MCA 201 PROBABILITY AND STATISTICS

Module 1:-Basic Statistics

Measures of central tendency: - mean, median, mode; Measures of dispersion-Range, Mean deviation, Quartile deviation and Standard deviation; Moments, Skewness and Kurtosis, Linear correlation, Karl Pearson's coefficient of Correlation, Rank correlation and linear regression.

Module 2:- Probability Theory

Sample space, Events, Different approaches to probability, Addition and multiplication theorems on probability, Independent events, Conditional probability, Bayes Theorem

Module 3:- Random variables and Distribution

Random variables, Probability density functions and distribution functions, Marginal density functions, Joint density functions, mathematical expectations, moments and moment generating functions.Discrete probability distributions - Binomial, Poisson distribution, Continuous probability distributions- uniform distribution and normal distribution.

Module 4:- Sampling and Estimation

Theory of Sampling: - Population and sample, Types of sampling

Theory of Estimation: - Introduction, point estimation, methods of point estimation-Maximum Likelihood estimation and method of moments, Central Limit Theorem (Statement only) .

Module 5:-Testing of hypothesis

Null and alternative hypothesis, types of errors, level of significance, critical region, Large sample tests – Testing of hypothesis concerning mean of a population and equality of means of two populations

Small sample tests – t Test-for single mean, difference of means. Paired t-test, Chi-square test (Concept of test statistic $ns^2/\sigma^2)$, F test - test for equality of two population variances.

References

- Fundamentals of statistics: S.C.Gupta,6^{th}Revised and enlarged edition-April 2004, Himalaya Publications.
- Introduction to Probability and Statistics, Medenhall, Thomson Learning , 12 Edn.
- Fundamentals of Mathematical Statistics- S.C.Gupta ,V.K.Kapoor. Sultan Chand Publications.
- Introduction to Mathematical Statistics -Robert V. Hogg &Allen T. Craig. Pearson education.

MCA 202 DATA STRUCTURES AND ANALYSIS OFCOMPUTER ALGORITHMS

Module I

Introduction: Algorithms, Data Structures, Data Types, Concepts in performance analysis – space complexity, time complexity- asymptotic notation

Arrays: Ordered lists – polynomial addition, sparse matrices, representation of array.

Stacks and Queues: Definition and concepts, Operations on stacks. Application of stacks- Evaluation of Arithmetic Expression, infix to postfix conversion. Queue, representation of queue, circular queue, deque, priority queue, Application of queues.

Module II

Linked List: Singly linked list, Linked stacks and queues, Polynomial addition, sparse matrices, doubly linked list and dynamic storage management.

Trees : Basic terminology, binary trees, binary tree representation, Binary tree traversal, Binary search tree – searching ,insertion , deletion , Balanced Trees – AVL Tree, B, B+.

Graphs: Terminology and representation, Traversals- BFS, DFS.

Module III

Searching and Sorting: Searching – Linear search, binary search, Fibonacci and interpolation search. Comparison of different methods.

Sorting – Insertion, Bubble, Selection, Heap, Radix. Sort comparison.

Hashing Techniques: Different hashing functions, methods for collision handling.

Module IV

Divide and conquer method – General method, Finding the maximum and minimum, Analysis of Binary search, Quick sort and Merge sort.

Greedy Method and Dynamic programming method – The general method, Minimum cost spanning tree- Prim's algorithm and Kruskal's algorithm Dynamic programming- General method, multistage graphs, All pairs shortest paths.

Module V

Backtracking and Branch and Bound techniques – The general method, The 8-Queens problem, Branch and Bound- Least Cost search, Travelling salesman problem. **NP-Hard and NP -complete problems** - Basic concepts, non deterministic algorithm, class of NP-hard and NP- complete .

References

- Fundamentals of data structures – Ellis Horowitz and Sartaj Sahni (Galgotia , 1994)
- Fundamentals of computer algorithms- Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajeshekharan (Universities Press , 2007)
- Data Structure using C & C++ b, Tannenbaum and Augustine,prentice hall.
- Data Structures – a pseudocode approach with C –Richard F Gilberg, Behrouz A Forouzan, Thomson Learning, 2 Edn., **Cengage Learning C2005**
- Data Structures and program design – R. L Kruse (Prentice Hall of India),C2001

- Data structures and Algorithms in C++, Adam Drozdek, Thomson Learning, 3 Edn, C2005
- Classic data structures – D Samanta (PHI), 2006
- Fundamentals of algorithms – Gilles Brassard, Paul Bratley (PHI),C1996
- Introduction to the design and analysis of algorithms – Anany Levitin (Pearson),2011

MCA 203 Microprocessors and Embedded Systems

Module 1 - The Processors : 8086
Register Organization of 8086, Architecture, Signal Description of 8086, Physical Memory Organization, General Bus Operation, I/O Addressing Capability, Special Processor Activities, Minimum Mode 8086 System and Timings, Maximum Mode 8086 System and Timings. Addressing Modes of 8086.

Module 2 - Instruction Set, Assembler Directives and Assembly Language Programming of 8086
Machine Language Instruction Formats – Instruction Set of 8086-Data transfer instructions,Arithmetic and Logic instructions,Branch instructions,Loop instructions,Processor Control instructions,Flag Manipulation instructions,Shift and Rotate instructions,String instructions, Assembler Directives and operators,Example Programs**,**Introduction to Stack, STACK Structure of 8086, Interrupts and Interrupt Service Routines, Interrupt Cycle of 8086, Non-Maskable and Maskable Interrupts, Interrupt Programming, MACROS.

Module 3 - Special Purpose Programmable Devices and their Interfacing
Data transfer schemes-programmed I/O, Interrupt I/O, DMA, DMA Controller 8257, Programmable Interval Timer 8253, Programmable Interrupt Controller 8259A, Programmable Communication Interface 8251 USART, Programmable Pripheral Interface 8255.

Module 4 – Architecture and Comparison of various Processors

80186,80286,80386,80486, Pentium
Case Study on Advanced Multiprocessors

Module 5 - Introduction to Embedded Systems
Embedded system – classification, Hardware Components of an Embedded system.
Microcontrollers 8051 – Introduction, Architecture, Memory Organization, Instruction Set – Programming.

References

- Advanced Microprocessors and Peripherals – Architecture, Programming and Interfacing by A.K. Ray and K.M. Bhurchand, Tata McGraw Hill,2002 Edition
- Embedded Systems – Architecture, Programming & Design by Raj Kamal -Tata McGraw Hill.
- The Intel Microprocessors 8086/8088, 80816/80188, 80286, 80486 Pentium and Pentium Pro Processor – Architecture, Programming and interfacing by Barry B Brey, 4th Edition, PHI.

- Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, 2nd Edition, Tata McGraw Hill, 2002.
- Microprocessor x86 Programming by K.R. Venugopal and Raj Kumar – BPB publications
- Microprocessors and Microcomputer based system design by Mohamed Rafiqussaman.
- Micro Controllers – [Theory And Applications] by Ajay V. Deshmukh- Tata McGraw Hill.

MCA 204 Operating Systems

Module I:

Evolution of operating systems:-Serial processing, Batch Processing, multiprogramming. Types of operating systems-Batch Operating System, Multi programming-Time sharing, Real time, distributed operating systems.

Operating Systems Structures:- Systems Components, Operating System Services, System Calls, System Programs, System Structures, Virtual Machines

Processor Management:-Job and process concept, Operating system view of processes, process-state transition diagram, PCB (Process control block), Threads, Operating system services.

Process Scheduling:-Types of schedulers, scheduling and performance criteria, scheduling algorithms, multiple processor scheduling.

Module II:

Inter process synchronization and communication-Concurrent Processes- need for inter process synchronization, critical section problem, mutual exclusion-mutual exclusion algorithms, semaphores-definition busy wait implementation, monitors, inter process communication using messages.

Deadlocks: -Definition –Deadlock characterization-Resource allocation graph, methods for handling deadlocks, deadlock prevention, deadlock avoidance-safe state-resource allocation graph algorithm-Banker's algorithm, deadlock detection, recovery from deadlock.

Module III:

Memory Management:-Preliminaries-address binding , dynamic linking and loading, Overlays. logical versus physical address space, Swapping, Contiguous allocation Paging-principles of page allocation. structure of page table- hardware support, multi level paging, hierarchical paging, inverted page table, shared pages.

Segmentation-principles of operation, hardware, implementation of segment table, protection and sharing, fragmentation, segmentation with paging.

Module IV:

Virtual Memory-Demand paging –performance. Page replacement-page replacement algorithms. Thrashing, Segmentation and paging implementation of virtual memory, hierarchical address translation tables and MMUS.

Device Management:-Disk structure, Disk scheduling-FCFS-SSTF-C-Scan-Look, Disk management, Swap space management, Disk reliability.

Module V:
File Management:-File structure, File types, File access, File attributes, File operations. Directories-Flat directory systems, hierarchical directory systems. File system implementation-Allocation methods-contiguous allocation, linked allocation, indexed allocation

References

- Abraham Silberschatz and Peter Baer Galvin,Greg Gange 'Operating System Concepts', (Sixth Edition) Wiley - India.

- Milan Milenkovic 'Operating systems' TATA Mc GrawHill.
- Andrew S. Tanenbaum, "Modern Operating System, Prentice Hall India

MCA 205 Object Oriented Programming with C++

Module I
Introduction to Object-Oriented Programming: Evolution of programming methodologies. Procedural Approach Vs Object-Oriented Approach. Encapsulation and Abstraction, Message Passing, Inheritance, Reusability, Extensibility, Polymorphism, Overloading.
Objects and Classes: Access Specifiers. Memory Allocation for Objects, Friend Functions and Friend Classes, Static Data Members; Static Member Functions. this pointer. Comparison of class with structure. Inline functions.
Arrays and Strings: Arrays Within a Class; Arrays of Objects; Objects as Function Arguments; Returning Objects; const Member Functions; Constructing Two-Dimensional Arrays. String Manipulation using objects

Module II
Constructors and Destructors: Purpose of Constructors and Destructors. Default Constructors, Constructors with & without parameters, Constructor Overloading, Copy Constructor. Invoking Constructors and Destructors.
Pointers in C++ : Pointer declaration and Access, Pointer to void, pointer and arrays, pointer to pointer, pointer to functions, call by pointer, pointer arrays, Jagged array, array of pointers to string, memory management – new and delete, pointer to object. self referencing class, wild pointers.

Module III
Polymorphism: Overloading Concepts, Function Overloading: Operator Overloading: Defining Operator Function, Rules for overloading Operators. Overloading unary operators, overloading binary operators, Overloading Comma, [], (), ->, new, delete Operators. Type Conversions – Basic to Class, Class to Basic and One class to another class type, Advanced Type Casting.

Module IV
Inheritance: Basic Concepts, Reusability & Extensibility. Defining derived classes, protected access specified in Base class constructors and destructors in derived classes – Types of Inheritances. Making a Private Member Inheritable; Member Classes: Nesting of Classes.
Virtual Functions: Virtual Base Classes, Normal member functions accessed with pointers, virtual member function access, late binding, pure virtual function, abstract classes.

Module V

Console I/O operations: C++ streams and C++ stream classes – Predefined Objects, unformatted I/O operations, Formatted I/O operations - manipulators - User defined manipulators - Overloading << and >> Operators for Objects.

Disk I/O Operations: Stream Classes, classes for file stream operations, opening and closing a file, file nodes, writing an object to disk, reading an object from disk, binary versus character files, I/O with multiple objects, tellg() and seekg(), seekp() and tellp(). Updating a File : Error Handling During File Operations; Command-Line Arguments ,sequential access to a file, file input/output with stream class,error handling during file manipulations, filter utilities.

Templates: Generic Functions- A generic swap function, Functions with more than one Generic Type, Overloading a Function Template. Generic Classes – A stack generic class, Class template with more than one Generic Type, type name and template keywords, Template Restrictions, The power of Templates.

Exception Handling: Fundamentals of Exception Handling, Catching Class Types, Using Multiple catch statements, Catching All Exception, Restricting Exception, throw statement, Setting the Terminate and Unexpected Handlers, Uncaught exception, bad_exception Classes, and Built-In Exceptions. Exception Vs Error Handling, Assertion in C++.

References

- Deitel & Deitel, *C++ How to program*, Pearson Education Asia, 7th Edition, 2010.
- Computer Science: A Structured Programming Approach Using C++, Forouzan, Thomson Learning , 2 Edn
- C++ Programming: Malik, Thomson Learning , 3 Edn
- K.R Venugopal Rajkumar, *Mastering C++* , TMH.
- Gaddis Tony*, Starting Out with C++,* dreamtech Press,
- Sotter A Nicholas and Kleper J Scott, *Professional C++*, Wiley Publishing Inc.
- Schildt Herbert, *The Complete Reference C++*, Tata McGraw Hill, 4th Edition

MCA 206 C++ Lab

1. Program to Implement Classes and Objects.
2. Program to Implement Constructors and Destructors with array of Objects.
3. Program to Implement Passing and returning parameters as objects by reference.
4. Program to demonstrate Function Overloading.
5. Program to overload different operators – incr & decr operators with post & pre forms; new, delete, [], () and arithmetic operators.
6. Program to perform pointer sort operation.
7. Program to demonstrate friend functions and friend classes.
8. Program using objects for String manipulation functions.
9. Program to implement different types of inheritances like Multiple, Multilevel and Hybrid.
10. Program to demonstrate the use of Virtual Functions.
11. Program to demonstrate the use of abstract classes.
12. Program to demonstrate I/O streams and functions.
13. Program to Overload << and >> operators as a member and as a non-member operator functions.

14. Program to create a file to store some records and search for a particular record and display it.
15. Program to demonstrate namespaces and Volatile member functions.
16. Program to perform all possible Type Conversions.
17. Program to create function Templates, and overload the function Templates.
18. Program to create a generic stack class and member functions to perform stack operations.
19. Program to implement Exception Handling with minimum 5 exception classes including two built-in exceptions.

MCA 207 Data Structures LAB in C

- Program to represent sparse matrix manipulation using arrays.
- Program to represent Singly Linked List.
- Program to represent Doubly Linked List.
- Program to represent Circular Linked List.
- Polynomial addition using Arrays and Linked List.
- Program to represent Stack operations using array and linked list
- Program to represent Queue operations using array and linked list
- Program for Conversion of infix to postfix.
- Program for Evaluation of Expressions.
- Program to represent Binary Tree Traversals.
- Program to represent Searching procedures (Linear search , Binary search and Inter-polation search)
- Program to represent sorting procedures (Selection , Bubble , Insertion ,Quick , Heap , Merge)
- Program to find the minimum cost spanning tree using Prim's Method.
- Program to implement 8-Queens Problem.