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Department of Computer Science and Engineering

Mid-Term Examination, Autumn-2022 Semester: 2^{nd}

Course Code: **CSE-1223** Course Title: **Discrete Mathematics**

Time: 1 Hours 30 minutes **Marks:** 30

			Marks	CO	DL
Q1.	**a)**	What is the set? Write the definition and example: Cardinality of a set, Complement of a set.	2	CO1	C1
		OR			
	a)	Define Cartesian product. Explain why $(A \times B) \times (C \times D)$ and $A \times (B \times C) \times D$ are not the same.	2	CO1	C2
	b)	Let A and B two sets. Prove that - $(A \cup B)' = A' \cap B'$	3	CO2	C3
		OR			
	b)	Define proper subset. Find the sets A and B if A-B ={1,5,7,8,15}, B-A ={3,6,10} and A∩B = {2,9,11,15}.	3	CO2	C3
	c)	Suppose that the universal set is U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}. Express each of these sets with bit strings where the i^{th} bit in the string is 1 if i is in the set and 0 otherwise. a) {3, 4, 5} b) {1, 3, 6, 10} c) {2, 3, 4, 7, 8, 9}	2.5	CO2	C3
	d)	Using the same universal set as in 1(c), find the set specified by each of these bit strings. a) 11 1100 1111 b) 01 0111 1000 c) 10 0000 0001	2.5	CO2	C3
Q2.	**a)**	What is the proposition? What do you mean by universal and existential Quantifier?	2	CO1	C1
	b)	Let I(x) be the statement "x has an internet connection and C(x, y) be the statement "x and y have chatter over the internet". Where the domain for the variables x and y consists of all students in your class. Use quantifier to express each of these statements. i) Rasel has not chatted over the internet with Rahul. ii) Not everyone in your class has an internet connection. iii) Everyone in your class with an internet connection has chatted over the internet with at least one other student in your class.	3	CO2	C3
	c)	Translate each statement into English. Where the domain for each variable for each variable consists of all real numbers. i) $\exists x \forall y\ (xy = y)$ ii) $\forall x \forall y((x \geq 0) \wedge (y < 0)) \rightarrow (x - y >))$ iii)	2	CO2	C3
	d)	Show that each of these conditional statement is a tautology by using truth table: i) $[\neg p \wedge (p \vee q)] \rightarrow q$ ii) $[(p \rightarrow q) \wedge (p \rightarrow r)] \rightarrow (p \rightarrow r)$	3	CO2	C3
Q3.	**a)**	Find the domain and range of these functions. Note that in each case, to find the domain, determine the set of elements assigned values by the function	3	CO2	C2

a) The function that assigns to each bit string the number of ones in the string minus the number of zeros in the string

b) The function that assigns to each bit string twice the number of zeros in that string

c) The function that assigns the number of bits left over when a bit string is split into bytes (which are blocks of 8 bits)

b) Consider these functions from the set of students in a discrete mathematics class. Under what conditions is the function one-to-one if it assigns to a student his or her — 2 CO1 C2

a) mobile phone number.
b) student identification number.
c) final grade in the class.
d) home town

OR

b) Consider these functions from the set of teachers in a school. Under what conditions is the function one-to-one if it assigns to a teacher his or her — 2 CO1 C2

a) Office.
b) Assigned bus to chaperone in a group of buses taking students on a field trip.
c) Salary.
d) Social security number.

c) What are the truth values of those that are propositions? — 2 CO2 C3

a) Do not pass go.
b) What time is it?
c) There are no black flies in Maine.
d) $4 + x = 5$

d) Let p and q be the propositions — 3 CO2 C3

p: I bought a lottery ticket this week.
q: I won the million dollar jackpot.

Express each of these propositions as an English sentence.

1) $p \to q$
2) $p \land q$
3) $p \leftrightarrow q$
4) $\neg p \to \neg q$
5) $\neg p \land \neg q$
6) $\neg p \lor (p \land q)$

OR

d) Let f and g be functions from the set of integers to the set of integers defined by f(x) = 2x^2+3 and g(x) = 3x+5. What is the composition of f and g, and also the composition of g and f? — 3 CO2 C3