**Section 2.3**

12)a) from Z to Z, determine one to one, meaning each y has a unique x.

f(n) = n-1

N1, N2 are integers.

N1 != N2 6 != 5

F(N1) != F(N2) 5 != 4

Therefore, the function is one-to-one.

b)

f(n) = (n^2) + 1

N1, N2 are integers.

N1 != N2 2 != -2

F(N1) = F(N2) F(2) = F(-2)

N1^2 + 1 = N2^2 + 1 4 + 1 = 4 + 1

N1 = (+/-) N2 5 = 5

Therefore the function is not one-to-one.

c)

f(n) = n^3

N1, N2 are integers

N1 != N2 2 != -2

F(N1) != F(N2) F(2) != F(-2)

N1^3 != N2^3 8 != -8

Therefore the function is one-to-one.

d)

f(n) = ⌈n/2⌉

N1, N2 are integers

N1 != N2 8 != 7

F(N1) = F(N2) F(8) = F(7)

⌈N1/2⌉ = ⌈N2/2⌉ ⌈4⌉ = ⌈3.5⌉

4 = 4

Therefore the function is not one-to-one.

14) A function is onto if the codomain is the same as the range, meaning that all y values have an x value.

a)

f(m,n) = 2m - n

f(0,x) = 2(0) - x

f(0,x) = -x want it to equal x.

f(0, -X) = 2(0) + X

F = X

Therefore, for every y value, there will be a value x. So it is onto.

b)

f(m,n) = m^2 - n^2

f(2,2) = 4-4

No x value for values for m=2, n=2.

Therefore, the function is not onto.

c)

f(m,n) = m + n +1

We want y to equal m or n.

f(m, -1) = m + -1 + 1

f(m, -1) = m

Therefore there is a x value, m, for every y value. The function is onto.

d)

f(m,n) = abs(m) - abs(n)

We want the function to equal m or n

f(m, 0) = abs(m) - abs(0)

f(m, 0) = abs(m)

Therefore there is a x value, m, for every y value. The function is onto.

e)

f(m,n) = m^2 - 4

m^2 will always be greater than 0. m^2 - 4 will always be greater than -4.

This does not fit in the domain of all integers.

Therefore, the function does not fit within the codomain. The function is not onto.

20) N to N, {0,1,2,3,4,5, etc}

a)

f(x) = 2x

There is no preimage for the image of 1. Otherwise, the function is one to one.

b)

f(x) = floor(x/2)

Not one to one because x = 3 and x = 2 would both be 1.

c)

f(2x-1) = 2x

f(2x) = 2x-1

One to one and onto because there is a preimage for every image, and they are all unique.

d)

f(x) = 2

Constant function, no unique values, and no preimages for all images.

22)

a)

f(x) = -3x + 4

-3x + 4 = -3y + 4

-3x = -3y

X = Y, one to one

G(y) = (Y - 4)/-3

f(g(y)) = x, onto.

Therefore the function is a bijection.

b)

f(x) = -3x^2 +7

-3x^2 = -3y^2

x^2 = y^2 , not one to one bc +- #

Therefore the function is not a bijection.

c)

f(x) = (x+1)/(x+2)

X+2 = 0 x = -2

f(-2) = -1/0 this is not a real number, therefore the function is not a bijection.

d)

f(x) = x^5 + 1

x^5 = y^5

X = y, the function is one to one.

g(y) = (y-1)^(⅕)

f(g(y)) = x, the function is onto.

Therefore the function is bijective.

60) 8 bits = 1 byte

a)

X bytes for 4 bits of data

X = 1. You need to use ceil(4/8).

b)

ceil(10/8)

You will need 2 bytes of data.

c)

ceil(500/8)

You will need 63 bytes.

d)

ceil(3000)

You will need 375 bytes.