BRAINWARE UNIVERSITY

Term End Examination 2023-2024

Programme – B.Tech.(CSE)-AIML-2021/B.Tech.(CSE)-DS-2021/B.Tech.(CSE)-AIML-2022/B.Tech.(CSE)-DS-2022

Course Name – Design and Analysis of Algorithms

Course Code - PCC-CSM402/PCC-CSD402

(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) State which sorting algorithm has not the worst-case time complexity of O(n^2)?

a) Quick sort b) Merge sort
c) Insertion sort d) Selection sort

(ii) Identify the time complexity of Prim's Algorithm.

a) O(E log V) b) O(V log E)
c) O(E^2) d) O(V^2)

(iii) Select the main idea behind Prim's Algorithm.

a) Starting from any vertex, select the edge with minimum weight and add it to the tree
b) Starting from any vertex, select the edge with maximum weight and add it to the tree
c) Starting from the root node, select the edge with minimum weight and add it to the tree
d) Starting from the leaf nodes, select the edge with minimum weight and add it to the tree

(iv) Identify which stage of algorithm development involves understanding the problem and its requirements?

a) Describing the problem b) Identifying a suitable technique
c) Designing the algorithm d) Proof of correctness

(v) Predict the time complexity of Strassen's algorithm for matrix multiplication :

a) O(n) b) O(n^2)
c) O(n^3) d) O(n^4)

(vi) State the set-covering problem?

a) A problem in which the goal is to find the smallest set of vertices that covers all edges in a graph.
b) A problem in which the goal is to find the smallest set of edges that covers all vertices in a graph.

c) A problem in which the goal is to find the largest set of vertices that covers all edges in a graph.

d) A problem in which the goal is to find the largest set of edges that covers all vertices in a graph.

(vii) State ,in the greedy algorithm for the set-covering problem, what is the criterion for choosing the next set to include in the cover?

a) Choose the set that contains the most uncovered vertices.

b) Choose the set that contains the most uncovered edges.

c) Choose the set that contains the fewest uncovered vertices.

d) Choose the set that contains the fewest uncovered edges.

(viii) Choose ,which of the following is true about the vertex cover problem on a tree?

a) The optimal vertex cover has size n/2, where n is the number of vertices in the tree.

b) The optimal vertex cover has size log n, where n is the number of vertices in the tree.

c) The optimal vertex cover has size 2, regardless of the number of vertices in the tree

d) The optimal vertex cover has size 1, regardless of the number of vertices in the tree.

(ix) Select,which of the following is true about the vertex cover problem on a bipartite graph?

a) The optimal vertex cover has size n/2, where n is the number of vertices in the graph.

b) The optimal vertex cover has size log n, where n is the number of vertices in the graph.

c) The optimal vertex cover has size 2, regardless of the number of vertices in the graph

d) The optimal vertex cover has size 1, regardless of the number of vertices in the graph

(x) Write the objective of K-center clustering?

a) To minimize the distance between data points in each cluster.

b) To maximize the distance between data points in each cluster.

c) To minimize the maximum distance between a data point and its assigned center

d) To maximize the maximum distance between a data point and its assigned center.

(xi) Identify the difference between NP-complete and NP-hard?

a) NP-complete problems are a subset of NP-hard pro,blems.

b) NP-hard problems are a subset of NP-complete problems.

c) NP-complete problems can be solved in polynomial time.

d) NP-hard problems can be solved in polynomial time.

(xii) Select which of the following is true about the clique problem?

a) It can be solved in polynomial time for any graph

b) It can be solved in polynomial time for some special graphs

c) It is an NP-hard problem

d) It is an NP-complete problem

(xiii) Choose which of the following is true about the space complexity of finding maximum cliques in a graph?

a) It is always polynomial in the size of the graph

b) It is always exponential in the size of the graph

c) It depends on the algorithm used

d) It is always constant

(xiv) State the current trend in algorithm design?

a) Increasing reliance on brute force approaches.

b) Focusing on optimization techniques.

c) Increasing use of machine learning algorithms.

d) Decreasing use of heuristic algorithms.

(xv) Choose which of the following is an example of a clustering algorithm?

a) Linear regression.

b) K-means clustering.

c) Decision tree.

d) Support vector machine.

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Write the basic characteristic of dynamic programming? (3)
3. Identify the optimal parenthesization of a matrix chain product whose sequence of dimensions is (5, 10, 3, 12, 5, 50, 6). Give an algorithm of the above procedure. Analyze its complexity. (3)
4. Define the SAT problem? (3)
5. Discuss the significance of Floyd-Warshall algorithm in real-world applications. (3)
6. Compare and contrast the time complexity of the Naïve String Matching Algorithm and the KMP algorithm. (3)

OR

Analyze the impact of pattern length on the performance of the Rabin-Karp Algorithm. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Explain interpolation problem in detail. (5)
8. Apply the Naïve String Matching Algorithm to find all occurrences of the pattern "aba" in the text "abababababab". Provide a step-by-step explanation of your approach, including the comparisons made at each step. (5)
9. Illustrate any three graph applications with algorithms. (5)
10. Compare Brute Force Algorithm,Greedy technique and dynamic programming method in solving traveling salesman problem. (5)
11. Discuss all pair shortest path using Floyd Warshall Algorithm. (5)
12. Summarize the K-center clustering problem and elaborate on its significance in data clustering and approximation algorithms. (5)

OR

Evaluate the concept of finding the global Minimum Cut in graph theory and algorithm design. (5)

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