Total number of pages: 2

Roll no.: 2024UCA1933

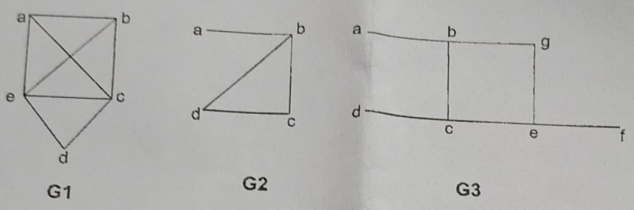
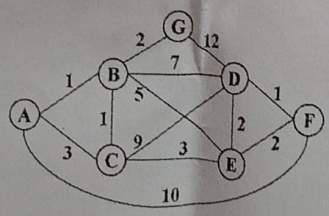
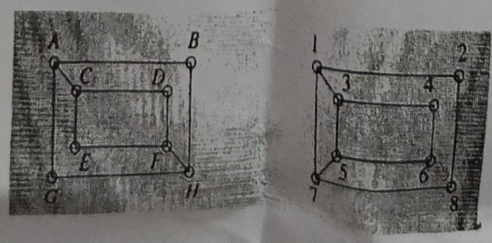
Second Semester- B.Tech. Course work
END SEMESTER EXAMINATION, April, 2025

Course Code: CACSC201/CDCSC201/COCSC201/CMCSC203/CACSC01/CDCSC01/COCSC01/CMCSC03
Course Title: Discrete Structures
Time: 3 hours

Maximum Marks. 50

Note: Missing data/information(if any), may be suitably assumed and mentioned in the answer.

Q. No.	Questions	Marks	CO
Q.1	Attempt any two parts of the following		
1a	Determine whether these system specifications are consistent using the rules of inference. (i) "The diagnostic message is stored in the buffer or it is retransmitted." (ii) "The diagnostic message is not stored in the buffer." (iii) "If the diagnostic message is stored in the buffer, then it is retransmitted."	5	CO1
1b	Let C(x) be the statement "x has a cat," let D(x) be the statement "x has a dog," and let F(x) be the statement "x has a ferret." Express each of these statements in terms of C(x), D(x), F(x), quantifiers, and logical connectives. Let the domain consist of all students in your class. (a) A student in your class has a cat, a dog, and a ferret. (b) All students in your class have a cat, a dog, or a ferret. (c) Some student in your class has a cat and a ferret, but not a dog. (d) No student in your class has a cat, a dog, and a ferret. (e) For each of the three animals, cats, dogs, and ferrets, there is a student in your class who has this animal as a pet.	5	CO1
1c	Construct a truth table for each of the following compound propositions. 1. $(p \bigoplus q) \vee (p \bigoplus \sim q)$ 2. $(p \longleftrightarrow q) \bigoplus (\sim p \longleftrightarrow r)$	5	CO1
Q.2	Attempt any two parts of the following		
2a	Use Generating function to solve the recurrence relation $a_k = 4a_{k-1} - 4a_{k-2} + k^2$ with the initial condition $a_o = 2$, and $a_1 = 5$.	5	CO2
2b	Find the number of solutions of the equation $x_1 + x_2 + x_3 + x_4 = 17$, where x_i, $i = 1, 2, 3, 4$, are non-negative integers such that $x_1 \leq 3$, $x_2 \leq 4$, $x_3 \leq 5$, and $x_4 \leq 8$.	5	CO2
2c	1. Show that if $f(x) = O(g(x))$, and $g(x) = O(h(x))$, then $f(x) = O(h(x))$. 2. Use mathematical induction to prove that $2n < n!$ for every integer n with $n \geq 4$.	5	CO2
Q.3	Attempt any two parts of the following		
3a	1. State Euclidean Algorithm. Use it to find the gcd of (12345,54321). 2. Prove or disprove that if $a \mid bc$, where a, b, and c are positive integers and $a \neq 0$, then $a \mid b$ or $a \mid c$.	5	CO3

3b	1. Let L be a lattice. Then for every a and b in L, Prove that $a \vee b = b$ if and only if $a \leq b$. 2. Define bounded and complemented lattice. Find the complement of each element of D_{42}.	5	CO3
3c	Using Boolean algebra, show that (i) $xy + xz + yz = xy + (x \oplus y)z$ (ii) $x'y'z' + x'yz' + xy'z' + xyz = x \oplus y \oplus z$.	5	CO3
Q.4	Attempt any two parts of the following		
4a	1. Which of the following simple graphs in the figure given below have a Hamiltonian/Eulerian circuit/path. Justify your answer?  G1 G2 G3 2. Define Bipartite and Complete Bipartite Graphs. Draw a complete bipartite graph $K_{4,5}$.	5	CO4
4b	Find shortest path from a A to F for the following graph using Dijkstra's algorithm.  	5	CO4
4c	Define isomorphism of graphs. Check whether the following two graphs are isomorphic, justify your answer.  	5	CO4
Q.5	Attempt any two parts of the following:		
5a	If $f_X(x) = \begin{cases} \frac{x}{15}; x = 1,2,3,4,5, \\ 0, \quad otherwise. \end{cases}$ Find $P[X = 1 \text{ or } 2]$ and $P\left[\frac{1}{2} < X < \frac{5}{2} \mid X > 1\right]$.	5	CO5
5b	Patients arrive at a hospital accident and emergency department at random at a rate of 6 per hour. Find the probability that during any 90 minutes period, the number of patients arriving at the hospityal accident and emergency department is (i) exactly 7 (ii) at least 10.	5	CO5
5c	Find the mean and variance of Geometric Distribution. State and prove the memoryless property of Geometric Distribution.	5	CO5