Reg. No. : ....

Code No. : 7884 Sub. Code : WCSM 11/
VCSC 11

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2024.

First Semester

Computer Science — Core

ANALYSIS AND DESIGN OF ALGORITHMS

(For those who joined in July 2023 onwards)

Time : Three hours   Maximum : 75 marks

PART A — (15 × 1 = 15 marks)

Answer ALL questions.

Choose the correct answer :

1. Which of the following is a step-by-step procedure for solving problems?

   (a) Program   (b) Algorithm

   (c) Code   (d) Syntax

2. Which complexity measures the amount of memory an algorithm uses concerning the input size?

   (a) time complexity

   (b) asymptotic complexity

   (c) space complexity

   (d) constant complexity

3. Which sorting algorithm sorts an array by repeatedly partitioning it around a pivot element?

   (a) Merge sort   (b) Binary search

   (c) Quick sort   (d) Insertion sort

4. Which traversal technique of a binary tree visits the left subtree, then the root node, and finally the right subtree?

   (a) Preorder traversal (b) Inorder traversal

   (c) Postorder traversal (d) Level-order traversal

5. Which search technique explores as far as possible along each branch before backtracking in a graph?

   (a) Depth-First search (DFS)

   (b) Breadth-First Search (BFS)

   (c) Dijkstra's algorithm

   (d) Bellman-ford algorithm

6. What is the time complexity of Binary search, implemented using divide and conquer, in the worst case?

(a) $O(n)$ (b) $O(\log n)$

(c) $O(n \log n)$ (d) $O(n^2)$

7. The first step in the naïve greedy algorithm is?

(a) adding flows with higher values

(b) reversing flow if required

(c) analyzing the zero flow

(d) calculating the maximum flow using trial and error

8. Which of the following methods is not a general problem-solving technique?

(a) Greedy method

(b) Divide and conquer

(c) Dynamic programming

(d) Binary search

9. In the 0/1 Knapsack problem, what does the '0/1' signify?

(a) The knapsack has a capacity of zero

(b) Each item can be taken either entirely or not at all

(c) The problem can be solved in either 0 or 1 iterations

(d) The knapsack can hold either zero or one item

10. What is a defining characteristic of problems that can be solved using dynamic programming?

(a) They can be solve using a recursive approach

(b) They involve overlapping sub problems

(c) They cannot have optimal solution

(d) They always require exponential time complexity

11. Which of the following best describes a multistage graph?

(a) A graph with multiple isolated components

(b) A graph where every vertex is connected to every other vertex

(c) A graph with multiple layers of vertices connected by edges

(d) A graph with cycles of arbitrary length

12. Which algorithm is commonly used to find the shortest paths between all pairs of vertices in a weighted graph?

(a) Dijkstra's algorithm

(b) Bellman-ford algorithm

(c) Floyd-Warshall algorithm

(d) Prim's algorithm

13. What is the primary objective of the 8-queen problem?
    (a) Placing eight queens on a chessboard so that no two queens attack each other
    (b) Finding the shortest path between eight cities
    (c) Partitioning a set of eight elements into subsets of equal sums
    (d) Coloring a graph with eight colors such that no two adjacent vertices have the same color

14. In the sum of subsets problem, what is the objective?
    (a) Finding the subset of elements that sums to a given target value
    (b) Finding the largest subset in a set of integers
    (c) Finding the smallest subset in a set of integers
    (d) Finding the average of all subsets in a set of integers

15. What does the graph coloring problem involve?
    (a) Finding the shortest path between two vertices in a graph
    (b) Assigning colors to the vertices of a graph such that no two adjacent vertices have the same color
    (c) Partitioning the vertices of a graph into two disjoint sets
    (d) Finding the maximum flow in a network
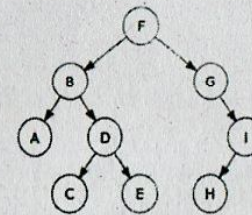
PART B — (5 × 4 = 20 marks)

Answer ALL questions, choosing either (a) or (b).
Each answer should not exceed 250 words.

16. (a) Write the definition of algorithm satisfied criteria and distinct area of study of an algorithm.

    Or

    (b) Sketch and explain the operations and link representation of stack.

17. (a) Write the pre-order, in-order, post-order traversal of the following binary tree.

    Or

    (b) Sort the given array using quick sort.

    | 2 | 8 | 7 | 1 | 3 | 5 | 6 | 4 |

18. (a) Compare the difference between divide and conquer method and greedy method.

    Or

    (b) Illustrate the general methods of greedy method.

19. (a) Construct the multi stage graph with neat diagram.

Or

(b) Write about traveling salesman problem.

20. (a) Point out the application and terminology of backtracking.

Or

(b) Determine the general methods of branch and bound.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b)
Each answer should not exceed 600 words.

21. (a) Explain the pseudocode conventions of an algorithm with an example.

Or

(b) Construct the binary tree for the following : (A-B) + C * (D/E)

22. (a) Categorize the various techniques of a graph with neat diagram in detail.

Or

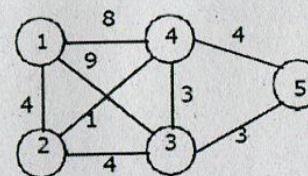(b) Construct the merge sort algorithm with its advantages and disadvantage. Give an example.

23. (a) Consider the following instance of the knapsack problem : n = 3, m = 20, (p1, p2, p3) = (25,24,15) and (w1, w2, w3) = (18,15,10)

Or

(b) Considering the following graph, find the minimal spanning tree using prim's algorithm.

24. (a) Explain in detail about 0/1 knapsack problem with an example.

Or

(b) Describe optimal binary search tree with an example.

25. (a) If S = {3,5,6,7} and d = 15, find the sum of subsets by using backtracking.

Or

(b) Explain about Hamiltonian cycle with an example.

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