Bharati Vidyapeeth's
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Model Question Paper - I [MCA – II Sem.]

Paper Code: MCA–102	**Subject: Data and File Structures**
Time: 3 Hours	**Maximum Marks: 75**

Note: Attempt five questions in all. Question no. 1 is compulsory and attempt one question from each unit.

1. Answer the following questions, briefly:-   (2.5×10 = 25)

    (a) Explain in brief, the various operations performed on data structures.

    (b) What do you mean by analysis of algorithms"? Discuss growth rate of algorithms.

    (c) List the advantages of studying worst-case analysis of algorithms.

    (d) Determine the minimum and maximum height of a binary tree having n nodes?

    (e) Compare B-tree and binary search tree.

    (f) Explain the Left-Left case (with suitable example) in constructing an AVL tree.

    (g) Design an algorithm for deleting en edge from an undirected graph.

    (h) List the advantages of random file organization over sequential file organization.

    (i) What is the importance of inverted file?

    (j) Justify the statement that only odd numbers of errors are detected by parity check.

UNIT - I

2. (a) Explain the limitations of a linear queue implemented with an array. How these   (6)
    limitations are overcome by circular queue. Write program/functions in "C" to
    implement the queue and its operations using linear linked-list.

    (b) Describe various categories of algorithms based on big oh (O) notation. Which   (6.5)
    category of algorithm is considered best? Prove that the worst-case time
    complexity of a binary search algorithm is $O(n \log n)$.

3. (a) Explain the limitations of a single stack implemented with an array. How these   (6)
    limitations are overcome by double stack. Write program/functions in "C" to
    implement the stack and its operations using linear linked-list.

    (b) "Postfix notation is considered most suitable for computer to calculate any   (6.5)
    expression". Justify this statement. Convert the following expression: (a + b - c) * d
    - (e + f) to its corresponding postfix expression.

UNIT - II

4. (a) Identify the problems in constructing binary search tree when data values are   (6)
    given in ascending order. How these problems can be solved? Demonstrate step-
    by-step construction of an AVL tree by inserting the following values: 14, 17, 11, 7,
    53, 4, 13, 12, and 8.

    (b) In how many ways, a tree could be traversed? Consider a complete binary search   (6.5)
    tree of 7 nodes, which traversal mechanism will sort/arrange the data values in

ascending order? Write program/function code to add the smallest and largest elements of a binary search tree.

5. (a) List the advantages of B-tree over binary search tree. Demonstrate step-by-step (6) construction of a B-tree of order 3 by inserting the numbers 1 to 10.

   (b) Explain the characteristics of a heap. How heap is beneficial to implement a (6.5) priority queue? Write program/function code in "C" to implement a priority queue.

UNIT - III

6. (a) Identify a suitable data structure to travers a graph using DFS (Depth First Search) (6) approach. Demonstrate step-by-step process to travers the following graph using DFS.
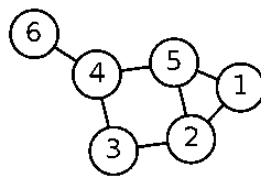
   (b) List the disadvantages of insertion sort technique. How these disadvantages are (6.5) solved by shell sort technique. Write program/function code for sorting n numbers using shell sort approach.

7. (a) Compare Dijkstra and Floyd–Warshall algorithms for shortest path. Determine (6) the shorted paths for the following graph using Dijkstra algorithm.
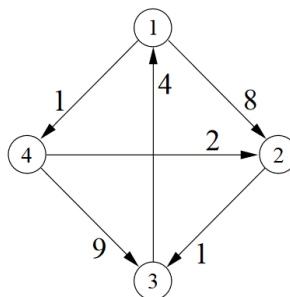
   (b) Suppose the books in a library need to be arranged in a sorted sequence. Which (6.5) one is the efficient sorting technique for arranging the books? Justify your answer and write program/function code for the identified sorting technique.

UNIT - IV

8. (a) Discuss the updating process of a sequential file. List the cases when an error may (6) encounter while updating a sequential file.

   (b) Explain sequential file organization. Compare sequential file organization and (6.5) random file organization.

9. (a) Create program code in "C" to insert all integers from 1 to 100 in a file (6) "number.txt". Open this file in read mode and retrieve the numbers one-by-one and then check the retrieved number is prime or not. If the number is prime, then write the number to another file named as "prime.txt".

(b) Explain the use of parity check for error detection? Determine the codeword for (6.5) the dataword (1 0 0 1) using cyclic redundancy check (CRC) error detection approach. The divisor to be considered, by sender and receiver is 1 0 1 1.