Veer Narmad South Gujarat University, Surat

Proposed Syllabus
M.Sc. (Computer Application), 1st Semester
Effective from July 2008

Paper: 101: Advanced Data Structures

[L:4, P:0]

Aim: To provide a comprehensive knowledge of Data Structures concept and their implementation

Prerequisite: Preliminary knowledge of Data Structure and its classification.

1. Introduction to Data Structure
   - 1.1. Basic concepts
   - 1.2. Overview of Primitive & Non-primitive Data Structures

2. Trees
   - 2.1. Basic Concepts
   - 2.2. Binary Trees
   - 2.3. N-ary Trees
   - 2.4. Tree Traversals
     - 2.4.1. Inorder, Preorder and Postorder
     - 2.4.2. Breadth-First Traversal
     - 2.4.3. Depth-First Traversal
     - 2.4.4. Search Trees
       - 2.4.4.1. Algorithms like Binary, AVL, M-Way
       - 2.4.4.2. Average Case Analysis of algorithms of 3.4.4.1
   - 2.5. Huffman trees and Data compression including Huffman coding
   - 2.6. Recent Applications

3. Graphs
   - 3.1. Basics
   - 3.2. Traversals – Depth-First, Breadth-First,
   - 3.3. Applications
   - 3.4. Topological sort
   - 3.5. Shortest Path Algorithm
   - 3.6. Minimum Cost Spanning trees – Prim's and Kruskal's algorithm
   - 3.7. Critical Path Analysis

4. Sorting and Searching algorithms
   - 4.1. Binary search
   - 4.2. Depth-First search
   - 4.3. Breadth-First search
   - 4.4. Nearest Neighbor search
   - 4.5. Branch and Bound
   - 4.6. A* algorithm

5. Hashing
   5.1. Basic Idea – Keys and Hash Functions including Collision avoidance
   5.2. Hashing Methods
      5.2.1. Division Method
      5.2.2. Middle Square Method
      5.2.3. Multiplication Method
      5.2.4. Fibonacci Hashing
   5.3. Hash Function Implementations
      5.3.1. Integral Keys
      5.3.2. Floating Point Keys
      5.3.3. Character String Keys
      5.3.4. Hashing Containers
      5.3.5. Using Associations
   5.4. Hash Tables
      5.4.1. Abstract Hash Tables
      5.4.2. Average Case Analysis
   5.5. Scatter Tables
      5.5.1. Chained Scatter Table
      5.5.2. Scatter Table using Open Addressing

6. Heaps and Garbage Collection
   6.1. Basic Concepts Heaps
   6.2. Binary, Leftist, Binomial Queues
   6.3. Recent Applications
   6.4. Basic concepts of Garbage Collection
   6.5. Reference Counting Garbage Collections
   6.6. Mark-and-Sweep Garbage Collections
   6.7. Stop-and-Copy Garbage Collections
   6.8. Mark-and-Compact Garbage Collections

7. Algorithmic Patterns and Problem Solvers
   7.1. Brute-Force and Greedy Algorithms
   7.2. Backtracking algorithms – Depth-First, Branch-and-Bound
   7.3. Top-Down Algorithms – Divide-and-Conquer
   7.4. Bottom-Up Algorithms

References:

1. Data Structures and Algorithms, Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, Addison-Wesley.
2. Data Structures and Algorithms with Object-Oriented Design Patterns in Java, Bruno R. Preiss, John Wiley & Sons
3. Handbook of Algorithms and Data Structures, Gaston H. Gonnet, Ricardo Baeza, Addison-Wesley Publishing Co. Inc.
4. An Introduction to Data Structures with Applications, J. Tremblay, P. Sorenson, Tata McGraw-Hill

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Paper: 102: Relational Database Management System

[L:4, P:0]

Aim: To provide a comprehensive knowledge of efficient database design approach, which includes normalization, indexing, hashing, transaction management and concurrency control.

Prerequisites: Basic concept of database management system.

1. Relational Database Design
   - 1.1. Introduction
   - 1.2. Features of Good Relational Designs
   - 1.3. Atomic Domains and First Normal Form
   - 1.4. Decomposition Using Functional Dependencies
   - 1.5. Decomposition Using Multivalued Dependencies
   - 1.6. More Normal Forms
   - 1.7. Database-Design Process

2. Storage and File Structure
   - 2.1. Overview of Physical Storage Media
   - 2.2. File Organization
   - 2.3. Organization of Records in Files
   - 2.4. Data-Dictionary Storage

3. Indexing and Hashing
   - 3.1. Basic Concepts
   - 3.2. Ordered Indices
   - 3.3. B+-Tree Index Files
   - 3.4. B-Tree Index Files
   - 3.5. Multiple-Key Access
   - 3.6. Static Hashing
   - 3.7. Dynamic Hashing
   - 3.8. Comparison of Ordered Indexing and Hashing
   - 3.9. Bitmap Indices

4. Query Processing and Optimization
   - 4.1. SQL Overview
   - 4.2. Nested Subqueries and Complex queries
   - 4.3. Views
   - 4.4. Integrity Constraints

4.5. Authorization
4.6. SQL Functions and Procedures
4.7. Measures of Query Cost
4.8. Selection Operation
4.9. Sorting
4.10. Join Operation
4.11. Other Operations
4.12. Evaluation of Expressions
4.13. Transformation of Relational Expressions
4.14. Estimating Statistics of Expression Results
4.15. Choice of Evaluation Plans
4.16. Materialized View

5. Transactions Management
    5.1. Transaction Concept & State
    5.2. Implementation of Atomicity and Durability
    5.3. Concurrent Executions
    5.4. Serializability
    5.5. Recoverability
    5.6. Implementation of Isolation
    5.7. Testing for Serializability

6. Concurrency Control
    6.1. Lock-Based Protocols
    6.2. Timestamp-Based Protocols
    6.3. Validation-Based Protocols
    6.4. Multiple Granularity
    6.5. Multiversion Schemes
    6.6. Deadlock Handling
    6.7. Insert and Delete Operations

7. Object-Based Databases & XML
    7.1. Introduction
    7.2. Complex Data Types
    7.3. Structured Types and Inheritance in SQL
    7.4. Table Inheritance
    7.5. Array and Multiset Types in SQL
    7.6. Object-Identity and Reference Types in SQL
    7.7. Implementing O-R Features
    7.8. Structure of XML Data
    7.9. XML Document Schema
    7.10. Querying and Transformation
    7.11. Application Program Interfaces XML
    7.12. Storage of XML Data
    7.13. XML Applications

References:

1. Database System Concepts, Silberschatz Henry F. Korth and S. Sudarshan, McGraw-Hill.
2. An Introduction to Database System, C.J. Date, Addision Wisley
3. An Introduction to Database System, Bipin C. Desai, Galgotia
4. Database Management Systems-Designing & Building Business Applications, Gerald V Post, Irwin Professional Publication
5. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGraw-Hill

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Paper: 103: Object Oriented System Design

[L:4, P:0]

Aim: To provide a comprehensive knowledge of Object Oriented concepts, tools, development life cycle, problem solving, modeling, analysis and design.

Prerequisite: Programming knowledge.

1. Object Oriented Design Fundamentals
    - 1.1. The Object Model
    - 1.2. Classes and Objects
    - 1.3. Complexity of Software
    - 1.4. Classification, Notation, Process
    - 1.5. Pragmatics
    - 1.6. Binary and Entity Relationship
    - 1.7. Object Types
    - 1.8. Object State
    - 1.9. OOSD Life Cycle.

2. Object Oriented Methodologies and UML
    - 2.1. Object Oriented Methodology: Rumbaugh, Booch, Jacobson, Shaler/Mellor, Coad/Yardon
    - 2.2. Patterns
    - 2.3. Frame Works
    - 2.4. The Unified Approach – UML

3. Object Oriented Analysis
    - 3.1. Identify Use Cases
    - 3.2. Use Case Model
    - 3.3. Documentation
    - 3.4. Classification
    - 3.5. Identifying Classes
    - 3.6. Noun Phrases Approach
    - 3.7. Common Class Pattern Approach
    - 3.8. Use Case Driven Approach
    - 3.9. Identifying Object Relationship
    - 3.10. Attributes And Models.

4. Object Oriented Design
    - 4.1. Design Process
    - 4.2. Design Axioms
    - 4.3. Designing Classes
    - 4.4. Access Layer Design

4.5. View Layer Design.

5. Object Oriented Development
    5.1. Managing Analysis and Design
    5.2. Evaluation Testing
    5.3. Coding
    5.4. Maintenance
    5.5. Metrics
    5.6. Case Study: Foundation Class Library – Client/Server Computing.

6. Aspect-Oriented Development
    6.1. Introduction to Aspect Oriented Programming
    6.2. Overview of Aspect-Oriented Software Development

References:

1. Ali Bahrami, Object Oriented System Development, Mc Graw Hill.
2. Larman, Applying UML & Patterns: An Introduction to Object Oriented Analysis and Design, Pearson Education
3. Bernd Bruegge, Allen H. Dutoit, Object Oriented Software Engineering using UML, Patterns and Java, Pearson Education.
4. J. Rambaugh, M. Blaha et al, Object Oriented Modeling and Design, PHI

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Paper: 104: Enterprise Data Management

[L:4, P:0]

Aim: To provide a comprehensive knowledge of the concepts related to Information Systems and modeling of data in these systems.

Prerequisites: Nil

1. Data Management
   - 1.1. Hierarchy of Data
   - 1.2. Data Modeling
   - 1.3. Data Integrity
   - 1.4. Data Quality
   - 1.5. Metadata
   - 1.6. Legacy Systems and Data Migration

2. Information System
   - 2.1. Overview of Information System
   - 2.2. Overview of different types of Information Systems: MIS, DSS, GDSS, ESS, GIS, KBS etc.
   - 2.3. Impact of Information System on an organization

3. Enterprise Information Systems
   - 3.1. Organizational structure
     - 3.1.1. Operations management system
     - 3.1.2. Material management system
     - 3.1.3. Personal management system
     - 3.1.4. Quality management system
   - 3.2. Content Management system

4. Enterprise Information System
   - 4.1. An Introduction to Electronic Commerce
   - 4.2. An Introduction to Mobile Commerce
   - 4.3. Threats and security to e-commerce and m-commerce

5. Business Intelligence
   - 5.1. Introduction
   - 5.2. Types of Business Rule
   - 5.3. Implementing Business Rule
   - 5.4. Business Re-engineering
   - 5.5. Overview of Data Warehousing and Data Mining
   - 5.6. Business Intelligence using Data Warehousing and Data Mining
   - 5.7. Business Intelligence Applications: Customer Relationship Management, Supply Chain Management.

References:

1. Principles on Information Systems: A Managerial Approach, Ralph Stair and Gearge Reynolds, Thomson Course Technology.
2. Management Information System: Managing the Digital Firm, Kenneth Laudon and Jane Laudon, Prentice Hall of India.
3. Content Management Bible, Bob Boiko, Wiley Publishing Inc.
4. Management Information System: Text & Applications , C.S. V. Murthy,Himalaya Publishing House
5. Management Information System , W.S. Jawadekar, Tata McGraw Hill.
6. Information System for Modern Management, Murdick Ross and Claget, Prentice Hall.

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Paper: 105: Information Security

[L:4, P:0]

Aim: To provide a comprehensive knowledge of security issues and cryptography.
Prerequisites: Programming in C# and Java.

1. Security Basics
   1.1. Computer Security
   1.2. Information Security
   1.3. Threat and Attacks
   1.4. Malicious Logic
   1.5. Countermeasures
   1.6. Security Policies
   1.7. Confidentiality Polices
   1.8. Integrity Policies
   1.9. Backup and Audit Overview

2. Operating System Security
   2.1. Security Risks
   2.2. Common Ports and Services
   2.3. Operating System Hardening
   2.4. File Systems and Resources
   2.5. User Accounts

3. Network Security
   3.1. Security Incidents and Attacks
   3.2. Boundary Devices
   3.3. Firewalls
   3.4. VPN
   3.5. Intrusion Detection and Prevention

4. Other Security Areas
   4.1. Web threats and attacks
   4.2. Database threats and attacks
   4.3. Security in wireless network
   4.4. Security concerns in e-commerce, m-commerce

5. Symmetric Ciphers
   5.1. Classical Encryption
   5.2. Block Cipher
   5.3. DES, Triple DES, AES
   5.4. Contemporary Symmetric Cipher

6. Key Management
   6.1. Number Theory
   6.2. Public-key Cryptography and RSA
   6.3. Message Authentication and Hash Functions
   6.4. Hash Algorithms
   6.5. Digital Signatures and Authentication Protocols

7. Cryptography in .NET
   7.1. Basic Cryptography
   7.2. Hashing
   7.3. Symmetric Encryption
   7.4. Asymmetric Encryption
   7.5. Digital Signatures
   7.6. Keys

8. Java Cryptography
   8.1. Symmetric Encryption
   8.2. Asymmetric Encryption
   8.3. SSL

9. Overview of Security Engineering

References:

1. Computer Security: Art and Science by Matt Bishop, Addison-Wesley
2. Introduction to Computer Security by Matt Bishop, Addison-Wesley
3. Cryptography and Public Key Infrastructure on the Internet by Klaus Schmeh, Willey
4. Pro ASP.NET 3.5 in C# 2008 by Matthew MacDonald, Apress
5. Programming .NET Security by Adam Freeman, Allen Jones, Oreilly
6. Beginning Cryptography with Java by David Hook, Wrox

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Paper: 106: Practical

[L:0, P:10]

Practical shall be based on above subjects and should be implemented using programming languages VC++, Java and C#