SEC1 1613 : DISCRETE STRUCTURE

SEM 1 ASSIGMENT 1.2

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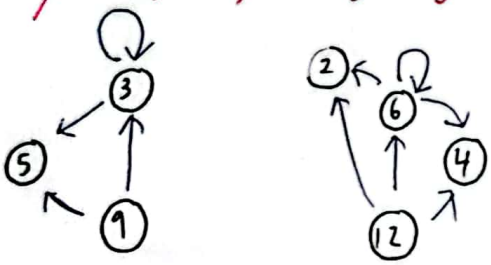
1. (i) $R = \{(3,3),(3,5),(6,2),(6,4),(6,6),(9,3),(9,5),(12,2),(12,4),(12,6)\}$ 2

(ii)



(iii) domain = $\{3,6,9,12\}$ ✓ 1

range = $\{2,3,4,5,6\}$ ✓ 1

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

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$M_R =$

	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

$= M_R^T$

→ reflexive 2

$(1,8) \in R$

$(8,1) \in R$

$(x,y) \in R$

$(y,x) \in R$

↳ symmetric 1

Show $M_R = M_R^T$ 1

2

$(1,1) \in R$ and $(1,1) \in R$ ...

Equivalent 1

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

2.5 → transitive

No.: Date:

3(i) (s,s) (u,u)
(s,u) (t,w)
(s,t) (t,t)
(u,s) (t,v)

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

(ii)

	s	u	t	v
in-degree	2	3	3	1
out-degree	3	2	3	0

(iii) Not partial order because not reflexive, not antisymmetric, not transitive.

Not transitive: $(v,v) \notin M_R$

Not antisymmetric: $(s,u) \in M_R \wedge x \neq y \rightarrow (u,s) \in M_R$

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

Not transitive

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

$w(-2) = 2(-2)$
$= -4$
$w(2) = 2(2)$
$= 4$
$w(0) = 2(0)$
$= 0$

$(-2, 0)$ Not one-to-one
$(0, 4)$ Not onto Y, range ≠ codomain
$(2, 0)$ Not bijection

$(-2, -4)$ one-to-one
$(2, 4)$ onto Y, codomain = range
$(0, 0)$ bijection

QUESTION 5

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

Let $y = g(x)$

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

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

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

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

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

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

$= g[g(7x-2)]$

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

$= g[\frac{14}{3}x - \frac{4}{3}]$

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

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

QUESTION 6

(i) $F_0 = 5.0$

$F_1 = 4.5$

$F(t) = F(t-1) + \frac{1}{5}F(t-2), \quad t \geq 2$

(ii) $F_0 = 5.0$

$F_1 = 4.5$

$F_2 = F_1 + \frac{1}{5}F_0 = 4.5 + \frac{1}{5}(5.0) = 5.5$

$F_3 = F_2 + \frac{1}{5}F_1 = 5.5 + \frac{1}{5}(4.5) = 6.4$

$F_4 = F_3 + \frac{1}{5}F_2 = 6.4 + \frac{1}{5}(5.5) = 7.5$

$F_5 = F_4 + \frac{1}{5}F_3 = 7.5 + \frac{1}{5}(6.4) = 8.78$

7. Input : n
Output : f(n)

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

f(0) = 5

f(1) = 7

f(2) = 2f(1) + f(0)
= 2(7) + 5
= 19

f(3) = 2f(2) + f(1)
= 2(19) + 7
= 45

f(4) = 2f(3) + f(2)
= 2(45) + 19
= 109

tree based approach
Start with n = 4

2f(3) + f(2)

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2f(2) + f(1)

|

2f(1) + f(0)