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Roll Number:_____

Thapar University, Patiala

Computer Science and Engineering Department

Mid-Semester Test

B. E. (Second Year): Semester-I (COE/COEM/CAG/CML/ SEM)	Course Code: UCS405 Course Name: Discrete Mathematical Structures
September 21 , 2017	Time: 2 Hours, M. Marks: 25

Note: ***Attempt all questions with proper justification. Assume missing data, if any.***

Q.1	(a) Draw the Hasse diagram for the poset {1, 2, 3, 6, 12, 24, 36, 48} having relation $R=\{(a,b) \mid b \% a == 0\}$. Answer the following questions: i) Find the maximal elements. ii) Find the minimal elements. iii) Find the greatest element, if any. iv) Find the least element, if any. v) Find the least upper bound of {1,6,12}, if any. vi) Find the greatest lower bound of {2,3,6},if any. (b) Determine whether this relation is a lattice or not. Give reason.	4+1
Q.2	Let $g : N \times N$ be defined by $g(n) = max\{0, n-3\}$ and let A = {0,2,4,6}. (a) Evaluate $g(A)$. (b) Evaluate $g^{-1}(A)$. (c) Is g a bijection?	2
Q.3	The number of students who got grade A in first examination is equal to the number of students who got grade A in second examination. If total number of students who got grade A in exactly one examination is 40, and 4 students did not get grade A in either examinations, determine the number of students who got grade A in first exam only, who got grade A in second exam only and who got grade A in both the exams.	3
Q.4	Let P be a set of programmers and Q be a set of projects. Let R be a binary relation from P to Q such that (a,b) is in R if programmer a is assigned project b. Let S be a binary relation on P such that (x,y) is in S if x and y can get along with each other if they were assigned same project. Derive a relation on R and S such that an assignment of the programmers to the project according to R will put only those programmers together on the same project who can get along with each other.	2
Q.5	Consider the set Z of integers. Define a relation R on Z by $b = a^r$ for some positive integer r. Determine if R is a partial order on Z with proper explanation.	3
Q.6	Find CNF and DNF for $p \leftrightarrow \overline{p} \vee \overline{q}$.	4
Q.7	Let $P(x)$, $Q(x)$, $R(x)$, and $S(x)$ be the statements "x is a duck," "x is one of my poultry," "x is an officer," and "x is willing to waltz," respectively. Express each of these statements using quantifiers; logical connectives; and $P(x)$, $Q(x)$, $R(x)$, and $S(x)$. (a) No ducks are willing to waltz. (b) No officers ever decline to waltz. (c) All my poultry are ducks. (d) My poultry are not officers. (e) Does (d) follow from (a), (b), and (c)? If not, is there a correct conclusion?	3
Q.8	Arrange the following function based on rate of growth (Big-O): (a) $F1(n)=2^n$ (b) $F2(n)= n^{3/2}$ (c) $F3(n)= n \log n$ (d) $F4(n)= n^{\log n}$	3