

# Homework #03

## CS2620: Discrete Structures

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Maximum Marks:15  
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Time: 5:00 PM  
Date: 23-12-2020

### Question#01

Consider these functions from the set of students in a discrete Structure 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

Ans:

- a. The function is one-to-one if and only if all the student has different mobile number which is actually true because no one can have same mobile number
- b. The function is one-to-one if and only if no student has same identification number which is fact that every student assigned a different identification number
- c. The function is one-to-one if and only if every student get separate final grade in the class
- d. The function is one-to-one if and only if every student has different home town

In general, the function is one-to-one if and only if no student shares the same data or the same data didn't assign to two or more students.

### Question#02

Data stored on a computer disk or transmitted over a data network are usually represented as a string of bytes. Each byte is made up of 8 bits. How many bytes are required to encode 100 bits of data?

Ans: When we divide the 100 bit by 8 we will get the result 12.5 which is not the integer and the bytes need to be always an integer. In order to turn this result into integer. We will see the concept of Floor function and Ceiling function. Since 0.5 is the smallest number so we will round up the decimal to 13 bytes.

$$\lceil 100/8 \rceil = \lceil 12.5 \rceil = 13$$

### Question#03

**In asynchronous transfer mode (ATM) (a communications protocol used on backbone networks), data are organized into cells of 53 bytes. How many ATM cells can be transmitted in 1 minute over a connection that transmits data at the rate of 500 kilobits per second?**

**Ans.**

**Given:**

53 bytes of data  $\rightarrow$  1 byte = 8 bits =  $53 * 8 = 424$  bits

500 kilobits per second  $\rightarrow$  1 kilobits = 1000 kilobits =  $500 * 1000 = 500000$  bits

$n = 500000$  per second \* 60 second = 30,000,000 bits per second

**Solution:**

We will divide the total number of kilobits per second with the total number of bits. In resultant we will get the number which is not integer so we will round off the decimal. Since it is 0.716 which is an greater integer number so we will round down the decimal by using floor function concepts

$$[30,000,000 / 424] = [70,754.716] = [70,754]$$

**Question#04**

**Let  $f(x) = \lfloor x^2 / 3 \rfloor$ . Find  $f(S)$  if**

**a)  $S = \{-2, -1, 0, 1, 2, 3\}$ .**

**b)  $S = \{0, 1, 2, 3, 4, 5\}$**

**Ans**

- a) When  $x = -2$ ,  
 $\lfloor -2^2 / 3 \rfloor = \lfloor 4/3 \rfloor = \lfloor 1.33 \rfloor = [1]$   
 When  $x = -1$ ,  
 $\lfloor -1^2 / 3 \rfloor = \lfloor 1/3 \rfloor = \lfloor 0.33 \rfloor = [0]$   
 When  $x = 0$ ,  
 $\lfloor 0^2 / 3 \rfloor = \lfloor 0/3 \rfloor = [0]$   
 When  $x = 1$ ,  
 $\lfloor 1^2 / 3 \rfloor = \lfloor 1/3 \rfloor = \lfloor 0.33 \rfloor = [0]$   
 When  $x = 2$ ,  
 $\lfloor 2^2 / 3 \rfloor = \lfloor 4/3 \rfloor = \lfloor 1.33 \rfloor = [1]$   
 When  $x = 3$ ,  
 $\lfloor 3^2 / 3 \rfloor = \lfloor 9/3 \rfloor = [3]$
- b) When  $x = 0$   
 $\lfloor 0^2 / 3 \rfloor = \lfloor 0/3 \rfloor = [0]$   
 When  $x = 1$ ,  
 $\lfloor 1^2 / 3 \rfloor = \lfloor 1/3 \rfloor = \lfloor 0.33 \rfloor = [0]$   
 When  $x = 2$ ,  
 $\lfloor 2^2 / 3 \rfloor = \lfloor 4/3 \rfloor = \lfloor 1.33 \rfloor = [1]$

When  $x = 3$ ,

$$[3^2 / 3] = [9/3] = [3]$$

When  $x = 4$ ,

$$[4^2 / 3] = [16/3] = [5.33] = [5]$$

When  $x = 5$ ,

$$[5^2 / 3] = [25/3] = [8.33] = [8]$$