibid 2, Page No. 52-54

REFERENCE BOOKS:

1   ibid 3, Page No. 1-2, 17-18
2   ibid 4, Page No. 28-29

ARTICLE:

1. Sonia Haiduc, VeneraArnaoudova, Andrian Marcus and GiulianoAntoniol, "The use of text retrieval and natural language processing in software engineering", Proceedings of the 38thInternational Conference on Software Engineering Companion, Pages 898-899,Austin, Texas, May 14 - 22, 2016, ACM New York, NY, USA

LECTURES 3-4

SOFTWARE LIFECYCLE MODELS

OBJECTIVE:

The objective of these lectures is to understand the software process models and when they might be used.

CONTENTS:

- ➢ Software Lifecycle models
  - o Essence of Lifecycle models
  - o Types of Lifecycle models
    - ▪ Build and fix model
    - ▪ Waterfall model
    - ▪ Prototyping
    - ▪ Iterative enhancement model
    - ▪ Spiral model
    - ▪ RAD model
  - o Selection of a Lifecycle Model

ASSIGNMENTS FROM QUESTION BANK:

1 Unit I, Section 2, Q 8, 9, 20, 27, 30
2 Unit I, Section 3, Q 8, 9, 10, 11, 24, 26-29, 31-33

OTHER ASSIGNMENTS:

1 ibid 1, Page No. 37-38, Multiple Choice Questions 2.1-2.25
2 ibid 1, Page No. 38-39, Exercice Questions 2.1-2.22
3 ibid 2, Page No.102, Q 3.7, 3.15
4 ibid 3, Page No. 62-64, Q 1-56
5 ibid 4, Page No. 54, Q 2.1-2.10

SUGGESTED READINGS:

TEXT BOOKS:

1 ibid 1, Page No. 20-35
2 ibid 2, Page No. 78-90

REFERENCE BOOKS:

1 ibid 3, Page No. 33-56
2 ibid 4, Page No. 29-53

ARTICLES:

1 T.Venkatesh, U.N.Sinha, "A Novel Technique in Software Engineering for Building Scalable Large Parallel Software: Demonstration on Dynamical Core of VARSHA – A Global Circulation Model Software", International Journal of Advanced Networking and Applications, Issue 02, Sept-Oct 2014, pp 2244-2252.
2 Amro Mohammad Hani Al-Said Ahmad, "Agile Large-Scale Software Development: Success Factors, Challenges and Solutions", I-manager's Journal of Software Engineering, Vol. 8, No. 3, Jan-March 2014, pp 1-12.
3 Ms. Shikhamaheshwari, Prof.Dinesh Ch. Jain, "A Comparative Analysis of Different types of Models in Software Development Life Cycle", International Journal of Advanced Research in Computer Science and Software Engineering Research, Volume 2, Issue 5, May 2012 ISSN: 2277 128X, Page 285-290, Paper Available online at: www.ijarcsse.com Research Scholar in Dept.of C.S.E. Reader, S.V.I.T.S,Indore S.V.I.T.S, Indore(M.P) http://www.ijarcsse.com/docs/papers/May2012/Volum2_issue5/V2I500405.pdf

LECTURES 5-10

REQUIREMENT ANALYSIS

OBJECTIVE:

The objective of these lectures is to understand the analysis phase of software process and how it is carried on.

CONTENTS:

➢ Requirements Engineering
➢ Types of Requirements
➢ Feasibility study
➢ Requirements Elicitation
 o Interviews
 o Brainstorming Sessions
 o FAST
 o QFD
 o Use Case Approach
➢ Requirements Analysis
 o DFD
 o Data Dictionary
 o ER diagrams
 o Requirements Documentation
 o Nature of SRS

o Characteristics of SRS
   o Organization of SRS
- ➢ Requirement Management
- ➢ IEEE Std. for SRS

ASSIGNMENTS FROM QUESTION BANK:

1 Unit I, Section 2, Q 10-15, 21,
2 Unit I, Section 3, Q 12-18, 25, 28, 29, 34-35
3 Unit I, Section 4, Q 1-3,5-6, 7-8

OTHER ASSIGNMENTS:

1 ibid 1, Page No.135-137, Multiple Choice Questions 3.1-3.25
2 ibid 1, Page No.137-138, Exercice Questions 3.1-3.36
3 ibid 3, Page No. 158-160, Q 1-11,16-20,26,30-32, 34-37
4 ibid 4, Page No. 116, Q 4.1-4.10

SUGGESTED READINGS:

TEXT BOOK:

1 ibid 1, Page No. 40-75

REFERENCE BOOKS:

1 ibid 3, Page No. 127-146
2 ibid 4, Page No. 82-114

ARTICLE:

1 G. Vijaya, S. Arumugam, "Feasibility Study on SPC in Software Process", International Journal of Computing & Application, Volume 9, No 1, Jan-June 2014, ISSN- 0973-5704, pp 1-8.
2 MB Blake, "Reflecting on Software Engineering Research for Internet Computing", IEEE Internet Computing, Volume- 20, Issue- 2, Mar-Apr. 2016

LECTURES 11-17

SOFTWARE PROJECT PLANNING

OBJECTIVE:

The objective of these lecture is to understand various project planning methods, what are the various kinds of risks associated with project and how to manage them.
CONTENTS:

- ➢ Project Planning
  - o Meaning
- ➢ Size Estimation models
  - o LOC
  - o Function Points
- ➢ Cost Estimation models
  - o COCOMO
  - o COCOMO II
  - o Putnam Resource Allocation Method
- ➢ Validating Software Estimates
- ➢ Software Risk Management
  - o Meaning of Risk
  - o Types of Risks
  - o Risk Management activities

ASSIGNMENTS FROM QUESTION BANK:

1   Unit II, Section 2, Q 1-3, 17-19, 23-25, 26,27-31
2   Unit II, Section 3, Q 1-6, 13, 14, 17, 18, 24, 25
3   Unit II, Section 4, Q 1-5, 9, 10

OTHER ASSIGNMENTS:

1   ibid 1, Page No. 198-200, Multiple Choice Questions 4.1-4.25
2   ibid 1, Page No. 200-202, Exercice Questions 4.1-4.36
3   ibid 2, Page No. 703, Q 23.1, 23.4-23.6
4   ibid 3, Page No. 378-380, Q 16,23,27,39,42,52,55

SUGGESTED READINGS:

TEXT BOOKS:

1   ibid 1, Page No. 139-196
2   ibid 2, Page No. 674-694

REFERENCE BOOK:

1   ibid 3, Page No. 338-341,365-372

LECTURES 18-22

SOFTWARE DESIGN

OBJECTIVE:

The objective of these lectures is to introduce various aspects of the software design that are important for software engineers.

CONTENTS:

- ➢ Software Design
  - o Meaning and Objectives of design
  - o Characteristics of design
    - ▪ Modularity
    - ▪ Coupling
    - ▪ Cohesion
  - o Classification of Cohesiveness & Coupling
  - o Strategy of Design
    - ▪ Bottom up design
    - ▪ Top down design
    - ▪ Hybrid design
  - o Approaches of Design
    - ▪ Function Oriented design
    - ▪ Object Oriented design

ASSIGNMENTS FROM QUESTION BANK:

1 Unit III, Section 2, Q 1-6,11, 16, 18,26-27
2 Unit III, Section 3, Q 1-8, 21, 23, 28
3 Unit III, Section 4, Q 2

ASSIGNMENTS FROM QUESTION BANK:

1 Unit I, Section 2, Q 4-12, 20-22
2 Unit I, Section 3, Q 7-12, 15, 16, 18, 19, 21, 22

OTHER ASSIGNMENTS:

1 ibid 1, Page No. 248-249, Multiple choice Questions 5.1-5.12
2 ibid 1, Page No. 249, Exercice Questions 5.1-5.24
3 ibid 2, Page No. 283-284, Q 9.1-9.2, 9.6, 9.9-9.11
4 ibid 3, Page No.186-188, Q1-6, 9-10,18-22,27-38,52-53,64,66

SUGGESTED READINGS:

TEXT BOOKS:

1 ibid 1, Page No. 203-234
2 ibid 2, Page No. 258-281

REFERENCE BOOK:

1 ibid 3, Page No. 161-207

ARTICLES:

1   VibhashYadav, Raghuraj Singh &Prashant Kumar Mishra,"Object Oriented Metrics: Features & Defects in Software Design & Quality", International Journal of Computing & Application, Volume 7, No 1, Jan-June 2012, ISSN- 0973-5704, pp 27-29.
2. AbidSaeedKhattak, Malik Sikander Hayat Khiyal, SanamShahlaRizvi "Verification and Validation of Agent-Based Model Using EVOMAS Approach "IJCSNS International Journal of Computer Science and Network Security, VOL.15 No.3, March 2015, pp 29-35

LECTURES 23-27

SOFTWARE METRICS

OBJECTIVE:

The objective of these lectures is to describe the very wide range of activities concerned with measurement called metrics in software engineering. It also provides information to support quantitative managerial decision-making during the software lifecycle.

CONTENTS:

- ➢ Software Metrics
    - o Meaning and Objectives of metrics
    - o Categories of metrics
        - ▪ Product metrics
            - • Size metrics
                - ✓ Lines of code
                - ✓ Token Count
                - ✓ Function Count
                - ✓ Data Structure metrics
            - • Control complexity metrics
                - ✓ Information flow metrics
            - • Halstead Software Science metrics
        - ▪ Process metrics
        - ▪ Project metrics

ASSIGNMENTS FROM QUESTION BANK:

1   Unit III, Section 2, Q 1-6,11, 16, 18, 28-29
2   Unit III, Section 3, Q 1-8, 21, 29
3   Unit III, Section 4, Q 2

OTHER ASSIGNMENTS:

1   ibid 1, Page No. 304-306, Multiple Choice Questions 6.1-6.20
2   ibid 1, Page No. 306-307, Exercise Questions 6.1-6.28
3   ibid 2, Page No. 671-672, Q 22.2-22.6

4   ibid 3, Page No. 378-379, Q 1-4,9-14,17-22,29-30,34

SUGGESTED READINGS:

TEXTBOOKS:

1   ibid 1, Page No. 251-286
2   ibid 2, Page No. 649-668

REFERENCE BOOK:

1   ibid 3, Page No. 326-365

ARTICLES:

1   VibhashYadav, Raghuraj Singh, Prashant Kumar Mishra,"Object Oriented Metrics: Features & Defects in Software Design & Quality", International Journal of Computing & Application, Vol. 7, No. 1, Jan-June 2012, pp 27-29.
2   Gagandeep Singh, "Metrics for Measuring the Quality of Object- Oriented Software", ACM SIGSOFT Software Engineering Notes, Vol 38, No. 5, September 2013, pp-66. http://doi.acm.org/10.1145/2507288.2507311.

LECTURES 28-32

SOFTWARE RELIABILITY

OBJECTIVE:

The objective of these lectures is to introduce software reliability which is one of the most important aspects of software quality. It is the quantitative study of the operational behavior of software-based systems with respect to user requirements concerning reliability.

CONTENTS:

- ➢ Software Reliability
  - ○ Meaning of Software Reliability
  - ○ Difference between Software reliability and Hardware reliability
  - ○ Failure and Faults
  - ○ Software reliability models
    - ▪ Basic Execution Time model
    - ▪ Logarithmic Poisson Execution Time model
- ➢ Software Quality
  - ○ Meaning of Software Quality
    - ▪ McCall Software Quality model
    - ▪ Boehm Software Quality model
  - ○ Capability Maturity model
  - ○ ISO 9000

ASSIGNMENTS FROM QUESTION BANK:

1 Unit III, Section 2, Q 7-10, 15, 17,30
2 Unit III, Section 3, Q 9-18, 22, 23, 27
3 Unit III, Section 4, Q 1, 4

OTHER ASSIGNMENTS:

1 ibid 1, Page No. 359-362, Multiple choice Questions 7.1-7.50
2 ibid 1, Page No. 306-307, Exercise Questions 7.1-7.35
3 ibid 3, Page No. 414-415, Q 6-10,12-14,18-23,29-35, Page No. 452-453, Q 1-8,26,30,32-33.

SUGGESTED READINGS:

TEXTBOOKS:

1 ibid 1, Page No. 308-357
2 ibid 2, Page No. 461-465

REFERENCE BOOK:

1 ibid 3, Page No. 392-423.

ARTICLE:

1 V.B Singh, P.K. Kapur, AshaallahBasirzadeh, "Open Source Software Reliability Growth Model by Considering Change-Point", BVICAM's International Journal of IT, Volume 4, No 1, Jan-June 2012, pp 15-20.

LECTURES 33-40

SOFTWARE TESTING

OBJECTIVE:

The objective of these lectures is to describe the processes of software testing and introduce a range of testing techniques.

CONTENTS:

➢ Software Testing
  o Meaning and Objectives of testing
  o Testing process
  o Design of test cases
  o Levels /Strategies of testing
    ▪ Unit testing
    ▪ Integration testing

- - Top down integration
    - Bottom up integration
    - Regression testing
  - Validation testing
    - Acceptance testing
    - Alpha testing
    - Beta testing
  - System testing
    - Recovery testing
    - Security testing
    - Stress testing
    - Performance testing
- Test case design methods
  - Black Box testing
    - Boundary Value Analysis
    - Equivalence class testing
    - Decision table testing
    - Cause effect graphing
  - White Box testing
    - Path testing
    - Data flow testing
    - Mutation testing
- Debugging
  - Meaning
  - Process
  - Techniques
  - Approaches
- Testing tools
  - Static testing tools
  - Dynamic testing tools

ASSIGNMENTS FROM QUESTION BANK:

1 Unit IV, Section 2, Q 1-7, 15, 17,24
2 Unit IV, Section 3, Q 1-8, 10, 22, 23, 24, 25
3 Unit IV, Section 4, Q 1-5, 12, 13

OTHER ASSIGNMENTS:

1 ibid 1, Page No. 451-455, Multiple choice Questions 8.1-8.50
2 ibid 1, Page No. 455-458, Exercise Questions 8.1-8.50
3 ibid 2, Page No. 459-460, Q 14.1-14.15
4 ibid 3, Page No. 459-460, Q 1-4,7-13,15-21,23-62
5 ibid 4, Page No. 232, Q 8.1-8.10
6 ibid 5, Page No. 18, Q 1

7   ibid 5, Page No. 50, Q 1-3
8   ibid 5, Page No. 132, Q 1-7

SUGGESTED READINGS:

TEXTBOOKS:

1   ibid 1, Page No. 365-450
2   ibid 2, Page No. 387-456

REFERENCE BOOKS:

1   ibid 3, Page No. 275-322
2   ibid 4, Page No. 206-230

ARTICLES:

1. MahfuzulHuda ,Y.D.S.Arya , M. H. Khan "Testability Quantification Framework of Object Oriented Software: A New Perspective" International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 1, January 2015, pp. 298-302.
2. AsmaBhat, Prof. S.M.K. Quadri" The Significance Of Testing Throughout The Software Development Life Cycle-A Roadmap ",International Journal of Advance Foundation And Research In Science & Engineering (IJAFRSE) Volume 1, Issue 9, February 2015 , pp 23-31.
3. Mahfuzul Huda, Y.D.S. Arya, M. H. Khan "Evaluating Effectiveness Factor of Object Oriented Design: A Testability Perspective" International Journal of Software Engineering & Applications (IJSEA), Vol.6, No.1, January 2015 pp. 41-49.

LECTURES 40-42

SOFTWARE MAINTENANCE

OBJECTIVE:

The objective of these lectures is to introduce the maintenance phase of software development lifecycle.

CONTENTS:

- ➢ Software Maintenance
  - o Meaning and Objectives of maintenance
  - o Categories of maintenance
  - o Maintenance process
  - o Maintenance models
    - ▪ Quick fix model
    - ▪ Iterative Enhancement model
    - ▪ Reuse Oriented model

- Boehm's model
- Taute maintenance model
  - o Reverse engineering
  - o Re-engineering
  - o Configuration Management
  - o Documentation

ASSIGNMENTS FROM QUESTION BANK:

1 Unit IV, Section 2, Q 8-14, 21-23, 25-26
2 Unit IV, Section 3, Q 11-21, 26, 27
3 Unit IV, Section 4, Q 11

OTHER ASSIGNMENTS:

1 ibid 1, Page No. 488-490, Multiple choice Questions 9.1-9.25.
2 ibid 1, Page No. 490-491, Exercise Questions 9.1-9.40.
3 ibid 3, Page No. 504-505, Q 1-8,10,14-17,20-30.
4 ibid 4, Page No. 258, Q 9.1, 9.4, 9.5
5 ibid 5, Page No. 148, Q1

SUGGESTED READINGS:

TEXT BOOK:

1 ibid 1, Page No. 459-486

REFERENCE BOOKS:

1 ibid 3, Page No. 490-505
2 ibid 4, Page No. 242-252

ARTICLES:

1 Ashok Kumar, Anil Kumar, "Re-engineering of Module for Public Sector and Complexity Measurement", International Journal of Computing & Application, Jan-June 2012, pp 39-42.
2 Ashutosh Mishra, VinayakSrivastava, "Intelligent Computing Methods for Software Maintenance: A Review", Journal of Software Engineering & Technology, Vol. 4 No.1, Jan-June 2012, pp 1-12.
3 T.Venkatesh, U.N.Sinha, "A Novel Technique in Software Engineering for Building Scalable Large Parallel Software: Demonstration on Dynamical Core of VARSHA – A Global Circulation Model Software", International Journal of Advanced Networking and Applications, Issue 02, Sept-Oct 2014, pp 2244-2252.
4 Phil McMinn, Mark Harman, Gordon Fraser, Gregory M. Kapfhammer," Automated search for good coverage criteria: moving from code coverage to fault coverage through search-based software engineering", Proceedings of the 9[th]International Workshop on Search-Based Software Testing, Pages 43-44, May 2016.