Green University Of Bangladesh

Midterm Assignment

Course Code : CSE 101

Course Title : Discrete-Math

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Answer to the question no: 1

Relations can be represented by 4 ways like as.

① Relation as a Matrix. ⓘⓘ Relation as a Directed graph

ⓘⓥ Relation as an Arrow Diagram ⓘⓘⓘ Relation as a Table.

⊛ Relation as a Matrix:

Let, $P = [a_1, a_2, a_3 ---- a_m]$ and $Q = [b_1, b_2, b_3 -- b_n]$ are finite sets, containing m and n number of elements respectively, R is a relation form P to Q

The relation R can be represented by $m \times n$.

Matrix $M = [M_{ij}]$, defined as,

$$M_{ij} = 0 \quad \text{if } (a_i, b_j) \notin R$$

$$1 \quad \text{if } (a_i, b_j) \in R$$

Exaple 01:

Let, $P = \{1, 2, 3\}$ and $Q = \{a, b, c\}$

Now, $R_1 = \{(1, a), (1, b), (2, b), (2, c), (3, a)\}$

Example 02:

Let, $P = \{8, 9, 10\}$ and $Q \{x, y, z\}$

Now, $R_2 = \{(8, x), (8, y), (9, y), (9, z), (10, x), (10, z)\}$

Example 01 - Matrix of relation R_1 is shown as fig:

$$M_{R_1} = \begin{array}{c} \\ 1 \\ 2 \\ 3 \end{array} \begin{array}{c} \begin{array}{ccc} a & b & c \end{array} \\ \left\{ \begin{array}{ccc} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \end{array} \right\} \end{array}$$

Example 02. Matrix of relation R_2 is shown of fig:

$$M_{R_2} = \begin{array}{c} \\ 8 \\ 9 \\ 10 \end{array} \begin{array}{c} \begin{array}{ccc} x & y & z \end{array} \\ \left\{ \begin{array}{ccc} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{array} \right\} \end{array}$$

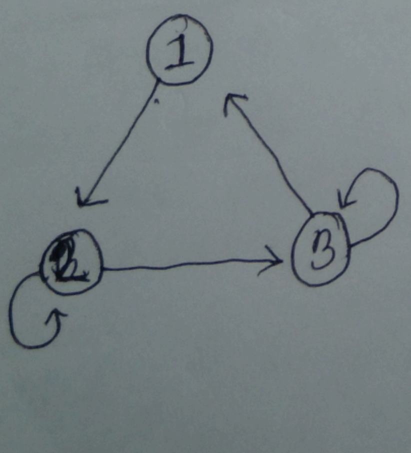
* Relation as a Directed Graph :

There is another way of picturing a relation. R when R is a relation form finite set to itself

Example 01 :

$A = \{1, 2, 3\}$

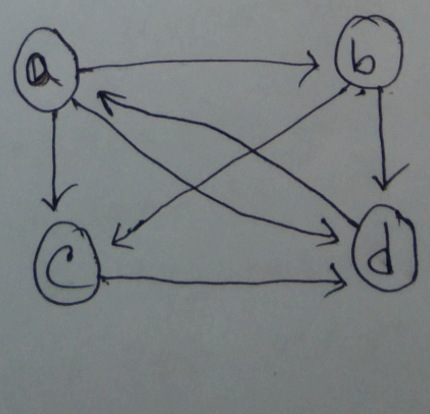
$R_A = \{(1, 2), (2, 2), (2, 3), (3, 1), (3, 3)\}$



Example 02 :

$B = \{a, b, c, d\}$

$R_B = \{(a, b), (a, c), (a, d), (b, c), (d, a), (b, d), (c, d)\}$



Relation as an Arrow Diagram:

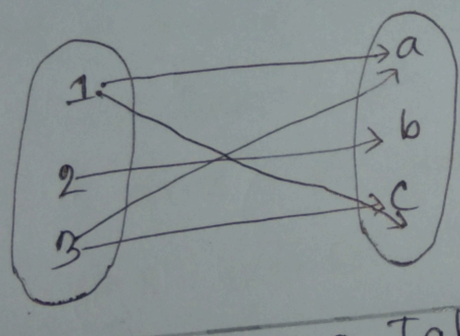
If P and Q arre finite sets and R is a relation form P to Q: Relation R can be respesented as an arrow diagram as follows.

Draw two ellipses for the sets P and Q write down the elements of Q colom-wise is there ellipses. Then draw an arrow form the frist ellipse to the second ellipse if a is related to be and $a \in P$ and $b \in Q$.

Example 01:

$P = \{1, 2, 3\}$ and $Q = \{a, b, c\}$

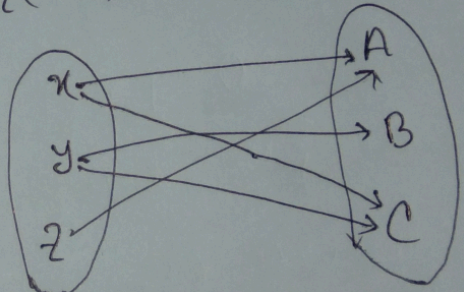
$R_1 = \{(1, a), (2, b), (3, c), (1, c), (3, a)\}$



Example 02:

$P = \{x, y, z\}$ and $Q = \{A, B, C\}$

$R_2 = \{(x, A), (x, C), (y, B), (y, C), (z, A)\}$



Relation as a Table:

If P and Q arre finite sets and R is a relation form P to Q. Relation R can be represented in tabular form.

Make the table which contains rows equivalent to an element of P and columns equivalent to the element of Q. Then place a cross (x) in the boxes which relation of elements on set P to set Q

Example 01 :

Let, $P = \{1,2,3\}, Q = \{a,b,c\}$

$R_1 = \{(1,a), (1,c), (2,b), (2,c), (3,a), (3,c)\}$

	a	b	c
1	X		X
2		X	X
3	X		X

Example : 02

Let, $P = \{x,y,z\}$ $Q = \{A,B,C\}$

$R_2 = \{(x,A) (x,B) (y,C) (z,C) (z,A) (y,B)\}$

	A	B	C
x	X	X	
y		X	X
z	X		X

Answer to the question no: 2

What is Nested Quantifiers ?

⇒ Two quantifiers are said to be nested if one is ~~within~~ within the scope of the other.

Example : $\forall x \exists y\, Q(x,y)$

$\exists$ is within the scope of $\forall$

IS order important for nested quantifier ?

Some time order is important and Some time order doesnot important.

Example on the other page.

* order does not important :

~~when~~ Two special cases where the order of quantifiers is not important are:

1. All quantifiers are universal quantifiers.
2. All quantifiers are Existenatial quantifiers.

Example: $\exists x \exists y (x+y=1)$ means the same as $\exists y \exists x (x+y=1)$

$\forall x \forall y (x,y)$ means the same as $\forall y \forall x (x,y)$

* order is important :

Two special cases where the order of quantifies is important are:

1. one quentifiers universal and one quantifiers Existenatial ~~quantifiers~~. $\forall x \exists y P(x,y)$
2. one quentifiers Existenatial and one quentifiers ~~are~~ Existenatial. $\exists x \forall y P(x,y)$

$\forall x \exists y P(x,y)$ when True : For every x there is a y for which $P(x,y)$ is true.

$\forall x \exists y\, P(x,y)$ when false: There is an x such that $P(x,y)$ is false for every y.

$\exists x \forall y\, P(x,y)$ when true: There is an x for which $p(x,y)$ is true for every y.

$\exists x \forall y\, P(x,y)$ when false: For every x there is a y for which $P(x,y)$ is false

So, we can see not,

$$\cancel{\forall x \exists y} \quad \forall x \exists y\, P(x,y) \neq \exists x \forall y\, P(x,y)$$

~~we can tall that nested quentifier is some time im.~~

we can ~~tall~~ that order importad some time and some time does not importand for nested quentifiers.

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Answer to the Question no: 03

Let

p = The weather is too hot.

q = too cold.

r = The game will be held.

s = A prize-giving ceremony will occur

t = The VC will give a speech.

01. $(\neg p \vee \neg q) \rightarrow (r \wedge s)$.

02. $r \rightarrow t$

03. $\neg t$

04. $\neg r$ [2, 3 Modus Tollens]

05. $(\neg p \vee \neg q) \rightarrow r$ [1 simplification]

06. $(\neg p \vee \neg q) \rightarrow s$ [1 simplification]

07. $p \wedge q$ [5, 4 Modus Tollens]

08. p [7 simplification]

∴ conclusion is the weather is too hot.

(proved)