UNIVERSITI TEKNOLOGI MALAYSIA

SECI1013 DISCRETE STRUCTURE
SECTION 02
SEMESTER 1 2025/2026

TOPIC :

ASSIGNMENT 2 (CHAPTER 2 – RELATION, FUNCTION & RECURRENCE)

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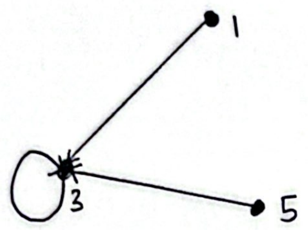
Question 1

i) R: $\{(1,3), (3,3), (5,3)\}$

ii) Domain : $\{1, 3, 5\}$

Range : $\{3\}$

iii)



iv) Relation R is not asymmetric because $(3,3) \in R$.

Question 2

given $(x,y) \in R$ and $(y,z) \in R$

Since R is equivalence relation, R must be symmetric, reflexive and transitive.

- R is reflexive, then $(x,x), (y,y), (z,z) \in R$.

- R is symmetric, $(x,y) \in R, (y,x) \in R$
  $(y,z) \in R, (z,y) \in R$

- R is transitive, (x,y) and $(y,z) \in R$, then $(x,z) \in R$, and also $(z,x) \in R$ because it is symmetric.

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

$(n_{xz} = 1)$ then $(m_{xz} = 1)$

(x,y) and $(y,z) \in R$, then $(x,z) \in R$

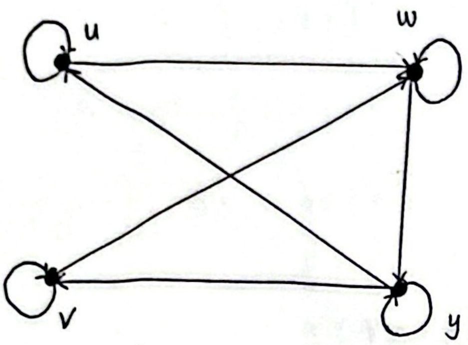
$R = \{(x,x), (x,y), (x,z), (y,x), (y,y), (y,z), (z,x), (z,y), (z,z)\}$

Question 3

i)

$$M_R = \begin{array}{c c} & \begin{array}{cccc} u & v & w & y \end{array} \\ \begin{array}{c} u \\ v \\ w \\ y \end{array} & \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \end{bmatrix} \end{array}$$

ii)



in-degree:	out-degree:
u = 2	u : 2
v = 2	v = 2
w : 3	w = 2
y : 2	y : 3

iii) ~~If set B is partial order refle~~

If R is partial order, R must be reflexive, antisymmetric and transitive.

Check;

R is reflexive because $(u,u), (v,v), (w,w), (y,y) \in R$.

R is antisymmetric because
$(u,w) \in R, (w,u) \notin R$
$(v,w) \in R, (w,v) \notin R$
$(y,u) \in R, (u,y) \notin R$
$(y,v) \in R, (v,y) \notin R$
$(w,y) \in R, (y,w) \notin R$.

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

$(n_{uy} = 1) \wedge (m_{uy} = 0)$

(u,w) and $(w,y) \in R$, but $(u,y) \notin R$

R is not transitive.

$\therefore$ R is not partial order because it is reflexive and antisymmetric but not transitive.

Question 4

$(x_1 - 1)^2 = (x_2 - 1)^2$

$|x_1 - 1| = |x_2 - 1| \quad x > 0$

$x_1 - 1 = x_2 - 1$

$x_1 = x_2$

Function f is one-to-one.

Let $y \in [0, \infty)$

$f(x) = y$

$(x-1)^2 = y$

$x = 1 + \sqrt{y}$

For every real number of y in range $[0, \infty)$, there is a real number x in domain $[1, \infty)$.

Thus, function f is onto.

$\therefore$ Since function f is one-to-one and onto, it is bijective.

Question 5

$f(x) = 9x + 4$

$g(x) = \frac{3}{2}x - 1$

a) Let $(y; x) \in g^{-1}$

$g^{-1}(y) = x$

$y = \frac{3}{2}x - 1$

$x = \frac{2}{3}(y+1)$

$g^{-1}(y) = \frac{2}{3}(y+1)$

b) $(g \circ f)(x) = gf(x)$

$= g(f(x))$

$= g(9x+4)$

$= \frac{3}{2}(9x+4) - 1$

$= \frac{27}{2}x + 5$

c) $(f \circ g)(x) = fg(x)$

$= f(g(x))$

$= f\left(\frac{3}{2}x - 1\right)$

$= 9\left(\frac{3}{2}x - 1\right) + 4$

$= \frac{27}{2}x - 5$

d) $(f \circ g \circ g)(x) = fgg(x)$

$= fg(g(x))$

$= fg\left(\frac{3}{2}x - 1\right)$

$= \frac{27}{2}\left(\frac{3}{2}x - 1\right) - 5$

$= \frac{81}{4}x - \frac{37}{2}$

Question 6

$P_0 = 4.0$

$P_1 = 5.0$

a) $P_t = P_{t-1} + \frac{1}{4} P_{t-2}$; $t \geq 2$ where initial temperature, $P_0 = 4$

b) $P_0 = 4.0°F$

$P_1 = 5.0°F$

$P_2 = P_1 + \frac{1}{4} P_0 = 5.0 + \frac{1}{4}(4.0) = 6.0°F$

$P_3 = P_2 + \frac{1}{4} P_1 = 6.0 + \frac{1}{4}(5.0) = 7.25°F$

$P_4 = P_3 + \frac{1}{4} P_2 = 7.25 + \frac{1}{4}(6.0) = 8.75°F$

$P_5 = P_4 + \frac{1}{4} P_3 = 8.75 + \frac{1}{4}(7.25) = 10.5625°F$

Question 7

a) input : n
output : S(n)

```
S(n) {
  if (n = 1)
     return 2
  else
     return (S(n-1))^2 - 1
}
```

b) S(4)

n = 4   return $(S(3))^2 - 1$

↓

S(3)

n = 3   return $(S(2))^2 - 1$

↓

S(2)

n = 2   return $(S(1))^2 - 1$

↓

S(1)

n = 1   return 2

$S(4) = 63$

return $8^2 - 1$

$S(3) = 8$

return $3^2 - 1$

$S(2) = 3$

return $2^2 - 1$

$S(1) = 2$

return 2

∴ Thus, $S_4 = 63$