NYU Computer Science Bridge to Tandon Course Winter 2021

Homework 5 Q3-Q5

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Question 3

a: 4.1.3 b Not a well-defined function, when x = 2 or x = -2. Thus not a function.

a: 4.1.3 c This is a function. Range of f is $\{f(x) \geq 0\}$

b: 4.1.5 b {4,9,16,25}

b: 4.1.5 d {0,1,2,3,4,5}

b: 4.1.5 h {(1,1),(2,1),(3,1),(1,2),(2,2),(3,2),(1,3),(2,3),(3,3)}

b: 4.1.5 i {(1,2),(1,3),(1,4),(2,2),(2,3),(2,4),(3,2),(3,3),(3,4)}

b: 4.1.5 l { ∅,{2},{3},{2, 3}}

Question 4

I a: 4.2.2 c
Not onto. For example, there is no integer x when y=2. One-to-one.If $x1 \neq x2$, then $f(x1) \neq f(x2)$

I a: 4.2.2 g
Not onto. For example, there is no pair (x,y), $x \in Z$ and $y \in Z$ when f(x,y) is (1,5). One-to-one. If $(x1, y1) \neq (x2, y2)$, then $f(x1, y1) \neq f(x2, y2)$

I a: 4.2.2 k
Not onto. For example, there is no pair (x,y), $x \in Z^+$ and $y \in Z^+$ when f(x,y)=1. One-to-one. If $(x1, y1) \neq (x2, y2)$, then $f(x1, y1) \neq f(x2, y2)$

I b: 4.2.4 b
Not Onto. There is no triple can make $f = 000$
Not One-to-one. For example, $f(001) = f(101) = 101$

I b: 4.2.4 c
Both Onto and One-to-one

I b: 4.2.4 d
One-to-one. But not Onto. Function f has a domain with 8 element and target with 16 elements. If it's Onto, domain should have at least 16 element.

I b: 4.2.4 g
Not One-to-one. $f(\{2,3\}) = f(\{1,2,3\})$=$\{2,3\}$
Not Onto. There is no element in domain can make f = $\{1\}$

II a: $f : Z \to Z^+$,

$$f(x) = \begin{cases} 3x & x > 0 \\ 3|x| + 1 & x \leq 1 \end{cases}$$

II b: $f : Z \to Z^+$, $f(x) = |x| + 1$

II c: $f : Z \to Z^+$,

$$f(x) = \begin{cases} 2x + 1 & x \geq 0 \\ -2x & x < 0 \end{cases}$$

II d: $f : Z \to Z^+$, $f(x) = 1$

Question 5

a: 4.3.2 c $f^{-1}(x) = (x - 3)/2$

a: 4.3.2 d Since $|D| \neq |T|$, The function is not a bijection. There is no inverse function.

a: 4.3.2 g The output of f^{-1} is obtained by taking the input string and reversing the bits.

a: 4.3.2 i $f^{-1}(x, y) = (x - 5, y + 2)$

b: 4.4.8 c f o h(x) = $2x^2 + 5$

b: 4.4.8 d h o f(x) =$4x^2$ + 12x + 10

c: 4.4.2 b 121

c: 4.4.2 c 16

c: 4.4.2 d h o f(x)=$\lceil x^2/5 \rceil$

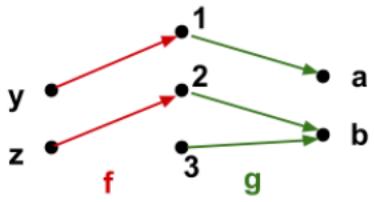
d: 4.4.6 c 111

d: 4.4.6 d {101, 111}

d: 4.4.6 e {001,101,011,111}

e: 4.4.4 c No. We will show that if g o f is one-to-one, then f must be one-to-one. If g o f is one-to-one, which means if $f(x) \neq f(y)$ then $g(f(x)) \neq g(f(y))$. then x$\neq y$.

e: 4.4.4 d Yes. The diagram below illustrates an example: (see next page)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