CECS 228 Name:

Lab 4.1 ID: Date:  
Objective:

* Be able to understand definition of functions
* Be able to determine whether a function is bijective, surjective or injective.
* Be able to understand important functions such as ceiling, floor functions
* Be able to find inverse function and compositional function

Exercise 1: Why is f not a function from to if  
a) f (x) = 1/x?

b) f (x) = ?

c) f (x) = ± ?

Exercise 2: Determine whether f is a function from **Z** to **R.** If not, explain why.   
a) f (n) = ±n.

b) f (n) =

c) f (n) = 1/(n2 − 4).  
  
  
Exercise 3: Give an example of a function from **N** to **N** that is  
a) one-to-one but not onto.  
  
  
  
  
b) onto but not one-to-one.  
  
  
  
  
  
c) both onto and one-to-one (but different from the identity function).

d) neither one-to-one nor onto.

Exercise 4:   
Find these values.  
a. ⌊1/2 + ⌊1/2⌋⌋

b. ⌈⌊1/2 + ⌊1/2⌋⌋⌉  
  
  
c. ⌊1/2 + ⌈3/2⌉⌋

Exercise 5:  
Prove or disprove each of these statements about the floor and ceiling functions  
a. ⌈xy⌉ = ⌈x⌉ ⌈y⌉ for all real numbers x and y.

b. ⌈x⌉ + ⌈y⌉ - ⌈x + y⌉ = 0 or 1 whenever x and y are real numbers.

Exercise 6:  
Sets A and X are defined as:  
A = { a, b, c, d }  
X = { 1, 2, 3, 4 }  
A function f: A → X is defined to be  
f = { (a, 3), (b, 1), (c, 4), (d, 1) }  
a. What is the target (or co-domain) of function f?

b. What is the range of function f?

c. What is f(c)?   
  
d. What is the domain of function f?

Exercise 7: Consider three functions f, g, and h, whose domain and target are **Z**. Let

*f*(*x*)=*x*2           *g*(*x*)=2x           *h*(*x*)=⌈*x5*⌉

a. Evaluate g ο h ο f(4)

b. Give a mathematical expression for f ο g.

Exercise 8: For each of the following functions, indicate whether the function has a well-defined inverse. If the inverse is well-defined, give the input/output relationship of f-1.

a. f: Z → Z. f(x) = 2x + 3

b. f: R → R. f(x) = 2x + 3