# Homework 5

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## Question 1

See C++ File.

# Question 2

See C++ File.

# Question 3

## 3.1 Exercise 4.1.3

b) Not a function. When x is 2 or -2, f(x) is not a real number.

c) Is a function. For any case of x, there is a single corresponding f(x).

## 3.2 Exercise 4.1.5

b) {4, 9, 16, 25}

d) {0, 1, 2, 3, 4, 5}

h) {(1,1) (2,2) (3,3)}

i) {(1,2), (2,2), (3,2), (1,3), (2,3), (3,3), (1,4), (2,4), (3,4)}

l) { ∅, {2}, {3}, {2,3} }

# Question 4

## 4.1 Exercise 4.2.2

c) The function is one-to-one, and not onto.

g) The function is only one-to-one. When (x,y) = (-1,0) or (x,y) = (0,0), f(x) = (0, 0).

k) The function is not onto or one-to-one. When (x,y) = (3,2) or (x,y) = (2,6), f(x) = 10.

## 4.2 Exercise 4.2.4

b) The function is not onto or not one to one. $f(x) = \{100, 101, 110, 111, 100, 101, 110, 111\}$

c) The function is both onto, and one to one. $f(x) = \{000, 100, 010, 110, 001, 101, 011, 111\}$

d) The function is one to one, but not onto. $f(x) = \{0000, 0010, 0100, 0110, 1001, 1011, 1101, 1111\}$

g) The function is not one-to-one or onto. $f(x) = \{\{\emptyset\}, \{2\}, \{3\}, \{4\}, \{5\}, \{6\}, \{\}, \{6\}, \{8\}\}$

## 4.3 Exercise 4.2.5

a) $\mathbb{Z} \rightarrow \mathbb{Z}^+ \; f(x) = 1$

b) $\mathbb{Z} \rightarrow \mathbb{Z}^+ \; f(x) = 3x \;$ if $x > 0, 3|x| + 1 \;$ if $x \leq 0$

c) $\mathbb{Z} \rightarrow \mathbb{Z}^+ f(x) = |x| + 1$

d) $\mathbb{Z} \rightarrow \mathbb{Z}^+ \; f(x) = 2xifx >= 0, 2|x| + 1ifx < 0$

# Question 5

## 5.1 Exercise 4.3.2

c) $f(x') = \frac{x-3}{2}$

d) There is not a well defined inverse for the function.

g) $f(x') = X$ such that X is a 3-bit string, where f(x') reverses the string

i) $f(x', y') = (x - 5, y + 2)$

## 5.2 Exercise 4.4.8

c) $foh(x) = 2x^2 + 5$

d) $hof(x) = 4x^2 + 12x + 9$

## 5.3 Exercise 4.4.2

b) 121

c) 16

d) $\frac{x^2}{5}$

## 5.4 Exercise 4.4.6

c)$hof(010) = 1111$

d) The range of $hof$ is $\{001, 111\}$

e) The range of $gof$ is $\{001, 011, 101, 111\}$

## 5.5 Exercise 4.4.4

c) No it is not possible. If f is one to one for each $Z \longrightarrow Z$, and g is one to one from $Z \longrightarrow toZ$, then it is not possible that gof is not also one-to-one.

d) Yes it is possible.
$Z \longrightarrow Z$
$f(x) = x + 1$
$g(x) = |x| - 1$
$gof = (x + 1) - 1$

If x is 2, then f(x) will evaluate to 3 and g(f(x)) will evaluate to 2.