Roll Number:_____

Thapar University, Patiala

Computer Science & Engineering Department

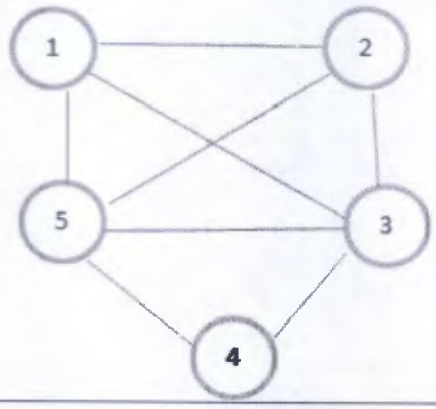
END SEMESTER EXAMINATION

B. E. (3rd Year): Semester-5 (2020-21) Course Code: UCS415

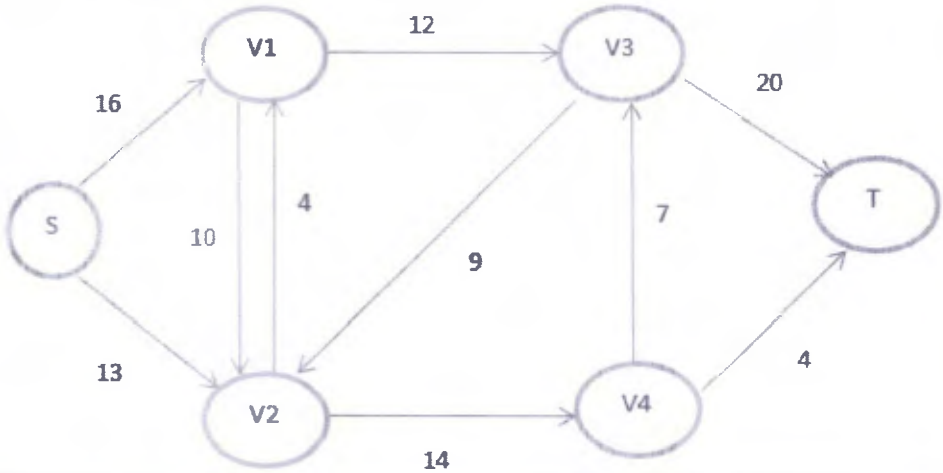
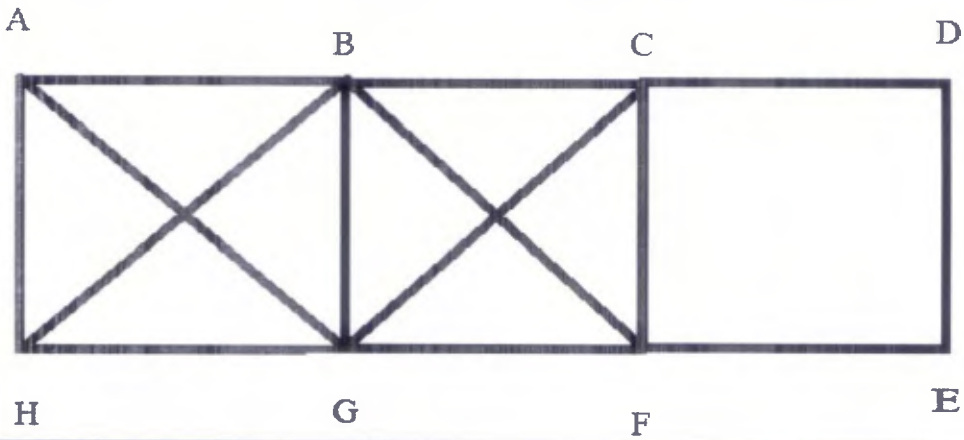
Course Name: Design & Analysis of Algorithms

January 29, 2021 Monday, 14.30PM

Time: 2 Hours, M. Marks: 50 Name Of Faculty: Rajiv Kumar, Rajesh Mehta, Ashish Giridhar

1	Let n = 4 and (a_1, a_2, a_3, a_4) = (*das, fish, ink, watch*). Let p(1: 4) = (4, 6, 8, 2) and q(0:4) = (6, 6, 6, 6, 5). The p's and q's have been multiplied by 100 for convenience. Use dynamic programming technique to find the optimal binary search tree. Write all the values used at one stage to calculate the next stage and so on. Show the values in table and construct the final optimal binary search tree also.	10
2	a) Solve the following recurrence relation using recursive tree method. $T(n) = \begin{cases} T(\frac{n}{4}) + T\left(\frac{n}{2}\right) + n^2 & n > 1 \\ 1 & n = 1 \end{cases}$ b) Explain the backtracking algorithm to find the Hamiltonian cycle of a graph G. Find the Hamiltonian cycle of the graph shown in following below: 	5,5
3	Consider the following matrix showing the distance between different cities. Solve the Travelling salesman problem and draw the complete state space tree using ***branch and bound*** algorithm. Also find the optimal solution starting from city 0.	10

	0	1	2	3	4
0	Infinity	20	30	10	11
1	15	Infinity	16	4	2
2	3	5	Infinity	2	4
3	19	6	18	Infinity	3
4	16	4	7	16	Infinity

4	Explain the maximum flow problem and apply Ford Fulkerson algorithm to find the maximum flow of the network shown below from source **S** to destination **T**. (show each step of algorithm). Also explain: (a) Augmented path (b) Residual graph (c) Minimal cut (d) Residual capacity.  	1,5,4
5	What is a min cut of a graph G? Write the Karger's min cut algorithm and apply the same on the graph given below (show intermediate steps)  	2,3,5
6	Working modulo $q = 11$, how many spurious hits does the Rabin-Karp matcher encounter in the text $T =$ 3 1 4 1 5 9 2 6 5 3 5 8 9 7 9 3 When looking for the pattern $P = 26$? Explain your answer with proper implementation of Rabin-Karp algorithm.	10
7	(a) By explaining the difference between deterministic and non-deterministic algorithm with example. Also write a short note on P, NP, NP hard and NP complete class problems. (b) If possible, find the topological sort for the graph G having 6 vertices. (for an ordered pair (x, y) means there is an edge from x to y) G= { (a, b), (a, c), (b ,d), (b, e), (d, e), (d, f), (a, e)}	5,5