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Comp 3240

Hw 5

5.1.1

a.) $\{a, b, c, d, e\}$

b.) $\{w, x, y, z\}$

c.) $\{w, y, z\}$

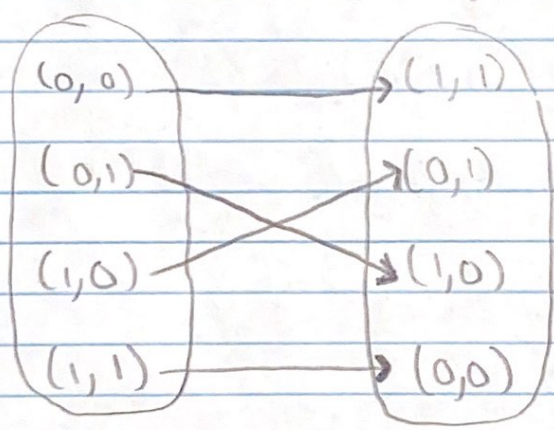
5.1.2

a.) $B = \{0,1\}$ (domain)

$= \{0,1\} \cdot \{0,1\}$

$= \{(0,0), (0,1), (1,0), (1,1)\}$

b.)



c.) $f = \{(1,1), (0,1), (1,0), (0,0)\}$ (range)

#5.2.3

a.) $\lfloor -3.7 \rfloor = -4$

b.) $\lceil -4.2 \rceil = -4$

c.) $\lfloor 5 \rfloor = 5$

d.) $\lceil \lfloor 3.5 \rfloor - 4.3 \rceil = \lceil 3 - 4.3 \rceil = \lceil -1.3 \rceil = -2$

e.) $\lfloor 3/2 + \lceil 1/3 \rceil \rfloor = \lfloor 1.5 + \lceil 0.33 \rceil \rfloor = \lfloor 1.5 + 1 \rfloor = \lfloor 2.5 \rfloor = 2$

#5.3.2

a.) $f(x)$ is not one to one function $(5, -5 \in R(\text{domain}))$
$f(x)$ is not onto function (no element $f^{-1}(-a) \in R(\text{domain})$

b.) $R \to R$ is both one to one function

c.) $h(x)$ is not onto function $(2 = x^3 = x = \sqrt[3]{2} \in Z)$

e.) This is one to one function, for every value we get a single value

A=1	f(x)=1
A=2	f(x)=2
A=3	f(x)=3
A=4	f(x)=4
A=5	f(x)=5
A=6	f(x)=6
A=7	f(x)=7
A=8	f(x)=8

#5.4.2

a.) $f = \mathbb{Z} \to \mathbb{Z}$, $f(x) = x + 3$

$f^{-1}(x) = y \quad x \in \mathbb{Z}$

$x = f^{-1}(x)$

$x = y + 3$

$y = x - 3 \qquad f^{-1}(x) =$ well defined

$f^{-1}(x) = x - 3$

b.) $f : \mathbb{Z} \to \mathbb{Z}$, $f(x) = 2x + 3$

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

$x = f(y)$

$x = 2y + 3$

$2y = x - 3$

$y = \frac{x-3}{2} \notin \mathbb{Z} \quad f^{-1}$ is not well defined

c.) $\mathbb{R} \to \mathbb{R}$, $f(x) = 2x + 3$

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

$x = f(y)$

$x = 2y + 3$

$y = \frac{x-3}{2} \in \mathbb{R} \quad f^{-1}(x) = \frac{x-3}{2}$ is well defined

5.5.2

a.) $f \circ g(0) = f(g(0)) = f(2^0) = f(1) = 1^2 = 1$

b.) $f \circ h(52) = f(h(52)) = f(\lceil 52/5 \rceil) = f(11) = 11^2 = 121$

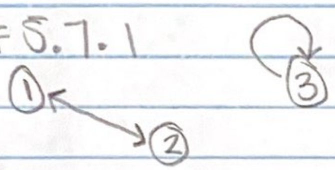
c.) $g \circ h \circ f(4) = g(h(f(4))) = g(h(4^2)) = g(h(16))$
$= g([16/5]) = g(3) = 2^3 = 8$

d.) $h \circ f = h(f(x)) = h(x^2) = \lceil x^2/4 \rceil$

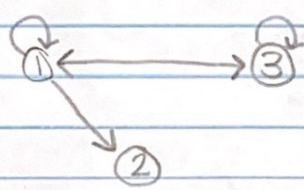
e.) $f \circ g = f(g(x)) = f(2^x) = (2^x)^2 = 2^{2x}$

5.7.1

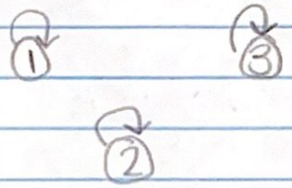
Ordered pairs

a.) 

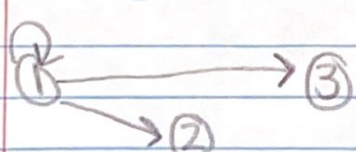
$\{(1,2), (2,1), (3,3)\}$

b.) 

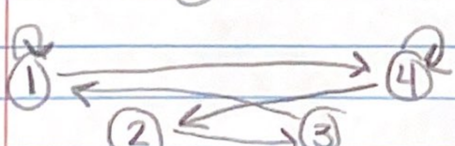
$\{(1,1), (1,2), (3,2), (3,3)\}$

c.) 

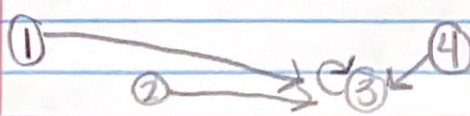
$\{(1,1), (2,2), (3,3)\}$

d. 

$\{(1,1), (1,2), (1,3)\}$

e.) 

$\{(1,1), (1,4), (2,3) (3,2) (4,2) (4,4)\}$

f.) 

$\{(1,3), (2,3) (3,3) (3,4)\}$

#5.7.2

a.) $M = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ $\{(1,1),(1,2),(1,3)\}$

b.) $M = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{bmatrix}$ $\{(1,1),(1,3),(2,2),(2,3)\}$

c.) $M = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 1 & 1 & 0 \end{bmatrix}$ $\{(1,2),(2,1),(3,1),(3,2)\}$

d.) $M = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix}$ $\{(1,2),(2,3),(3,4),(4,1)\}$

e.) $M = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix}$ $\{(1,1),(1,4),(2,2),(3,3),(4,1)(4,4)\}$

f.) $M = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$ $\{(1,1),(1,4),(2,1),(3,3),$
$(4,3),(3,2)\}$

5.8.3

a.) No, it isn't possible.
The reflexive relation on $\{a,b,c\}$ must contain the three pairs (a,a) (b,b) (c,c)

b. Yes, a relation on $\{a,b,c\}$ can be both symmetric and anti-symmetric. One example is $\{(a,a)(b,b)(c,c)\}$

c.) Yes, a relation on $\{a,b,c\}$ can neither symmetric and anti-symmetric. One example is $\{(a,b),(b,c)\}$

d. Yes, a relation on $\{a,b,c\}$ can be both symmetric and transitive but not reflexive. One example is $\{(a,a),(a,b),(b,a),(b,b)\}$

#5.9.1

a.) The indegree is number of edges coming on vertices, d is 2.

b.) The out degree of vertices is the number of outgoing edge on that vertices for c is 3

c.) The head of edge is c

d. The tail of edge is g.

f No, there is no edge from f to c. No walk, no path, no trail

g Yes, it is a walk. Yes, it is a trail, and also a path

h. Yes, it is a circuit in the graph and its a cycle.

e. (b,c,d), (c,f,c), (c,g,f,e), (c,g), (c,f,d,b)