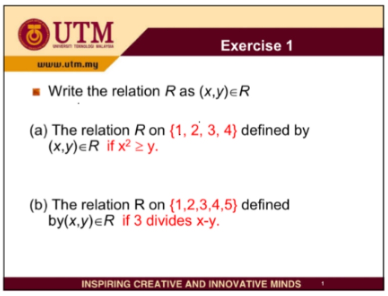
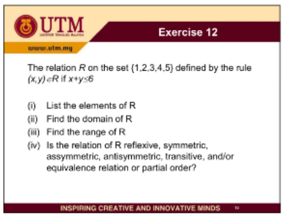


(a) $R = \{(1,1),(2,1),(2,2),(2,3),(2,4),(3,1),(3,2),(3,3),(3,4),$
$(4,1),(4,2),(4,3),(4,4)\}$

(b) $R = \{(1,1),(1,4),(2,2),(2,5),(3,3),(4,1),(4,4),$
$(5,2),(5,5)\}$



(i) $R = \{(1,1),(1,2),(1,3),(1,4),(1,5),(2,1),(2,2),$
$(2,3),(2,4),(3,1),(3,2),(3,3),(4,1),(4,2),$
$(5,1)\}$

(ii) Domain $= \{1,2,3,4,5\}$

(iii) Range $= \{1,2,3,4,5\}$

(iv) The relation R is not reflexive because $(5,5),(4,4) \notin R$

$$M_R = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix} \quad M_R^T = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$M_R = M_R^T$
$\therefore$ It is symmetric

$(1,2)\in R, (2,1)\in R$
$\therefore$ Its not antisymmetric

Its not irreflexive and antisymmetric
$\therefore$ Its not asymmetric

$$\begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix} \otimes \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

$(m_{25} = 0) \neq (n_{25} = 1)$

$(2,1),(1,5) \in R$, but $(2,5) \notin R$
$\therefore$ Its not transitive

For equivalence relation,
- It is symmetric but its not transitive and reflexive.

$\therefore$ Its not equivalence relation

For partial order,
- Its not antisymmetric, transitive and reflexive

$\therefore$ Its not partial order

Exercise 13

The relation R on the set {1,2,3,4,5} defined by the rule $(x,y) \in R$ if 3 divides x-y

(i) List the elements of R
(ii) Find the domain of R
(iii) Find the range of R
(iv) Is the relation of R refelxive, symmetric, assymmetric, antisymmetric, transitive, and/or equivalence relation or partial order?

(i) $R = \{(1,1),(1,4),(2,2),(2,5),(3,3),(4,1),(4,4),(5,2),(5,5)\}$

(ii) Domain $= \{1,2,3,4,5\}$

(iii) Range $= \{1,2,3,4,5\}$

(iv) It is reflexive because $(x,y) \in R$

$$M_R = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \end{bmatrix} \qquad M_R^T = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \end{bmatrix}$$

$M_R = M_R^T$

$\therefore$ It is symmetry

$(1,4) \in R, (4,1) \in R$

$\therefore$ It is not antisymmetric

Its not irreflexive and antisymmetric

$\therefore$ Its not asymmetric

$$M_R = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \end{bmatrix}$$

$(m_{11} = 1), (n_{11} = 1)$

$\therefore$ Its is transitive because $(1,4),(4,1) \in R$, $(1,1) \in R$

For equivalence relation,
It is reflexive, symmetry and transitive.
$\therefore$ It is equivalence relation

For partial order,
It is reflexive, transitive but not antisymmetric.
$\therefore$ It is not partial order