Roll Number: _____

Thapar University, Patiala

Department of Computer Science and Engineering Department

B. Tech. (Second Year): Semester-IV COE	Course Code: UCS405/UCS101 Course Name: Discrete Mathematical Structures
March 19, 2016	Wednesday, 1.00 pm – 3.00 noon
Time: 2 Hours, M. Marks: 40 Weightage: 20	Name of Faculty: Dr A. K. Loura, Mr. S. Modi, Dr H. S. Pannu, Ms. R. K. Chahal

Note: *Attempt all questions with* ***proper Justification. Without Justification zero marks will be awarded.*** *Assume missing data, if any, suitably.*

1. Write the statement of Inclusion exclusion principle for three sets A, B and C. Prove it using the membership table. (3)

2. Given relation $R_1 = \{(0,0),(1,1),(1,2),(1,3),(2,2),(2,3)(3,3)\}$ and $R_2 = \{(0,0),(0,1),(0,2)(1,0)(1,1),(1,2)(2,0)(2,2)(3,3)\}$ over set $A = \{0,1,2,3\}$. Determine whether these relations are irrefexive, anti-symmetric, asymmetric and symmetric or not. Give proper justification to your answer. **Without justification zero marks will be awarded.** (4)

3. Solve the recurrence relation $a_n = -3a_{n-1} - 3a_{n-2} - a_{n-3}$ with $a_0 = 1$, $a_1 = -2$, $a_2 = -1$ (4)

4. Let R be the relation such that $R = \{(a,b) \mid a < b\}$ on the set of integers. Find inverse and complement of R. (2)

5. Put the following functions in order from lowest to highest in terms of their Θ classes. (Some of the functions may be in the same Θ class. Indicate that on your list also. **Any two wrong entry leads to zero marks.**). **Give Justification.** (3)
   a) $f1(n) = n \log n$
   b) $f2(n) = n^{3/2}$
   c) $f3(n) = 10,000$
   d) $f4(n) = \sqrt{n}\ (n + \log n)$
   e) $f5(n) = 3n$
   f) $f6(n) = 2n + 2$
   g) $f(n) = 0.0001$

6. Let $A = B = \{a,b,c\}$. Consider the relation $g = \{(a,b),(b,c),(c,c)\}$. Is g one-to-one? Is g onto? Why. (2)

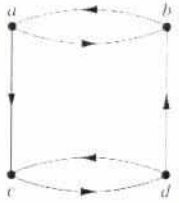
7. Draw Hasse diagram for the relation $(\{1,2,3,4,5,6,7,8,9\}, |)$. (5)
   a) Find the maximal and minimal elements.
   b) Is there a greatest element?
   c) Is there a least element?

[P.T.O.]

d) Find lower bound and upper bound of $\{2,5,7\}$

8. Given $X=\{a,b,c,d,e\}$. The collection of set $A=\{A_1,A_2,A_3,A_4\}$ where $A_1=\{a,b\}, A_2=\{c\}, A_3=\{d\}, A_4=\{e\}$. Is A a partition of X. List the ordered pairs in the equivalence relation R produced by A. (2)

9. Using Warshall's algorithm, find the transitive closure of the following diagram. Explain step by step. (3)



11. Following table consists of a column Ages and Degree of Membership of four categories, namely, Infant, Adult, Young and Old in various ages given in the first column. Using this information, find out: (2)

a) Young $\cup$ Old

b) Young $\cap$ Old

Ages	Infant	Adult	Young	Old
5	0	0	1	0
10	0	0	1	0
20	0	.8	.8	.1
30	0	1	.5	.2
40	0	1	.2	.4
50	0	1	.1	.6
60	0	1	0	.8
70	0	1	0	1
80	0	1	0	1

12. Two friends A and B living on different floors of the same building go for grocery shopping. A buys 1 kg apples, 2 kg rice, 10 kg flour and 250 grams cheese. B buys 2 kg oranges, 3 kg rice, 5 kg flour and 200 grams mushroom. Answer the following questions: (2)

a) Construct a set that represents the quantity of items used by B alone, if both friends use the same items.

b) Construct a set that represents the quantity of each item to be bought if both A and B use the groceries commonly.

13. Give a Big-Theta notation for the function $(2^n + n^2)(n^3 + 3^n)$ (3)

14. Find complement of each element $\{0,1,a,b,c,d,e\}$ of the following figure. (5)
Check whether this is a distributive lattice or not.