office Copy

Roll Number:_____ Number of Pages: 02

Thapar Institute of Engineering and Technology, Patiala

Department of Computer Science and Engineering

END SEMESTER EXAMINATION

B. E. (Second Year): Sem-II (2021/22) Course Code: UCS415

Course Name: Design and Analysis of Algorithms

June 04, 2022 Saturday, 11:25 0 Hrs – 13:25 Hrs Time: 2 Hours, M. Marks: 35

Name of Faculty: Rajiv Kumar, Maninder Kaur, Shreelekha Pandey, Rajesh Mehta, Mamta Dabra, Yashwant Singh Patel, Vaibhav Pandey, Shruti Aggarwal

Note: Attempt subparts of a question in sequence at one place. Assume missing data, if any, suitably.

Q1. Execute Ford Fulkerson Algorithm to find the maximum flow for a graph (**Fig. 1**). Show all the intermediate stages of residual graph. What is the minimum cut corresponding to the obtained maximum flow? If each edge capacity in the graph (shown in **Fig. 1**) is increased by a value 1, then what will be the changed maximum flow? **(7)**

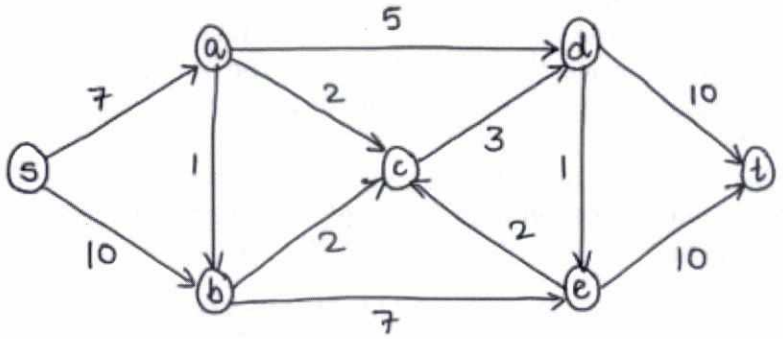

Fig. 1

Q2. (a) State the differences between the 2-approximation and 3/2-approximation algorithms for the traveling-salesman problem with the triangle inequality. **(1)**

(b) Solve the following instance of the knapsack problem using the branch-and-bound technique. Draw the state-space tree which is generated while using the branch-and-bound technique. **(6)**

Item	Weight	Value	Knapsack Capacity W = 12.
1	6	72	
2	7	63	
3	5	40	
4	4	12	

Q3. Apply dynamic programming approach to determine the cost and structure of all the possible optimal binary search trees for a set of n = 3 keys with the following probabilities: **(7)**

	0	1	2	3
p_i		4/17	1/17	4/17
q_i	3/17	1/17	1/17	3/17

Q4. Instructor wants to schedule some final exams for CS courses with the following course numbers: C101, C112, C213, C224, C315, C326, C417, C428, and C439. Suppose that there is no student in common taking the following pairs of courses: **(7)**

C101 – C315, C101 – C326, C101 – C428, C101 – C439
C112 – C213, C112 – C224, C112 – C315, C112 – C326, C112 – C417, C112 – C428
C213 – C112, C213 – C315, C213 – C439
C224 – C112, C224 – C315, C224 – C417, C224 – C428
C315 – C101, C315 – C112, C315 – C213, C315 – C224, C315 – C428
C326 – C101, C326 – C112
C417 – C112, C417 – C224, C417 – C428, C417 – C439
C428 – C101, C428 – C112, C428 – C224, C428 – C315, C428 – C417, C428 – C439
C439 – C101, C439 – C213, C439 – C417, C439 – C428

How many minimum exam slots are necessary to schedule exams? Give appropriate algorithm and show all intermediate steps involved by using that algorithm.

Q5. Write an efficient algorithm or pseudocode to compute the shift value using good suffix shift rule in the Boyer Moore string matching algorithm. It should include the required pre-processing logic along with the update in the shift value. Explain the proposed algorithm or pseudocode for the pattern "CTTACTTAC". **(7)**

Note: The proposed algorithm or pseudocode can only take the pattern as an input argument. If needed then length of the pattern can also be considered as an input argument.

----------**ALL THE BEST**----------

Roll No. _____ Name: _____ Group: _____

TIET, Patiala

Department of Computer Science & Engineering

UCS415: Design and Analysis of Algorithms

Sessional Quiz - 04 June, 2022 @ 11:15 AM

Time: 10 Minutes *Maximum Marks:* 10

Note: All answers must be written within the space provided for each question. Overwritten answers will not be evaluated. Use only capital alphabets (A/B/C/D) to record your responses.

Write the correct answers here:

Q1 1 mark	Q2 1 mark	Q3 1 mark	Q4 1 mark	Q5 2 mark	Q6 2 mark	Q7 2 mark

Q1. The time complexity to determine an augmenting path in Ford-Fulkerson algorithm is

A. O(|E|) B. O(|E| log |V|) C. $O(|E|^2)$ D. $O(|E|^2 \log |V|)$

Q2. What is the worst-case time complexity for finding all m-colorings of a graph with n vertices using backtracking?

A. O(n) B. $O(m^n)$ C. O(n×m) D. $O(n \times m^n)$

Q3. The total number of nodes in the 4-queens state space tree is _____.

A. 63 B. 65 C. 64 D. 66

Q4. Which of the following is not true regarding the number of binary search trees with n nodes?

A. It is equal to the number of ways of multiplying (n+1) matrices.

B. It is equal to the number of rooted binary trees with n nodes.

C. It is equal to $\frac{1}{n+1}\binom{2n}{n}$.

D. It is equal to n!.

Q5. Which one of the following does not provide an optimal solution for 8-queens problem?

A. 5,3,8,4,7,1,6,2 B. 4,1,5,8,6,3,7,2 C. 1,6,3,8,3,2,4,7 D. 6,2,7,1,4,8,5,3

Q6. For the given instance of 0/1 knapsack problem: Weight = [4,7,5,3], Value = [40,42,25,12] and Knapsack Capacity = 10, what would be the upper bound cost at the root of state space tree? ____

Q7. The search cost for the binary search tree shown here with the following successful and unsuccessful search probabilities is _____.

	0	1	2	3	4
p_i		3	3	1	1
q_i	2	3	1	1	1