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
May 2019

Max. Marks: 60 | **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**

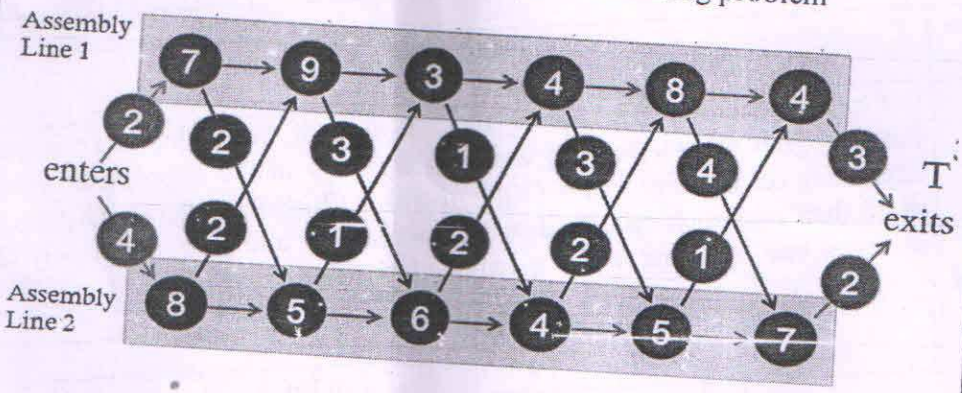
<table>
<tr><th>Question No.</th><th>Question</th><th>Max. Marks</th><th>CO</th></tr>
<tr><td>Q. 1 a)</td><td>i. For each function f(n) along the left side of the table, and for each function g(n) across the top, write O, Ω, or Θ in the appropriate space, depending on whether f(n) = O(g(n)), f(n) = Ω(g(n)), or f(n) = Θ(g(n)). If more than one such relation holds between f(n) and g(n), write only the strongest one. The first row is a demo solution for f(n) = n2 .
<table>
<tr><td colspan="2"></td><td colspan="3">g(n)</td></tr>
<tr><td rowspan="3">f(n)</td><td></td><td>n</td><td>n log n</td><td>n^2</td></tr>
<tr><td>n^2</td><td>Ω</td><td>Ω</td><td>θ</td></tr>
<tr><td>n^3</td><td></td><td></td><td></td></tr>
<tr><td>n log n</td><td></td><td></td><td></td></tr>
</table>
ii. State True or False :
1. If f(n) = O(g(n)) and g(n) = O(f(n)) then f(n) = g(n)</td><td>03

01</td><td rowspan="3">CO1</td></tr>
<tr><td>Q.1.b)</td><td>i. Solve the given recurrences using substitution method
T(1)=4
T(n)= 2T(n/2) + 4n

ii. Solve the given recurrences using recursion tree method
T(n)= 3T(n/4) + cn^2</td><td>02

02</td></tr>
<tr><td>Q. 1 c)</td><td>Apply Strassen's matrix multiplication algorithm to multiply the given matrices

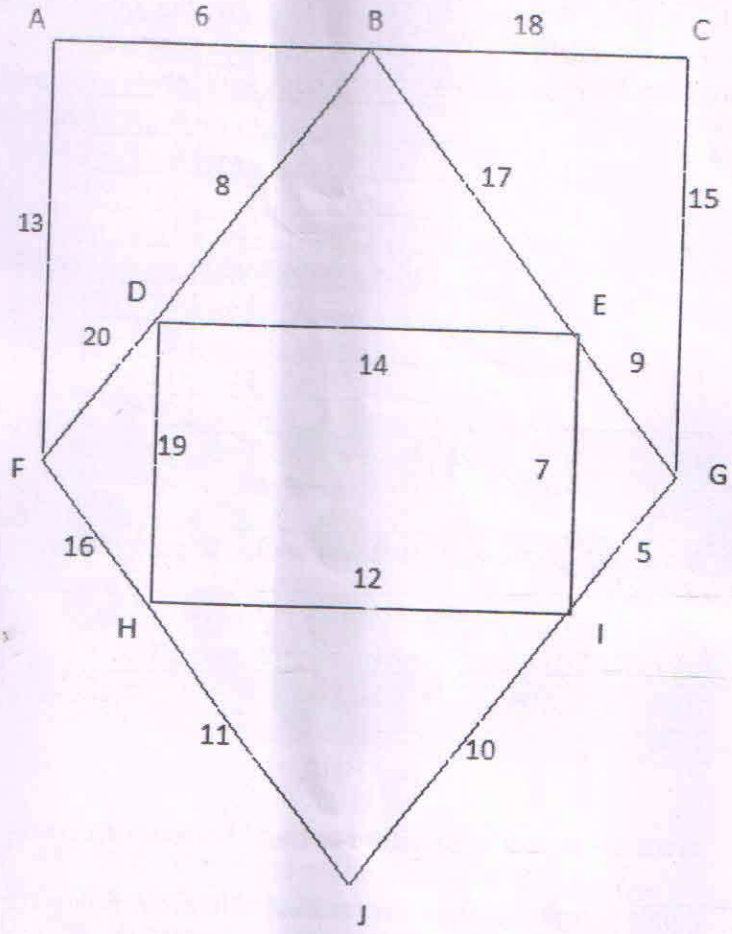
X= <table><tr><td>1</td><td>3</td></tr><tr><td>7</td><td>5</td></tr></table> Y= <table><tr><td>6</td><td>8</td></tr><tr><td>4</td><td>2</td></tr></table></td><td>06</td><td>CO2</td></tr>
</table>

Q. 2 a)	i. Write an algorithm using Divide and conquer approach for finding minimum and maximum element from an array. ii. Analyze it's time complexity by stating its recurrence relation. iii. Simulate the above algorithm to find Min and Max on the following elements. Show the tree of recursive calls 22 13 -5 -8 15 60 17 31 47	*03* *01* *02*	CO2
Q2. b)	i. State the steps to be followed to develop a dynamic programming solution for the Assembly Line scheduling problem ii. Apply the Dynamic Programming approach to find Optimal solution to following Assembly Line scheduling problem  **OR** i. State and apply the steps to be followed to develop a dynamic programming solution to the Longest common Subsequence ii. Apply the Dynamic Programming approach to find LCS for following two strings. X = BACDB and Y = BDDB.	*03* *03* *03* *03*	CO3

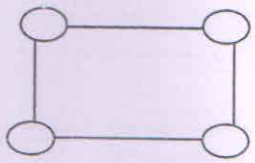
Q .3a)	Apply Least Cost Branch and Bound to solve the given instance of 15 puzzle problem and draw the portion of state space tree for 15 puzzle. Show cost function calculation of each node generated a) initial configuration b) goal configuration	*06*	CO4
Q.3 b)	i. Write an algorithm of Huffman coding to generate an optimal prefix codes ii. apply the same on the given set of frequencies a:1 b:1 c:2 d:3 e:5 f:8 g:19 h:21 **OR** i. Write a Kruskal's algorithm to find Minimum spanning tree. ii. Apply Kruskal's algorithm to find Minimum Spanning Tree for the given network. The following network has 10 vertices A----J, numbers on edge represents distance in miles between pair of vertices.	*03* *03* *03* *03*	CO3

1	2	3	4
5	6		8
9	10	7	11
13	14	15	12

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	



Q.4 a)	i. Construct the string matching automaton for the given pattern and show the sequences of states it enters in for the given text and also show occurrences of pattern in the text Pattern : a a b a b Text : a a a b a b a a b a a b a b a a b	*03*	
	ii. Compute KMP prefix function for the given pattern and check if it is present in given text. Pattern = a b d c a b d Text = a b d c a b a b d c a b d c b	*03*	**CO5**

Q.4 b)	i.	Write a backtracking algorithm for graph coloring problem.	*03*	
	ii.	Draw the portion of state space tree that is generated to find minimum number of colors required to color the given graph 	*03*	CO4
		OR		
	i.	Write a backtracking algorithm for sum of subsets problem.	*03*	
	ii.	apply the same on given problem, Let n=6, M=30 and W(1…6)=(5,10,12,13,15,18). Find all possible subsets of w that sum to m. Draw the portion of state space tree for fixed tuple size solution.	*03*	
Q.5a)		Make a linear programming model and identify the objective function and constraints: A farmer has recently acquired an 110 hectares piece of land. He has decided to grow Wheat and barley on that land. Due to the quality of the sun and the region's excellent climate, the entire production of Wheat and Barley can be sold. He wants to know how to plant each variety in the 110 hectares, given the costs, net profits and labor requirements according to the data shown below:	*04*	CO6

Variety	Cost (Price/Hec)	Net Profit (Price/Hec)	Man-days/Hec
Wheat	100	50	10
Barley	200	120	30

The farmer has a budget of US$10,000 and an availability of 1,200 man-days during the planning horizon.

Q.5. b)	Solve the following problem using SIMPLEX: Maximize $Z = f(x,y) = 3x + 2y$ subject to: $2x + y \leq 18$ $2x + 3y \leq 42$ $3x + y \leq 24$ $x \geq 0 , y \geq 0$	*6*	**CO6**