

Roll Number: _____

Thapar Institute of Engineering & Technology, Patiala

Department of Computer Science and Engineering

MID SEMESTER EXAMINATION

B. E. (Second Year): Semester-III (2019/20)	Course Code: UCS405
(COE)	Course Name: Discrete Mathematical Structures
September 25 th , 2019	Wednesday, 10:30 A.M. - 12:30 P.M.
Time: 2 Hours, M. Marks: 25	Name of Faculty: MJU, ASG, RPK, SHM, HK

Note: Attempt all questions in a proper sequence with justification.

Assume missing data, if any, suitably.

Q1(a)	Let A, B, C, D, E, and F are sets such that: $A = \{1, \{4\}, \{2\}, 3, 4, 5\}$, $B = \{\{\{1, 4, 5, 3, 1\}\}\}$, $C = \{1, \{3\}, 2, 1\}$, $D = \{1, 1, 3\}$, $E = \{1, 4, \{5\}, \{3\}\}$, $F = \{1, 8, \{1, 2, 3, 4\}\}$ Calculate for the following sets. i. $A \cap C$ ii. $B \cap F$ iii. $D \cup C$ iv. $C \cap E$ v. $C \cup (D \cap F)$ vi. $A \cap E$	(3)
Q1(b)	Set A comprises all three digit numbers that are multiples of 5, Set B comprises all three–digit even numbers that are multiples of 3 and Set C comprises all three–digit numbers that are multiples of 4. How many elements are present in $A \cup B \cup C$?	(2)
Q2(a)	Let $A = \{1, 2, 3, \dots, 9\}$ and R be the relation in $A \times A$ defined by $(a, b) R (c, d)$ if $a + d = b + c$ for $(a, b), (c, d)$ in $A \times A$. Prove that R is an equivalence relation and also obtain the equivalent class $[(2, 5)]$.	(4)
Q2(b)	Let a and b be positive integers, and suppose Q is defined recursively as follows: $Q(a, b) = \begin{cases} 0, & \text{if } a < b \\ Q(a - b, b) + 1, & \text{if } b \leq a \end{cases}$ i. Find: (a) $Q(4, 10)$; (b) $Q(21, 7)$. ii. What does this function Q do? Find $Q(5861, 7)$.	(2)
Q3	Answer these questions for the POSET $(\{2, 4, 6, 9, 12, 18, 27, 36, 48, 60, 72\}, /)$: i. Draw the Hasse Diagram. ii. Find all minimal and maximal elements. iii. Find the least and greatest element.	(5)
Q4(a)	Using truth table find CNF and DNF for $a \wedge (b \leftrightarrow c)$.	(3)
Q4(b)	Suppose $A = \{a, b, c, d\}$ and Π_1 is the following partition of A: $\Pi_1 = \{\{a, b, c\}, \{d\}\}$ i. List the ordered pairs of the equivalence relations induced by Π_1 ii. Draw the graph of the above equivalence relation.	(2)
Q5(a)	Give a Big-O estimate for each of the following functions using a simple function g of smallest order. i. $(n^3 + n^2 \log n)(\log n + 1) + (17 \log n + 19)(n^3 + 2)$ ii. $(2^n + n^2)(n^3 + 3^n)$ iii. $(n^n + n 2^n + 5^n)(n! + 5^n)$	(1.5)
Q5(b)	Use rules of inference to show that the hypotheses “If it does not rain or if it is not foggy, then the sailing race will be held and the lifesaving demonstration will go on,” “If the sailing race is held, then the trophy will be awarded,” and “The trophy was not awarded” imply the conclusion “It rained.”	(2.5)

