BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – M.Tech.(CSE)-AIML-2024
Course Name – Advanced Algorithm
Course Code - MTA10101
(Semester I)

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) Identify which of the following is/are property/properties of a dynamic programming problem?

a) Optimal substructure
b) Overlapping sub problems
c) Greedy approach
d) Both optimal substructure and overlapping sub problems

(ii) Identify the correct option, in dynamic programming, the technique of storing the previously calculated values is called

a) Saving value property
b) Storing value property
c) Memorization
d) Mapping

(iii) Identify the correct option, randomized algorithm is _____

a) An algorithm that always produces a random output.
b) An algorithm that uses random numbers to make decisions.
c) An algorithm that generates random numbers.
d) An algorithm that only works with random data.

(iv) Identify which of the following is the "Monte Carlo" approach in the context of randomized algorithms

a) An approach that uses random numbers to approximate solutions with a known probability of error.
b) An approach that guarantees an exact solution using random numbers.
c) An approach that never uses random numbers.
d) An approach that uses random numbers to generate truly random solutions.

(v) Choose the primary difference between NP-Complete and NP-Hard problems.

a) NP-Hard problems have known polynomial-time solutions.
b) NP-Complete problems are harder to solve than NP-Hard problems.
c) NP-Hard problems are easier to verify than NP-Complete problems.
d) There is no significant difference between them.

(vi) Choose the correct option, can an NP-Complete problem be solved in polynomial time?

a) Yes, always.
b) No, never.
c) It depends on the specific problem instance.
d) Only if P equals NP.

(vii) State why Dijkstra's algorithm may not work correctly for graphs with negative edge weights.

a) It gets stuck in an infinite loop
b) It fails to guarantee the shortest path
c) It produces a negative shortest path
d) None of the above

(viii) State the Ford-Fulkerson method can be applied to networks with which of the following

a) Only integer capacities.
b) Only real number capacities.
c) Both integer and real number capacities.
d) Only binary capacities.

(ix) Select which of the following is a drawback of the Ford-Fulkerson method?

a) It is computationally very slow.
b) It always finds the unique maximum flow.
c) It is not applicable to directed graphs.
d) It may not terminate if capacities are not integers.

(x) Select which element is chosen as the "pivot" for partitioning the array in Quick Sort.

a) The first element
b) The middle element
c) The last element
d) A randomly selected element

(xi) Select what is the time complexity of the Quick Sort algorithm in the average case?

a) O(n)
b) O(n log n)
c) O(n^2)
d) O(log n)

(xii) Identify the correct option, in the context of Quick Sort is an in-place sorting algorithm. What does "in-place" mean?

a) It uses extra memory for sorting.
b) It doesn't require any additional memory for sorting.
c) It's not efficient for sorting.
d) It can only sort a small number of elements.

(xiii) Select the elements that need to be "covered", in the knapsack cover problem.

a) Weights
b) Values
c) Profits
d) Items

(xiv) Choose the primary objective of the knapsack cover problem.

a) Maximizing the total value of selected items
b) Minimizing the total weight of selected items
c) Covering as many weights as possible with the fewest items
d) Maximizing the number of items selected

(xv) Select the complexity of the knapsack cover problem.

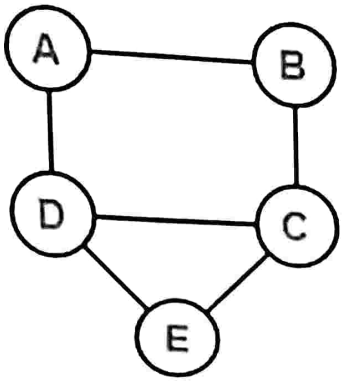
a) NP-hard
b) P-time
c) Polynomial-time solvable
d) NP-complete

Group-B

(Short Answer Type Questions) 3 x 5=15

2. State the constraints of 0-1 knapsack problem. (3)
3. Explain Approximation algorithm (3)

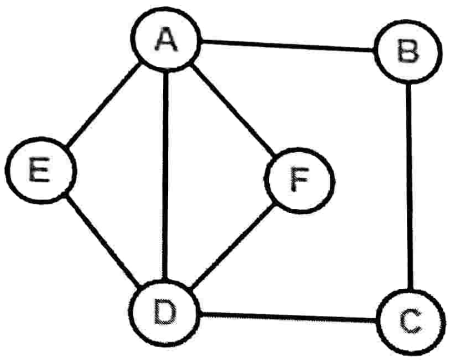
4.



(3)

Trace the the hamiltonian path from the graph.

5.



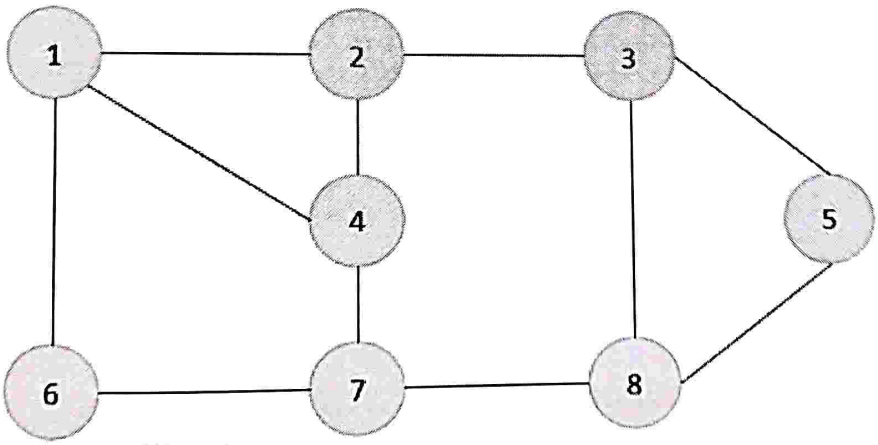
(3)

Judge if this graph is a Hamiltoian graph or not.

6. Evaluate the following knapsack problem so that profit is maximized. weights and profits are: Weights: {3, 4, 6, 5} Profits: {2, 3, 1, 4} The weight of the knapsack is 8 kg (3)

OR

(3)

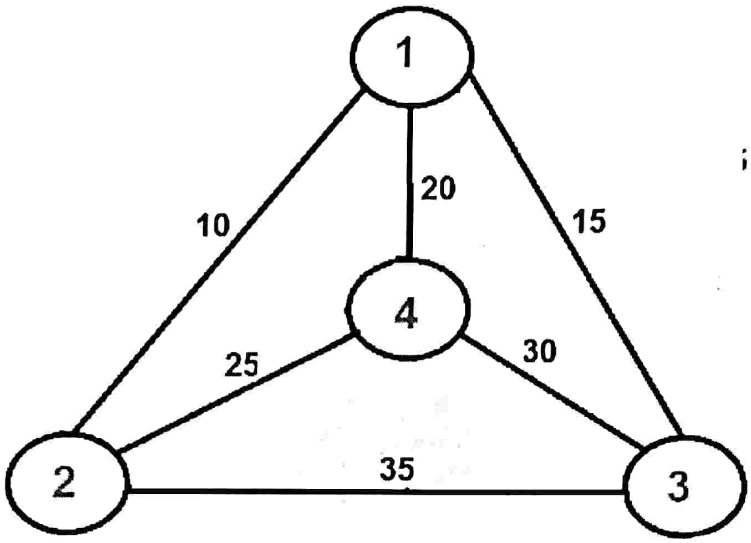


Evaluate the minimum vertex cover from the graph using approximation algorithm.

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Define randomized algorithms and explain their significance in computer science. (5)
8. Explain the Monte Carlo algorithm and its applications in solving probabilistic problems. (5)
9. Distinguish NP-complete and NP-hard problems (5)
10. Illustrate vertex cover problem with an example. (5)
11. Distinguish NP Complete and NP Hard problems. (5)
12. (5)



Evaluate the Travelling Salesman problem using Approximation algorithm.

OR

Justify that Travelling Salesman problem is NP-Complete (5)

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