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A24SC0215

SECTION 3

Question 1

i) $D = \{1, 3, 5\}$

multiple of 6 :

6

12

18

24

30

36

R is a relation on D of ordered pairs.

$3x + y$ when divide by 6, become 0.

x: 1, 3, 5 $\quad$ y: 1, 3, 5

$3(1) + 1 = 4$

$3(1) + 3 = 6$ ✓

$3(1) + 5 = 8$

$3(3) + 1 = 10$

$3(3) + 3 = 12$ ✓

$3(3) + 5 = 14$

$3(5) + 1 = 16$

$3(5) + 3 = 18$ ✓

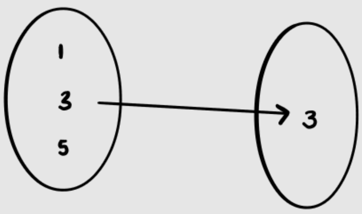
$3(5) + 5 = 20$

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

ii) Domain of $R = \{1, 3, 5\}$

Range of $R = \{3\}$

iii)



iv) Not asymmetric

Question 2

R $A = \{x, y, z\}$

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

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

All these list of R is the only possible answer because it included all reflenivity which includes all similar pair, symmetry which include their reverses, and transitivity.

Question 3

i)

M_R	u	v	w	y
u	1	0	1	0
v	0	1	1	0
w	0	0	1	1
y	1	1	0	1

ii)

	Out - degrees	In - degrees
u	$(u, u), (u, w)$	$(u, u), (y, u)$
v	$(v, v), (v, w)$	$(v, v), (y, v)$
w	$(w, w), (w, y)$	$(w, w), (u, w), (v, w)$
y	$(y, u), (y, v), (y, y)$	$(w, y), (y, y)$

iii) Partial order relation
1. Reflenive
2. Antisymmetric
3. Transitive

(1. R has (u,u), (v,v), (w,w), (y,y)

It is reflexive

(2. R has (u,w) | Reverse $(w,u) \notin R$

(y,u) | $(u,y) \notin R$

(y,v) | $(v,y) \notin R$

It is antisymmetric

(3. $y \to u \to w$

$(y,u) \in R$ $\quad$ $(u,w) \in R$

$(y,w) \notin R$

R is not transitive

= Therefore, R is not partial order relation because it falls the transivity.

Question 4

One - one

if $f(x_1) = f(x_2)$ then $x_1 = x_2$

$(x-1)^2 = (x-1)^2$

$(x-1) = \pm\sqrt{(x-1)^{\cancel{2}}}$

$(x-1) = (x-1)$ $\quad$ $(x_1 - 1) = -(x_2 - 1)$

$x - 1 = x - 1$ $\quad$ $x_1 - 1 = -x_2 + 1$

$x_1 + x_2 = 1 + 1$

$x_1 = 1 \qquad x_2 = 1$

the domain of $x \in [1, \infty)$, and $x_1 = x_2$, so the function is one -one.

Onto

codomain is $[0, \infty)$

let $f(x) = y$

$y = (x-1)^2$

$\sqrt{y} = x - 1$

$x = \sqrt{y} + 1$

$y \geq 0$ because y is in codomain $[0, \infty)$

therefore $\sqrt{y} \geq 0$

$x = 1 + \sqrt{y} \geq 1 + 0 = 1$

$x \geq 1$ in the domain $[1, \infty)$

the function is onto.

Therefore, the function is bijective because it's both one-one and onto.

Question 5

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

a) let $g(x) = y$

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

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

$2y = 3x - 2$

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

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

b) $g(f(x))$

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

$= \frac{27x + 12}{2} - 1$

$$= \frac{27x}{2} + 6 - 1$$

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

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

$$= \frac{27}{2}x - 9 + 4$$

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

d) $f(g(g(x)))$

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

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

$$= \frac{9}{4}x - \frac{5}{2}$$

$$f(g(g(x))) = 9\left(\frac{9}{4}x - \frac{5}{2}\right) + 4$$

$$= \frac{81}{4}x - \frac{45}{2} + 4$$

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

Question 6

$P_0 = 4.0\,°F$

$P_1 = 5.0\,°F$

$t \geq 2$ minutes

$P_{new} = P_{prev} + 1/4$ temp 2 minutes ago

a) $P_{prev} = P_{t-1}$

$$P_t = P_{t-1} + \frac{1}{4} P_{t-2}$$

b) $P_0 = 4$

$P_1 = 5$

$$P_2 = P_{2-1} + \frac{1}{4} P_{2-2}$$
$$= P_1 + \frac{1}{4} P_0$$
$$= 5 + \frac{1}{4}(4)$$
$$= 6$$

$$P_3 = P_{3-1} + \frac{1}{4} P_{3-2}$$
$$= P_2 + \frac{1}{4} P_1$$
$$= 6 + \frac{1}{4}(5)$$
$$= 7.25$$

$$P_4 = P_{4-1} + \frac{1}{4} P_{4-2}$$
$$P_3 + \frac{1}{4} P_2$$
$$= 7.25 + \frac{1}{4}(6)$$
$$= 8.75$$

$$P_5 = P_{5-1} + \frac{1}{4} P_{5-2}$$
$$P_4 + \frac{1}{4} P_3$$
$$8.75 + \frac{1}{4}(7.25) = 10.5625$$

Question 7

a) Algorithm calculate_sn (n):

Input : positive integer n which represent term number

Output : Value of nth term, s_n

```
function s(n) :
    if n == 1
        return 2 // base case
    else :
        // Recursive step
        RETURN calculate_sn (n-1) * calculate_sn (n-1) - 1
    end if
```

b) $S_4 = S_{4-1}^2 - 1 = S_3^2 - 1$

$S_3 = S_{3-1}^2 - 1 = S_2^2 - 1$

$S_2 = S_{2-1}^2 - 1 = S_1^2 - 1$

$S_1 = 2$

calculate back

$S_2 = (2)^2 - 1 = 3$

$S_3 = (3)^2 - 1 = 8$

$S_4 = (8)^2 - 1 = 63$

time

$S_4 \rightarrow$ calls $S_3 \rightarrow$ calls $S_2 \rightarrow$ calls $S_1 \rightarrow S_1 = 2$

$S_2 = (2)^2 - 1 = 3$

$S_3 = (3)^2 - 1 = 8$

$S_4 = (8)^2 - 1 = 63$