**COURSE : Mathematical Structures**

**COURSE CODE : 21MAT41A**

**MODULE – 4: Relations**

**Question Bank**

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| **Q.No** | **Questions** |
| **1.** | a) Let and and let the relation from to be defined by  . Write down the matrix of  b) Consider the relation R from X to Y , X = {1, 2, 3}, Y = {8, 9}  and R = {(1, 8) (2, 8) (1, 9) (3, 9)}  Find the complement relation of R. |
| **2.** | Let and let be the relation on defined by if and only if “ divides ”, written .  a) Write down as a set of ordered pairs  b) Draw the digraph of  c) Determine the in-degrees and out-degrees of the vertices in the diagraph |
| **3.** | a) Let and be a relation on defined by if and only if is a multiple of  . Represent the relation as a matrix and draw its diagraph.  b) Show that the identity relation on a set A is an equivalence relation |
| **4.** | a)Determine the relation from a set as described by the following matrix  b)Let A = {u, v, x, y, z} and R be a relation on A whose matrix is as given below. Determine R and the digraph of the matrix. . |
| **5.** | Let and . Also let be a relation from to defined by and and be relations from to  defined by . Find and |
| **6.** | a) Let and . For the relation and , where , , Find and . Also verify that  b) Let A = { 1, 2, 3, 4} with R = {(1, 1), (1, 3), (3, 2), (3, 4), (4, 2)} and  S = {(2, 1), (3, 3), (3, 4), (4, 1)} as relations on A. Find . |
| **7.** | a) If and are relations on defined by  . Find , write down their matrices.  b) Let A = {a,b,c,d,e,f}, the digraph in figure below represents a relation R on A. Determine R as well as its associated relation matrix. |
| **8.** | a) Let and and be relations on A whose matrices are as given below.  ;  Find the composite relations and their matrices.  b) On the set of all integers Z defined by the relation R by aRb iff ab > 0, Show that R is an equivalence relation. |
| **9.** | (a). If and is a relation on defined by ), (1,3), (2,4), (3,2), (3,3), (3,4)}, find and . Write down their diagraphs.  (b). Let and be relations on the set  . Find . |
| **10.** | Let R be a relation on a set A. Prove that   1. is reflexive iff is irreflexive 2. If is reflexive, so is 3. If is symmetric, so are 4. If is transitive, so is |
| **11.** | Let and be relations on a set . Prove that   1. If and are reflexive, so are and 2. If and are symmetric, so are and 3. If and are antisymmetric, so is 4. If and are transitive, so is |
| **12.** | Let and be a relation on . Verify that is an equivalence relation. |
| **13.** | a) If , where , define the relation on  by iff and are in the same set , . Is an equivalence relation?  b) Let A = {1,2,3,4} and R is a relation on A defined by R={(1,2),(1,3),(2,4),(3,2),(3,3),(3,4)}. Find R2 and R3. Write down their digraph and write its associated relation matrix. |
| **14.** | a) For a fixed integer , prove that the relation “Congruent modulo ” is an equivalence  relation on the set of all integers, .  b) For the relations R1 and R2 defined on the sets A={1, 2, 3, 4}, B={w,x,y,z} and C={5, 6, 7}  as R1 = {(1,x), (2,x), (3,y), (3,z)} and R2 = {(w,5), (x,6)} verify that |
| **15.** | a) Let . Define a relation on by if and only if  . Verify that is an equivalence relation on .  b) Find the matrix of the partial order relation whose Hasse diagram is given by : |
| **16.** | a) If is a relation on the set defined by if , prove that is a poset.  Draw a Hasse diagram.  b) Determine the matrix of the partial order whose Hasse diagram is given below.  C:\Users\Rammohan\Downloads\IMG_20200824_153339.jpg |
| **17.** | a) Let . On , define the relation by iff divides . Prove that is a  partial order on . Draw the Hasse diagram for this relation  b) Draw the Hasse diagram of the relation R on A = {1,2,3,4,5} whose matrix is |
| **18.** | a) Draw the Hasse diagram representing the positive divisors of 36.  b) If A = {1, 2, 3, 4} and R and S are relations on a defined by R = {(1,2), (1,3) (2,4), (4,4)}, S = {(1,1), (1,2), (1,3), (1,4), (2,3), (2,4)}. Verify the following |
| **19.** | a) Let . On , define the partial ordering relation by x iff x|y. Draw the Hasse diagram for this relation  b) A partial order R on the set A={1,2,3,4} is represented by the following digraph. Draw the Hasse diagram for R and Determine the relation matrix for R. |
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| **20** | a) For A={a,b,c,d,e}, the HAsse diagram for the poset (A,R) is shown below.  (i) Determine the relation matrix for R  (ii) Construct the diagraph for R  b) The Hasse diagram of a partial order R on set A={1,2,3,4,5,6}is as given below. Write down R as a subset of AxA. Construct its diagraph and the relation matrix for R. |