

Time: 3 hours

19/12/2025

Marks: 80

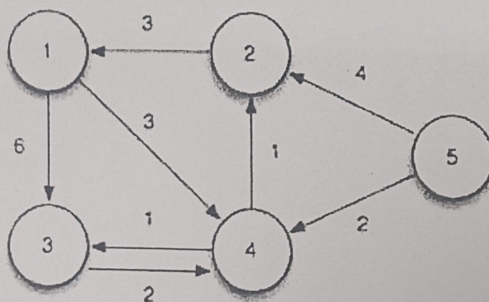
- N.B. (1) Question one is Compulsory.
 (2) Attempt any 3 questions out of the remaining.
 (3) Assume suitable data if required.

Q. 1

- a) What is the job sequencing with deadlines problem? Explain with an example how it can be solved using greedy approach. (05)
- b) Explain the Divide and Conquer approach with a suitable example. (05)
- c) Explain how the N-Queen's problem can be solved with backtracking using a suitable example. (05)
- d) Solve the following recurrence relations using Master's method. (05)
- i. $T(n) = 2T(n/2) + n$
 - ii. $T(n) = 3T(n/4) + n^2$

Q. 2

- a) What is the sum of subsets problem? Explain its working for the following example: $n=5$, $W = \{1, 4, 6, 9, 10\}$ and target sum = 19. Use backtracking approach. (10)
- b) Find the shortest path from vertex 1 to all other vertices using greedy approach. (10)
 Show output after each iteration.



Q. 3

- a) Write an algorithm for Merge sort. Derive and discuss its time complexity for all cases. Explain the working of the Merge Sort algorithm with a suitable example containing at least seven elements in the list. Illustrate each step of the divide and conquer process, including both splitting and merging phases. (10)
- b) What is the 15-puzzle problem? Explain with an example how this can be solved using Branch and Bound. (10)

Q. 4

- a) Solve the following 0/1 Knapsack problem and give its optimal solution using dynamic programming: $n = 4$, Knapsack capacity $M = 5$, Weights $W = \{2, 1, 3, 2\}$ and Profits $V = \{12, 10, 20, 15\}$. (10)
- b) Explain the Rabin-Karp algorithm for string matching with a suitable example. Explain the concept and significance of spurious hit in Rabin-Karp algorithm? (10)

Q. 5 (10)

a) Write a detailed note on Big Oh, Omega and Theta notations. (10)

b) What is the LCS problem? Find the LCS for the following strings: X = "BARCELONA" Y = "BALTIMORE" using dynamic programming (20)

Q. 6 Write short notes on (any 2):

a) P, NP, NP-Hard and NP-Complete Problems

b) Multistage graphs using dynamic programming

c) Minimum Spanning Tree using Kruskal's Algorithm
