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20MC101 COMPUTER PROGRAMMING AND DATA STRUCTURES

Course Description and Objectives:

This course is aimed at offering fundamental concepts of programming language to the students. It starts with the basics of C-programming and deals with the structure and various attributes required for writing a 'C' program. It also introduces various operators and control statements used in programming. Then it switches to functions and arrays. It goes on with strings, pointers, files & the user defined data types. As a first-level course in computer science, it forms the basis to understand usage of various attributes in writing a program.

Course Outcomes:

The student will be able to:

- Analyze problems and develop solutions by writing algorithms.
- Design of various test cases for validating input/output data and functionality of the programs.
- Develop simple real-time applications to get familiarity of the programming environment.
- Analyze characteristics of various data structures.
- Apply the concepts of graphs and trees in computer applications.
- Evaluate the importance of sorting and searching techniques in solving certain real time problems.

Skills:

- Identify suitable data types for an application.
- Apply control statements for decision making problems.
- Use multidimensional array for matrix manipulations.
- Design a program to perform statistical analysis on given data.
- Develop the sorting algorithm suitable for a given scenario.
- Implement array or linked list for a given problem.
- Usage of trees and graphs.

Activities:

ACTIVITY – 1: LIBRARY MANAGEMENT SYSTEM (LMS)

Our University wants to provide a Library management system (LMS) interface to the students and staff for the purpose of self issue and returns. If any user (student or staff) wants to take book from library, he must interact with Library management system by providing the credentials (username and password) of user. Then, LMS allows the user to get issues and returns by their own.

Activity – 2 : EMPLOYEE MANAGEMENT SYSTEM

In this project, we maintain the details of all employees and their children using nesting of structures. Consider each employee has four children and all are studying same number of subjects in same class. These are the structure members of Employee, Children, and Subjects.

Employee	Children	Subjects
ID	name	sub1
Name	age	sub2
Age	gender	sub3
Gender	struct subjects	total
Salary		
Struct children		

ACTIVITY – 3: HOTEL MANAGEMENT SYSTEM

Develop an application for Hotel management system with the following modules using structures, pointers to structure variables, passing structure pointers to function.

1. Get availability
2. Features of room
3. Room allocation
4. Show customer details
5. Room de-allocation
6. Restaurant
7. Billing.

Make your own assumptions for this project, design and implement Hotel management system.

ACTIVITY – 4 : CALENDER APPLICATION

Develop a calender application that uses many windows properties to make it colorful, for example, to indicate the vacation, it uses the red foreground color. The calendar can be used for two purposes. First to see the date and month as usual calendars and second to find out the day corresponding to given date. Some of the silent features of the project are

- It uses various windows properties to make the program colorful although it has lack of graphics.
- It entirely uses C code which is written in simple manner with lots of comments and important notes can be added.
- The date with such notes appears different than others with red background color.
- The months can be navigated using arrow keys.

ACTIVITY – 5: CRICKET SCORE SHEET

Developing a real-time cricket score sheet which displays a welcome screen that fades up to display the main menu. The main menu comprises three options namely:

- New Score Sheet
- View Score Sheet
- Exit

ACTIVITY – 6: BANK APPLICATION

Develop a Banking project in C language which will implement the following features and functionality in the program.

- Account Creation
- Deposit Amount
- Withdraw Amount
- View Details
- Foreign Exchange
- Exit

ACTIVITY – 7: CALENDER 1900 - 2100

The simple Project should accept the date, month and year between 1900 to 2100 and should display the calendar of that particular month.

Syllabus

UNIT – 1

9 Hours

PROGRAM STRUCTURE AND DATA TYPES: Structure of C program - Variable declaration statement and Executable statement; C character set, Constants, Identifiers, Operators, Punctuations, Keywords, Modifiers, Identifiers, Variables, Basic data types, Typedef, Enumeration, Storage classes, Control statements.

FUNCTIONS AND ARRAYS: Function - Declaration, Prototype, Definition, Call by value and call by address, Standard library functions and Recursive functions; Array - Declaration, Initialization, Reading, Writing, Accessing and Passing as a parameter to functions, Multidimensional arrays.

UNIT - 2

9 Hours

STRINGS, POINTERS AND STRUCTURES: Strings - Declaration, String library functions, Array of strings, Command line arguments; Pointers - Declaration, Initializing pointers, Multiple indirection, Relationship between arrays and pointers; Scaling up - Array of arrays, Array of pointers, Pointer to a pointer, Pointer to an array; Pointer to functions, Dynamic memory allocation functions.

Structures - Declaration, Initialization and accessing, Array of structures, Passing structures to functions, Structure pointers, Structures within structures; Unions, Bit-fields.

UNIT - 3

9 Hours

DATA REPRESENTATION AND SORTING: Introduction - Data, Data type, Data Structure, Primitive and Non-primitive - Data type, Data Structure; Storage structures - Sequential and Linked storage representations; Sorting – Bubble, Selection, Insertion, Quick, and Merge; Hashing - Hash tables, Hash functions, Different Hash functions - Division method, Multiplication method, Mid-Square method, Folding method.

UNIT – 4

9 Hours

LINKED LISTS: Introduction, Types of Linked List - Singly Linked List, Doubly Linked List, Circular Linked List; Operations - Insertion, Deletion, Traverse forward/reverse order.

STACKS AND QUEUES: Stacks - Introduction, Array and Linked representations, Implementation; Queues - Introduction, Array and Linked representations, Implementation, Circular queue.

UNIT – 5

9 Hours

TREES: Introduction, Properties, Binary Tree - Introduction, Properties, Array and Linked representations; Tree traversals and their Implementation, Expression trees, BST Definition and implementation.

GRAPHS: Introduction, Properties, Modeling problems as graphs representations - Adjacency matrix, Adjacency list; Traversals - Breath first search and Depth first search.

LIST OF EXPERIMENTS

Total hours-30

1. Compute the factors of a number.
2. Compute the average of 'n' numbers.
3. Find whether a number is palindrome or not.
4. Find whether a number is a power of 2 or not.
5. Compute the factorial of a number.
6. Swap two values using call by value and call by reference.
7. Find the frequency of each number in the array.
8. Reverse the contents of the array.
9. Find the factorial of a number using recursion.
10. Access the structure and union members.
11. Quick, Merge, Heap and Radix sorting techniques.
12. Linear and Binary search algorithms.
13. Singly linked list, doubly linked list and circular linked list.
14. Stack using an array and linked list.
15. Queue using an array and linked list.
16. Tree using an array and linked list.
17. Check if given expression is fully parenthesis or not using stack.
18. Tree traversing techniques.
19. BST using an array and linked list.
20. Graph traversal techniques.

Text Books:

1. Ajay Mittal, "Programming in C - A practical Approach", 1st edition, Pearson Education India, 2015.
2. Reema Thareja, "Introduction to C Programming", 2nd edition, Oxford University Press India, 2015.
3. Reema Thareja, "Data Structures Using C", 2nd edition, Oxford University Press, 2014.

Reference Books:

1. Herbert Schildt, C, "The Complete Reference", 4th edition, Tata McGraw-Hill, 2000.
2. E. Balagurusamy, "Programming in ANSI C", 4th edition, Tata McGraw- Hill, 2008.
3. Richard F. Gilberg and Bhrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", 2nd edition, Cengage Learning, 2004.
4. Jean Paul Tremblay and Paul G. Sorenson, "An Introduction to Data Structures with Applications", 2nd edition, Tata Mc-Graw Hill, 2004.
5. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd edition, Pearson Education, 2006..