**COMSATS Institute of Information Technology, Islamabad Campus**

**Department of Computer Science**

**Discrete Structures – CSC102**

**BCS/BSE – II**  **Assignment Sets & Functions Marks: 50**



**Mapped to CLO3 Due date: Monday 10 Oct**

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| Question # 1 Sets [4+7+6=17] |
| 1. Prove the set identity (A − B) ∪ (B − C) = (A ∪ B) − (B ∩ C) using: 2. Membership Table (Truth Table) 3. Venn Diagram 4. Laws of Set 5. Comment on which method you found easier and why? 6. 380 students are taking courses:   215 taking Discrete Structure(DS) , 173 taking Programming Fundamental(PF) , 182 taking Multivariable Calculus(MC) .  72 taking Discrete Structure and Programming Fundamental , 90 taking Discrete Structure and Multivariable Calculus , 60 taking Programming Fundamental and Multivariable Calculus.  Find the number of students in each of the following part.     1. The symmetric difference of A and B, denoted by A ⊕ B, is the set containing those elements in either A or B, but not in both A and B. 2. Construct Membership Table of A ⊕ B 3. Draw a Venn Diagram for the symmetric difference of the sets A and B. 4. Let A = {1, 2, 3, 4}, B = {3, 4, 5, 6}, and C = {5, 6, 7, 8}. Find each of the following sets:    1. B⊕C    2. (A⊕ B)⊕C 5. Show that A ⊕ B = (A ∪ B) − (A ∩ B). 6. Show that A ⊕ B = (A − B) ∪ (B − A).   Note: Symmetric difference is equivalent to XOR |

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| Question # 2 Relations [2+3+2+3=10] |
| Do as directed:   1. Draw the digraph of the relation. 2. The relation *R* = {(1, 2), (2, 3), (3, 4), (4, 1)} on {1, 2, 3, 4} 3. The relation *R*={(1, 2), (2, 1), (3, 3), (1, 1), (2, 2)} on *X* = {1, 2, 3} 4. Write the relation as a set of ordered pairs. Also Find Domain and Range of each relations  |  |  |  | | --- | --- | --- | |  |  |  |  1. Let R1 and R2 be the relations on {1, 2, 3, 4} given by   R1 = {(1, 1), (1, 2), (3, 4), (4, 2)}  R2 = {(1, 1), (2, 1), (3, 1), (4, 4), (2, 2)}.  List the elements of:   1. R1 R2 2. R1  R2 3. Let X be the set of all four-bit strings (e.g., 0011, 0101, 1000). Define a relation R on X as s1 Rs2 if some substring of s1 of length 2 is equal to some substring of s2 of length 2. Examples: 0111 R 1010 (because both 0111 and 1010 contain 01). 1110 ̸R 0001 (because 1110 and 0001 do not share a common substring of length 2).   Is this relation reflexive, symmetric, transitive? |

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| Question # 3 Sequences [2+5=7] |
| 1. Find        1. Let *a*n denote the number of times the statement x = x +1 is executed in the following loop. Write  *a*n in summation form.  |  |  | | --- | --- | | for i = 1 to n do  for j = 1 to i do  x = x +1 | for i = 1 to n do  for j = 1 to i do  for k = 1 to i do  x = x +1 | | for i = 1 to n do  for j = 1 to i do  for k = 1 to j do  x = x +1 | for i = 1 to n do  for j = 1 to i do  for k = 1 to 1 do  for l = 1 to i do  x = x +1 |  1. Evaluate each sum obtained in part (a) when n = 4 |

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| Question 4 Functions [2+1+1+2+3+3+4=16] |
| 1. A town in Islamabad charges each household a minimum of Rs.75 for upto 4000 cubic feet(ft3) of water every 6 months. In addition, each household has to pay 60 paisa for every 100 ft3 of water in excess of 4000 ft3. Express the water bill f(x) as a function of number of cubic feet of water x used for 6 months. 2. Write the definition of “one-to-one” using logical notation (i.e., use , ∃, etc.) 3. Write the definition of “onto” using logical notation (i.e., use , ∃, etc.). 4. Determine whether each of these functions is a bijection from R to R.   f (x) = 2x + 1  f (x) = x2 + 1  f (x) = x3  f (x) = (x2 + 1)/(x2 + 2)   1. Find at least three different sequences beginning with the terms 3, 5, 7 whose terms are generated by a simple formula or rule. 2. Find the first five terms of the sequence defined by each of these recurrence relations and initial conditions.   a) an = 6an−1, a0 = 2  b) an = a2 n−1, a1 = 2   1. Suppose that the number of bacteria in a colony triples every hour.   a) Set up a recurrence relation for the number of bacteria after n hours have elapsed.  b) If 100 bacteria are used to begin a new colony, how many bacteria will be in the colony in 10 hours? |