Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous College Affiliated to University of Mumbai)

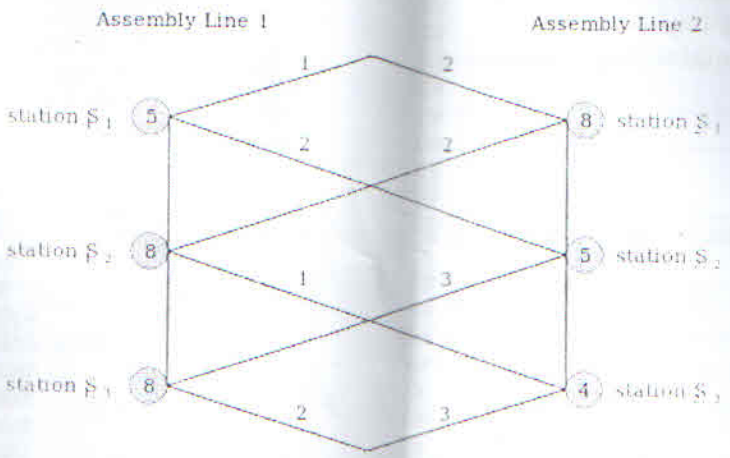
End Semester Examination
April 2018

Max. Marks: 100 | **Duration: 3 Hrs**
Class: S.E. | **Semester: IV**
Course Code: IT41 / CE41 | **Branch: IT/COMP**
Name of the Course: Design and Analysis of Algorithm

Instructions:
(1) **All Questions are Compulsory**
(2) **Draw neat diagrams**
(3) **Assume suitable data if necessary**

Question No.	Question	Max. Marks	CO
Q. 1 a)	Write Binary Search algorithm and derive its time complexity.	*05*	CO1
Q. 1 b)	Solve the given recurrences using Master method theorem. **If** the recurrence relation is solvable, specify the applicable case **else** justify why it is not solvable. i) $T(n)= 6T(n/3) + n^2\log n$ ii) $T(n)=2^n T(n/2)+ n^n$	*05*	CO1
Q. 1 c)	Write an algorithm of Quick Sort using Divide and conquer approach. Analyze it's time complexity. **OR** Write an algorithm of Merge Sort using Divide and conquer approach. Analyze it's time complexity.	*05*	CO2
Q. 1 d)	Compare Divide and Conquer Approach, Greedy Approach and Dynamic Programming Approach.	05	CO2
Q. 2 a)	Show the steps of sequence of Dynamic Programming Approach to solve 0/1 Knapsack Problem. Justify with an example	*10*	CO3
Q2. b)	Write an algorithm of Kruskal's method to find minimum cost spanning tree using Greedy approach and analyze it's time complexity **OR** Write an algorithm for Knapsack Problem using Greedy Approach and state its time complexity. Find the optimal solution to the below given knapsack instance where n=5 and capacity of the knapsack=80.	*10*	CO4

Objects	1	2	3	4	5
Weight	20	30	40	10	7
Profit	7	8	9	1	6

Q.3 a)	Iron Man and Captain America start for a mission from Isengard to Middle Earth. As shown in Fig. 1, there are two different tracks from Isengard to Middle-Earth. Each track has 3 toll stations where they have to pay and in between they can change track from any toll but for that they have to pay extra. By changing track from i^{th} toll of first track one can reach $(i+1)^{th}$ toll of second track and vice versa. Apply dynamic programming approach to calculate is minimum cost required to reach from Isengard to Middle-Earth. Show the calculation.  Fig. 1	*10*	CO3
Q.3 b)	Write a backtracking algorithm for N Queen Problem. Draw portion of state space tree that is generated to find all possible solution for 4 Queen **OR** State how to check whether the given instance of 15-puzzle is solvable or not? If the puzzle is solvable then use Least Cost Branch and Bound to solve the given instance and draw the portion of state space tree for 15 puzzle. Show cost function calculation of each node generated 1 2 3 4 5 6 8 9 10 7 11 13 14 15 12	*10*	CO5
Q.4 a)	Write a KMP-Prefix Function algorithm and Compute the prefix function for the given pattern i) cocacola ii) bababba **OR** Consider working module q=11, how many spurious hits does the Rabin-Karp Matcher counter in the text T= 31415926535 when looking for the pattern P = 26	*05*	CO5

Q.4 b)	What are Branch and Bound Techniques? Explain any two techniques with example showing node generation in state space tree.	*05*	CO5
Q4 c)	Write an algorithm for Finite-Automata-Matcher and transition function of string matching. Construct the string-matching automata for the given pattern **P = aabab** and illustrate its operation on the text string **T = aaababaabaababaab** by stating the sequences of states it enters in.	*10*	CO5
Q.5a)	Describe standard form and slack form. Explain how to convert linear Program into standard and slack form. Apply the same to the given problem and also state what the basic and non-basic variables are in the given problem. Maximize $2x_1 - 6x_3$ Subject To : $x_1 + x_2 - x_3 \leq 7$ $3x_1 - x_2 \geq 8$ $-x_1 + 2x_2 + 2x_3 \geq 0$ $x_1, x_2, x_3 \geq 0$ **OR** Write short note on Duality. Formulate the given Primal Problem into Dual problem Maximize $18x_1 - 12.5x_2$ Subject To : $x_1 + x_2 \leq 20$ $x_1 \leq 12$ $x_2 \leq 16$ $x_1, x_2 \geq 0$	*10*	CO6
Q.5. b)	Solve the following linear program using SIMPLEX: Maximize $2x_1 - x_2 + 2x_3$ Subject To : $2x_1 + x_2 \leq 10$ $x_1 + 2x_2 - 2x_3 \leq 20$ $x_1 + 2x_3 \leq 15$ $x_1, x_2, x_3 \geq 0$	*10*	CO6

Q.4 b)	What are Branch and Bound Techniques? Explain any two techniques with example showing node generation in state space tree.	*05*	CO5
Q4 c)	Write an algorithm for Finite-Automata-Matcher and transition function of string matching. Construct the string-matching automata for the given pattern **P = aabab** and illustrate its operation on the text string **T = aaababaabaababaab** by stating the sequences of states it enters in.	*10*	CO5
Q.5a)	Describe standard form and slack form. Explain how to convert linear Program into standard and slack form. Apply the same to the given problem and also state what the basic and non-basic variables are in the given problem. Maximize $2x_1 - 6x_3$ Subject To : $x_1 + x_2 - x_3 \leq 7$ $3x_1 - x_2 \geq 8$ $-x_1 + 2x_2 + 2x_3 \geq 0$ $x_1, x_2, x_3 \geq 0$ **OR** Write short note on Duality. Formulate the given Primal Problem into Dual problem Maximize $18x_1 - 12.5x_2$ Subject To : $x_1 + x_2 \leq 20$ $x_1 \leq 12$ $x_2 \leq 16$ $x_1, x_2 \geq 0$	*10*	CO6
Q.5. b)	Solve the following linear program using SIMPLEX: Maximize $2x_1 - x_2 + 2x_3$ Subject To : $2x_1 + x_2 \leq 10$ $x_1 + 2x_2 - 2x_3 \leq 20$ $x_1 + 2x_3 \leq 15$ $x_1, x_2, x_3 \geq 0$	*10*	CO6