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SECI1013: DISCRETE STRUCTURE

ASSIGNMENT 1 (PART 2) : CHAPTER 2

(SECPH-02)

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Question 1

1. $A = \{3, 6, 9, 12\}$

$B = \{2, 3, 4, 5, 6\}$

a R b only if a - b even num

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(i) $R = \{(3,3), (3,5), (6,2), (6,4), (6,6), (9,3), (9,5), (12,2), (12,4), (12,6)\}$

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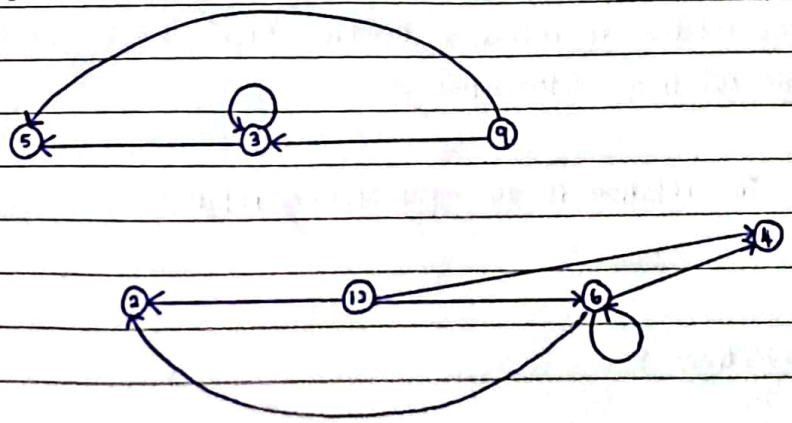
(ii)



(iii) Domain = $\{3, 6, 9, 12\}$

Range = $\{2, 3, 4, 5, 6\}$

Question 2

2. $D = \{1, 3, 8, 10, 15\}$

$x = \{1, 3, 8, 10, 15\}$

$y = \{1, 3, 8, 10, 15\}$

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y - x :

$R = \{(1,8), (1,15), (3,10), (8,1), (8,15), (10,3), (15,1), (15,8), (1,1), (3,3), (8,8), (10,10), (15,15)\}$

$M_R =$

	1	3	8	10	15
1	1	0	1	0	1
3	0	1	0	1	0
8	1	0	1	0	1
10	0	1	0	1	0
15	1	0	1	0	1

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

The relation is symmetric 1/2 show $M_R = M_R^T$

The relation is reflexive because $(1,1), (3,3), (8,8), (10,10), (15,15) \in R$

The relation is transitive

∴ The relation is an equivalence relation

Question 3

3. $R = \{(s,s), (s,t), (s,u), (u,u), (u,s), (t,t), (t,u), (t,v)\}$

(i)

	s	t	u	v
s	1	1	1	0
t	0	1	1	1
u	1	0	1	0
v	0	0	0	0

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(ii)

	s	t	u	v
In - degree	2	2	3	1
Out - degree	3	3	2	0

(iii)

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

It is not transitive.

It is not reflexive because $(v,v) \notin R$

It is not antisymmetric because $(s,u), (u,s) \in R$

∴ It is not partial order

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Question 4

$X = \{-2, 0, 2\}$ $Y = \{-4, 0, 4\}$

$v(-2) = 4 - (-2)^2$

$= 0$

$v(0) = 4 - 0^2$

$= 4$

$v(2) = 4 - 2^2$

$= 0$

5 1/2

- $v(x)$ is not a one-to-one function because $v(-2) = v(2)$ and $-2 \neq 2$.
- $v(x)$ is not onto Y, it is only onto $\{0, 4\}$

$w(-2) = 2(-2)$

$= -4$

$w(0) = 2(0)$

$= 0$

$w(2) = 2(2)$

$= 4$

- $w(x)$ is a one-to-one function and onto Y.
- $w(x)$ is a bijection

Question 5

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(i) Inverse of $g(x)$

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

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

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

(ii) $(g \circ g \circ f)(x)$

$(g \circ f)(x) = g[f(x)]$

$= \frac{2}{3}(7x - 2)$

$= \frac{14x - 4}{3}$

$(g \circ g \circ f)(x) = g[g(f(x))]$

$= \frac{2}{3}\left[\frac{14x - 4}{3}\right]$

$\frac{28}{9}x - \frac{8}{9}$

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Question 6

(5)

(i) $F_t = F_{(t-1)} + 1/5\,(F_{(t-2)})$, $t \geq 2$

(ii) $F_0 = 5.0$

$F_1 = 4.5$

$F_2 = F_1 + 1/5\,(F_0) = 4.5 + 1/5\,(5) = 5.5$

$F_3 = F_2 + 1/5\,(F_1) = 5.5 + 1/5\,(4.5) = 6.4$

$F_4 = F_3 + 1/5\,(F_2) = 6.4 + 1/5\,(5.5) = 7.5$

$F_5 = F_4 + 1/5\,(F_3) = 7.5 + 1/5\,(6.4) = 8.78$

$\therefore F_0 = 5.0, F_1 = 4.5, F_2 = 5.5, F_3 = 6.4, F_4 = 7.5, F_5 = 8.78$

Question 7

(8)

$W_0 = 5$, $W_1 = 7$, $W_n = 2W_{n-1} + W_{n-2}$ for $n \geq 2$. Trace algorithm for $n = 4$

```
input : n
output : w(n)

w(n) {
   if (n=0)
      return 5
   else if (n=1)
      return 7
   else
      return 2*(w(n-1)) + w(n-2)
}
```

$n = 4$, because $n \neq 0, n \neq 1$
return $2(w(3)) + w(2)$

$n = 3$, because $n \neq 0, n \neq 1$
return $2(w(2)) + w(1)$

$n = 2$, because $n \neq 0, n \neq 1$
return $2(w(1)) + w(0)$

$n = 1$, return 7

$n = 0$, return 5

for $n = 2$, return $2(7) + 5 = 19$

for $n = 3$, return $2(19) + 7 = 45$

for $n = 4$, return $2(45) + 19 = 109$

$\therefore W_0 = 5, W_1 = 7, W_2 = 19, W_3 = 45, W_4 = 109$