



Bharatiya Vidya Bhavan's
SARDAR PATEL INSTITUTE OF TECHNOLOGY

(Autonomous Institute Affiliated to University of Mumbai)
Munshi Nagar, Andheri (W), Mumbai – 400 058.

RE

End Semester Examination
December 2022

Max. Marks: 100

Class: MCA

Course Code: MC507

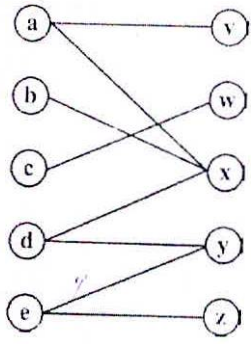
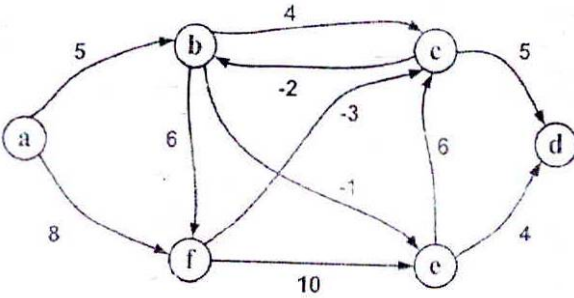
Name of the Course: Design and Analysis of Algorithms

Duration: 180 Min.

Semester: II

Instruction:

- 1) All questions are compulsory.
- 2) Draw neat diagrams.
- 3) Assume suitable data if necessary but justify the same.

Q. No.	Question	Max. Marks	CO-BL
Q. 1	Solve the following recurrence relations using Recursion-tree method. (i) $T(n) = T(n-1) + n$ (ii) $T(n) = 3T(n/3 + 5) + n/2$ (iii) $T(n) = T(\alpha n) + T((\alpha + 1)n) + cn$	20	CO1-4
Q. 2	<p>Consider the following Bipartite Graph $G_b = (L \cup R, E)$ where $L = \{a, b, c, d, e\}$ and $R = \{v, w, x, y, z\}$. The edges of the bipartite graph are as shown below.</p>  <p>Answer the followings questions:</p> <ol style="list-style-type: none">(i) Show the conversion of the given bipartite graph G_b to its equivalent flow Graph and(ii) Find the maximum matching of the bipartite graph after applying all iterations of Ford-Fulkerson Algorithm on the flow graph. <p style="text-align: center;">OR</p> <p>Consider the following $G = (V, E)$ where $V = \{a, b, c, d, e, f\}$. The edges of the graph are shown below in the graph.</p>  <p>Show all iterations of running Bellman-Ford Algorithm on the above graph G.</p> <ol style="list-style-type: none">(i) Find the shortest distances from the node a to all other nodes using Bellman-Ford Algorithm.(ii) Find the shortest paths from the node a to all other nodes using Bellman-Ford Algorithm.	20	CO4-3



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Q. 3	<p>Show the sorting of list of elements $E = [8, 34, 2, 1, 4, 23, 64, 21]$ using Heap Sort Algorithm as follows.</p> <ul style="list-style-type: none">(i) Build Max Heap of array E using Heapify method. Consider all elements of E at time as input to Heapify.(ii) Show all steps to sort all elements of E by running Heapify on the built Max Heaps.	20	CO2-3
Q. 4	<p>Consider the list of three elements $E = [8, 34, 2]$. Answer the following questions:</p> <ul style="list-style-type: none">(i) Show all the possible Binary Search Tree (BSTs) of these three elements.(ii) Find the Optimal BST for E using Dynamic Programming. Assume that the probability of each successful search is 0.2 and the probability of each unsuccessful search is 0.1	20	CO3-3
Q. 5	<p>Consider the 8 Queens Problem where eight queens are placed on 8x8 chessboards so that no two queen attack. Any two queens is said to attack when they are in the same row/column/diagonal.</p> <ul style="list-style-type: none">(i) Discuss the fixed and variable sized tree organizations of solution space to 8 queens problem using backtracking approach.(ii) Discuss the bounding function for any one of the tree organizations mentioned in (i)	20	CO4-5