BRAINWARE UNIVERSITY

Term End Examination 2025-2026
Programme – Dip.CSE-2024
Course Name – Design and Analysis of Algorithm
Course Code - DCS40111
(Semester IV)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Select the role of data gathering and analysis play in the context of real-life problem-solving.

a) Data gathering and analysis are unnecessary for algorithm design
b) Data gathering and analysis help identify patterns and understand the problem better
c) Data gathering and analysis are only useful for academic research
d) Data gathering and analysis should be outsourced to third-party agencies

(ii) Choose the algorithm that is commonly used to find the maximum flow in a network.

a) Bellman-Ford algorithm
b) Ford-Fulkerson algorithm
c) Dijkstra's algorithm
d) Kruskal's algorithm

(iii) Select the approach to solve travelling salesman problem.

a) a spanning tree
b) a minimum spanning tree
c) bellman – ford algorithm
d) Branch and Bound

(iv) Identify from the following is/are property/properties of a dynamic programming problem.

a) Optimal substructure
b) Overlapping subproblems
c) Greedy approach
d) Both a & b

(v) Choose from the following that best describes the Floyd-Warshall algorithm.

a) A greedy algorithm used for finding the shortest path between nodes in a graph.
b) An algorithm for finding the maximum flow in a flow network.
c) A dynamic programming algorithm for finding the shortest paths between all pairs of vertices in a weighted graph.
d) An algorithm for detecting cycles in a graph.

(vi) Choose the correct one, Floyd Warshall's Algorithm can be applied on _____

a) Undirected and unweighted graphs
b) Undirected graphs

c) Directed graphs
d) Acyclic graphs

(vii) Choose the term "residual capacity" represent in the context of network flows.

a) The maximum flow that can be sent through a network
b) The remaining capacity of an edge after some flow has been sent through it
c) The capacity of an edge in the opposite direction of the flow
d) The capacity of an edge in the original network

(viii) Identify from the following factors that should NOT be considered when evaluating the effectiveness of an algorithm for a real-life problem.

a) Speed and efficiency
b) Accuracy and correctness
c) Complexity and simplicity
d) Personal preferences of the algorithm designer

(ix) Indicate that Communication between a computer and a keyboard involves _____ transmission.

a) Automatic
b) Half-Duplex
c) Full-Duplex
d) Simplex

(x) State the time complexity of fun() int fun(int n) { int count = 0; for (int i = n; i > 0; i /= 2) for (int j = 0; j < i; j++) count += 1; return count; }

a) O(n2)
b) O(n*log(n))
c) O(n)
d) O(n*log(n*Log(n)))

(xi) Select the disadvantage of using brute force approach.

a) It is easy to implement
b) It has high time complexity
c) It guarantees optimal solution
d) It is suitable for all types of problems

(xii) Identify the basic idea of the Divide and conquer approach.

a) Solving a problem by dividing it into smaller subproblems, solving each subproblem recursively, and combining the solutions of the subproblems
b) Solving a problem by solving it directly without dividing it into smaller subproblems
c) Solving a problem by randomly selecting solutions until the optimal solution is found
d) Solving a problem by selecting the first feasible solution that is found

(xiii) Choose the main advantage of the Rabin-Karp Algorithm over the Naïve String Matching Algorithm.

a) It uses hashing to achieve an average-case time complexity of O(n + m)
b) It requires no preprocessing
c) It always runs in O(1) time
d) It works only for binary strings

(xiv) Select the main advantage of Strassen's Matrix Multiplication Algorithm over the conventional matrix multiplication method.

a) It reduces the multiplication complexity to $O(n^{2.807})$
b) It is easier to implement
c) It always produces an exact result
d) It works only for square matrices

(xv) Identify the recurrence relation that represents the time complexity of Binary Search.

a) T(n) = 2T(n/2) + O(n)
b) T(n) = T(n/2) + O(1)
c) T(n) = T(n-1) + O(n)
d) T(n) = 3T(n/3) + O(n)

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Define Backtracking in Design & Analysis of Algorithms (3)
3. Illustrate whether a problem can belong to both P and NP. (3)
4. Illustrate the concept of Knuth-Morris-Pratt (KMP) algorithm. (3)
5. Examine and show the Big O notation of f(n)=2n^2 +n. (3)
6. Analyze NP in terms of computational complexity. (3)

OR

Explain an example of a problem in NP. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Explain the concept of Fractional Knapsack using Greedy Approach. (5)
8. Describe with diagram recurrence Tree for recurrence T(n) = 2T(n/2) + O(n) and calculate its time complexity. (5)
9. Explain the steps involved in the Floyd-Warshall algorithm for finding the shortest paths between all pairs of vertices in a weighted graph with example. (5)
10. Explain the techniques employed in attempts to solve the P vs NP problem. (5)
11. Evaluate the significance of scalability in the context of approximation algorithms. (5)
12. Explain the NP-hard problem with the example of the Traveling Salesman Problem. (5)

OR

Illustrate the concepts of NP-completeness and discuss their significance in understanding the complexity landscape of computational problems. (5)

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