No.:

Discrete Structure Assignment 1 2

Section : 2

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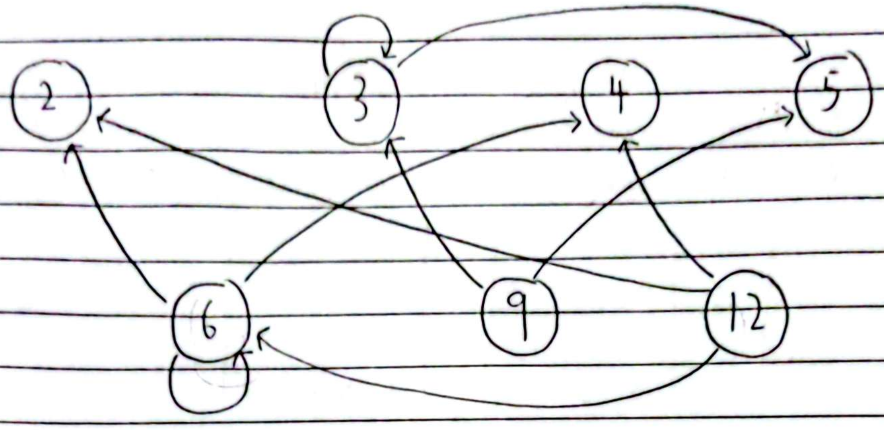
1) (i) $aRb \leftrightarrow a \cdot b \in Z^{even}$

~~R = {(6,2),(12,2),(3,3),(6,4),(6,2),(6,6),(9,3),(12,4),(9,5),(12,6)}~~

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

(ii)



(iii) The domain of R is {3, 6, 9, 12}.

The range of R is {2, 3, 4, 5, 6}.

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

~~Since~~

Equivalent relation exist if a relation is reflexive, symmetric and transitive.

~~Since xRy~~

such as no existent of (1,1), (3,3), (8,8), (10,10) and (15,15),

Since there is no any element related to itself, xRy is not reflexive.

Thus, this relation is not an equivalence relations.

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3) (i)

$$M_R: \begin{array}{c c} & \begin{array}{cccc} s & t & u & v \end{array} \\ \begin{array}{c} s \\ t \\ u \\ v \end{array} & \begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

(ii)

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

(iii) If a relation is partial order, it is reflexive, antisymmetric and transitive.

Relation R is not reflexive, since there is no existent of (v,v) in R.

Relation R is not antisymmetric, since there are existent of (s,u) and (u,s) in R.

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

Since $M_R \otimes M_R \neq M_R$, relation R is not transitive.

In conclusion, relation R is not partial order.

4) ~~If v and w is one-to-one, then when v(x)=w(x), x=x.~~

~~$v(x)=w(x)$~~

~~$4-x^2=2x$~~

~~$0=x^2+2x-4$~~

~~Since $x \neq x$, v and w not one-to-one relation.~~

4) When $x=-2$, $v(x)=4-(-2)^2$, $w(x)=2(-2)$

$=4-4$ $\quad$ $=-4$

$=0$

When $x=0$, $v(x)=4-(0)^2$, $w(x)=2(0)$

$=4-0$ $\quad$ $=0$

$=\cancel{0}4$

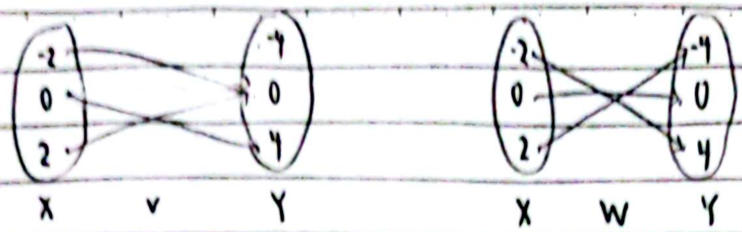
When $x=2$, $v(2)=4-(2)^2$, $w(x)=2(2)$

$=4-4$ $\quad$ $=4$

$=0$

No :

4)



Based on diagram, $v(x)$ is not one-to-one, not onto Y, thus not bijection (bijection exist when a relation is both one-to-one and onto Y.)
Based on diagram, $w(x)$ is one-to-one and onto Y. Thus, $w(x)$ is ~~also~~ bijection.

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

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

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

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

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

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

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

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

$= \frac{4}{9}(7x-2)$

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

6) (i) Chemical A and B combined become C.

F_0 of chemical A $= 5.0$ Fahrenheit.

F_1 of chemical B $= 4.5$ Fahrenheit.

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

The recurrence relation of chemical C for $t \geq 2$ is $F_t = F_{t-1} + \frac{1}{5}F_{t-2}$, $F_0 = 5.0$, $F_1 = 4.5$.

(ii) $F_0 = 5.0$, $F_1 = 4.5$

$F_2 = F_1 + \frac{1}{5}F_0$

$= 4.5 + \frac{1}{5}(5.0)$

$= 4.5 + 1.0$

$= 5.5$

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6) $F_3 = F_2 + \frac{1}{5}F_1$

$= 5.5 + \frac{1}{5}(4.5)$

$= 5.5 + 0.9$

$= 6.4$

$F_4 = F_3 + \frac{1}{5}F_2$

$= 6.4 + \frac{1}{5}(5.5)$

$= 6.4 + 1.1$

$= 7.5$

$F_5 = F_4 + \frac{1}{5}F_3$

$= 7.5 + \frac{1}{5}(6.4)$

$= 7.5 + 1.28$

$= 8.78$

7) ~~f(n)~~ w(n)

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

~~w(4)~~ Trace output of n=4 in w(n)

w(4)

n=4

Since n≠0 and 1,

return 2w(3)+w(2)   Return 2(45)+19   w(4)=109

w(3)

n=3

Since n≠0 and 1,

return 2w(2)+w(1)   Return 2(19)+7   w(3)=45

w(2)

n=2

Since n≠0 and 1,

return 2w(1)+w(0)   Return 2(7)+5   w(2)=19

w(1)

n=1

Since n=1,

return 7   Return 7   w(1)=7

Based on tracing w(1)=7, w(2)=19, w(3)=45 and w(4)=109.