**Lab 09 -Functions**

**Objective**

Solving exercises from the textbook in chapter 2.3

**Current Lab Learning Outcomes (LLO)**

By completion of the lab, the students should be able to:

1. will understand functions and different types of functions

2. Finding the domain and range of function, composite of function and graph of function.

3. Will be able to solve shorter/easier or longer / harder problems given in the textbook.

**Lab Requirements**

Students allowed using their lecture notes in the lab and use blackboard slides in order to solve the exercises.

**Lab Assessment**

1- Divide students to groups and let them to solve the given example.

2- Discuss the answers with the groups and write on board the optimal solution.

**Lab Description**

In this lab, the following exercises are going to be solved and explained to them:

1. Why is f not a function from R to R if

a) f (x) = 1/x?

b) *f (x)* = ±

Solution

* 1. F(0) is not defined x<0
  2. F(x) is not well-defined because there are two distinct values assigned to each *x*.

1. Find the domain and range of these functions. Note that in each case, to find the domain, determine the set of elements assigned values by the function.

**a)** the function that assigns to each nonnegative integer its last digit

**b)** the function that assigns the next largest integer to a positive integer

**c)** the function that assigns the number of bits left over when a bit string is split into bytes (which are blocks of 8 bits)

a)Solution: Domain: N; Range: {0, 1, 2, ..., 9} .

b) Domain: Z+; Range: Z+ − {1} .

c) Domain the set of bit strings; range the set of nonnegative integers not exceeding 7

1. find the domain of the function f(x)=x2+3x+5/x2-5x+4.

solution: since x2-5x+4 =(x-4)(x-1), the function f is defined on all real numbers except at x=4 and at x =1. hence the domain of the function f is R – {1,4}

1. find the domain and range of the function f(x)=x-2/3-x

Solution:Domain(f)=R-{3}, Range of f:

let y=x-2/3-x

=3y-xy=x-2

=x(y+1)=3y+2

=x=3y+2/y+1,

Range =R-{-1}

1. Find these values.

a) b) c) d) e)

Solution:

1 b)0 c)-1 d)2 e)1

1. Consider these functions from the set of students in a discrete mathematics class. Under what conditions is the function one-to-one if it assigns to a student his or her

**a)** Mobile phone number.

**b)** Student identification number.

**c)** Final grade in the class.

**d)** Home town.

a) 1-1. All mobile phone numbers   
b) 1-1 All student ID numbers   
c) Not 1-1 unless it's a very small class and everyone gets a different grade (unlikely). All possible grades.   
d) Not 1-1 unless everyone is from a different home town (possible but unlikely). All towns in the world (or smaller set if everyone is from the same country, state, etc.)

1. Determine whether the function *f* : **Z** × **Z** → **Z** is onto if

**a)** *f (m, n)* = *m* + *n*. **b)** *f (m, n)* = *m*2 + *n*2. **c)** *f (m, n)* = *m*.

**d)** *f (m, n)* = |*n*|. **e)** *f (m, n)* = *m* − *n*.

Solution:a) onto b)not onto c)onto d)not onto e)onto

1. Determine whether each of these functions is a bijection from **R** to **R**.

**a)** *f (x)* = 2*x* + 1 **b)** *f (x)* = *x*2 + 1 **c)** *f (x)* = *x*3 **d)** *f (x)* = *(x*2 + 1*)/(x*2 + 2*)*

Solution: **a)** Yes **b)** No **c)** Yes **d)** No

1. Determine whether each of these functions from **Z** to **Z** is one-to-one.

**a)** *f (n)* = *n* − 1 **b)** *f (n)* = *n*2 + 1 **c)** *f (n)* = *n*3  **d)** *f (n)* = ⎡n/2⎤

TRUE FALSE TRUE FALSE

1. How many bytes are required to encode *n* bits of data where *n* equals

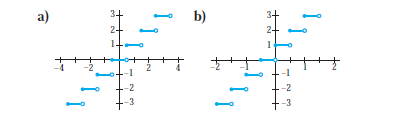
**a)** 7? **b)** 17? **c)** 1001? **d)** 28,800?

**Solution: a)** 1 **b)** 3 **c)** 126 **d)** 3600

Or Ceil(n/8) or **⎡n/8⎤**

1. Draw the graph of the function





1. Given *f*(*x*) = 2*x* + 3 and *g*(*x*) = –*x*2 + 5, find (*f* o *g*)(*x*), (*g* o *f* )(*x*).

*Solution. f* o *g*)(*x*) = *f* (*g*(*x*))   
    = *f* (–*x*2 + 5)   
    = 2(             ) + 3     ... setting up to insert the input formula   
    = 2(–*x*2 + 5) + 3   
    = –2*x*2 + 10 + 3   
    = **–2*x*2 + 13**

(*g* o *f* )(*x*) = *g*(*f*(*x*))   
    = *g*(2*x* + 3)   
    = –(           )2 + 5    ... setting up to insert the input   
    = –(2*x* + 3)2 + 5   
    = –(4*x*2 + 12*x* + 9) + 5   
    = –4*x*2 – 12*x* – 9 + 5   
    = **–4*x*2 – 12*x* – 4**

1. Let f(x) = -x + 4, find f-1(x). f:R🡪 R b) f(x) = x3+1, f:R🡪 R

Solution: y = - x + 4

y– 4 = - x

x = - y + 4

f-1(y) = - y + 4

b)f(x) = x3 + 1

y – 1 = x3

x = (y – 1 )1/3

f-1(y) = (y – 1)1/3