SETS AND FUNCTIONS

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- sets are collection of objects : here objects can be anything. For example, in a set of numbers the elements will be numbers, in a set of words the elements can be other related words or even alphabets.
- Functions : it is a way to manipulate or identify objects from sets, functions in sets are related to functions in programming somewhat. Functions help to identify what kind of a relation a particular function represents.

HOW TO DEFINE SETS ?

The objects in a set are called elements.

- A set is denoted using the curly braces {}
- **∈ denotes "belongs to"**
- **∉ denotes "doesn't belong to"**
- **the uppercase letters denote the sets and the lowercase letters denote the elements in the sets.**

Examples :

A= set of numbers <5

A ={ 4,3,2,1}

B = $\{x \in \mathbb{N} : x < 4\}$

B= {1,2,3}

There are some alphabets denoted to a particular set which are

- $\mathbb{N}$ The set of natural numbers: **{1, 2, 3, 4, …}**
- $\mathbb{Z}$ The set of integers: **{0, ±1, ±2, …}**
- $\mathbb{Q}$ The set of rational numbers: a/b, for a, b integers, $b \neq 0$
- $\mathbb{R}$ The set of real numbers, which includes $\mathbb{N}$, $\mathbb{Z}$, $\mathbb{Q}$, and irrational numbers
- $\mathbb{C}$ The set of complex numbers: $x + iy$, for x, y real, $i^2 = -1$

The universal set is denoted by U, whereas a null set is denoted by {} or ∅

SUBSETS AND PROPER SUBSETS

- A is called a subset of B if all the elements of A are there in B. it is denoted by $A \subset B$
- Example : A = {1, 2, 3, 4 ,5 }
  B = { 1,2,3,4,5,6,7,8,9} so A is a subset of B.
- We use $A \not\subset B$ to denote that ***A*** is not a subset of ***B***.

OPERATIONS ON SETS

UNION OF SETS

A union of set is nothing but combining all the elements of the given sets.

It is denoted by $A \cup B$.

For example A={1,2,3,4,5,6}

B= { 7,8,9}

so A U B = { 1,2,3,4,5,6,7,8,9}

INTERSECTION OF SETS

Intersection means finding the common elements of the two sets and creating a new set.

For example :

A= {1,2,3,4,5,6}

B= {2,3,4,5,6,7,8,9}

$A \cap B$ = { 2,3,4,5,6}

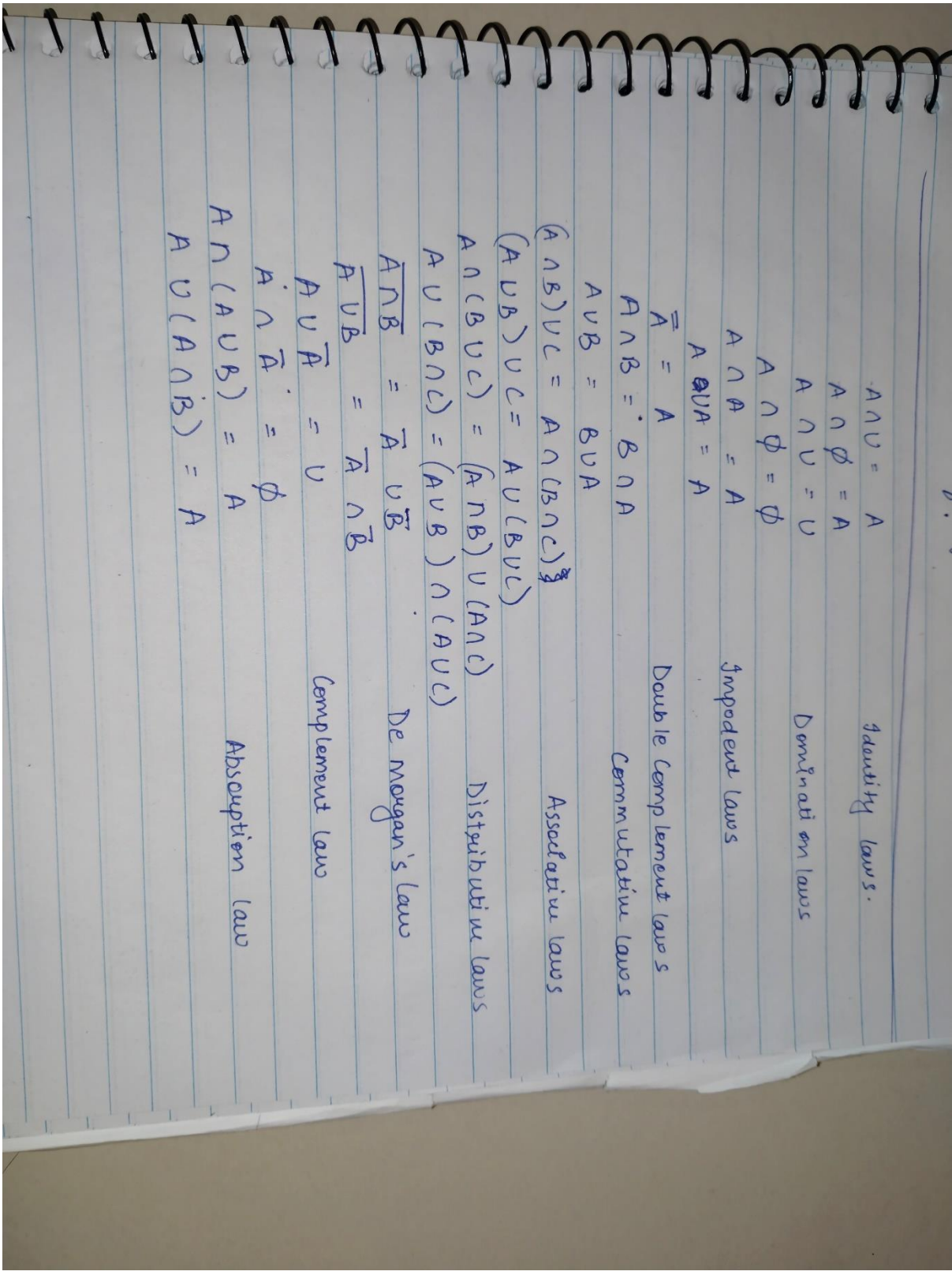
COMPLEMENT OF SETS

Complement of a set is the set of all elements a universal set ***U***, but not in ***A***, and is denoted by $\bar{A}$ or A'

DIFFERENCE OF SETS

The **set difference** of ***A*** and ***B*** is the set of all elements in ***A*** excluding those in ***B***, and is denoted by ***A\B*** or ***A − B***.

LAWS IN SETS


A ∩ U = A
Identity laws.
A ∩ ∅ = A
A ∩ U = U
Domination laws
A ∩ ∅ = ∅
A ∩ A = A
Impodent laws
A ∪ A = A
$\overline{\overline{A}} = A$
Double complement laws
A ∩ B = B ∩ A
Commutative laws
A ∪ B = B ∪ A
(A ∩ B) ∪ C = A ∩ (B ∩ C)
Associative laws
(A ∪ B) ∪ C = A ∪ (B ∪ C)
A ∩ (B ∪ C) = (A ∩ B) ∪ (A ∩ C)
Distributive laws
A ∪ (B ∩ C) = (A ∪ B) ∩ (A ∪ C)
$\overline{A \cap B} = \overline{A} \cup \overline{B}$
De Morgan's law
$\overline{A \cup B} = \overline{A} \cap \overline{B}$
A ∪ $\overline{A}$ = U
Complement law
A ∩ $\overline{A}$ = ∅
A ∩ (A ∪ B) = A
Absorption law
A ∪ (A ∩ B) = A

FUNCTIONS

Functions are also called **mappings** or **transformations**.
For example :

- Let ***X*** and ***Y*** be sets. A **function *f*** from ***X*** to ***Y*** assigns each element of ***X*** to exactly one element in ***Y***.
- In ***f* : *X* → *Y***, (i.e. ***f*** maps ***X*** to ***Y***):

  X is called the **domain** of ***f***.

  Y is called the **co-domain** of ***f***.

- n ***f* (*x*) = *y***:

  y is referred to as the **image** of ***x***.

  x is the **pre-image** of ***y***.

Floor function

The **floor function** takes an input ***x*** and outputs the greatest integer less than or equal to ***x***.

For example f(5.5)= [5.5]= 5

Ceiling function

The **ceiling function** takes an input ***x*** and outputs the smallest integer greater than or equal to ***x***.

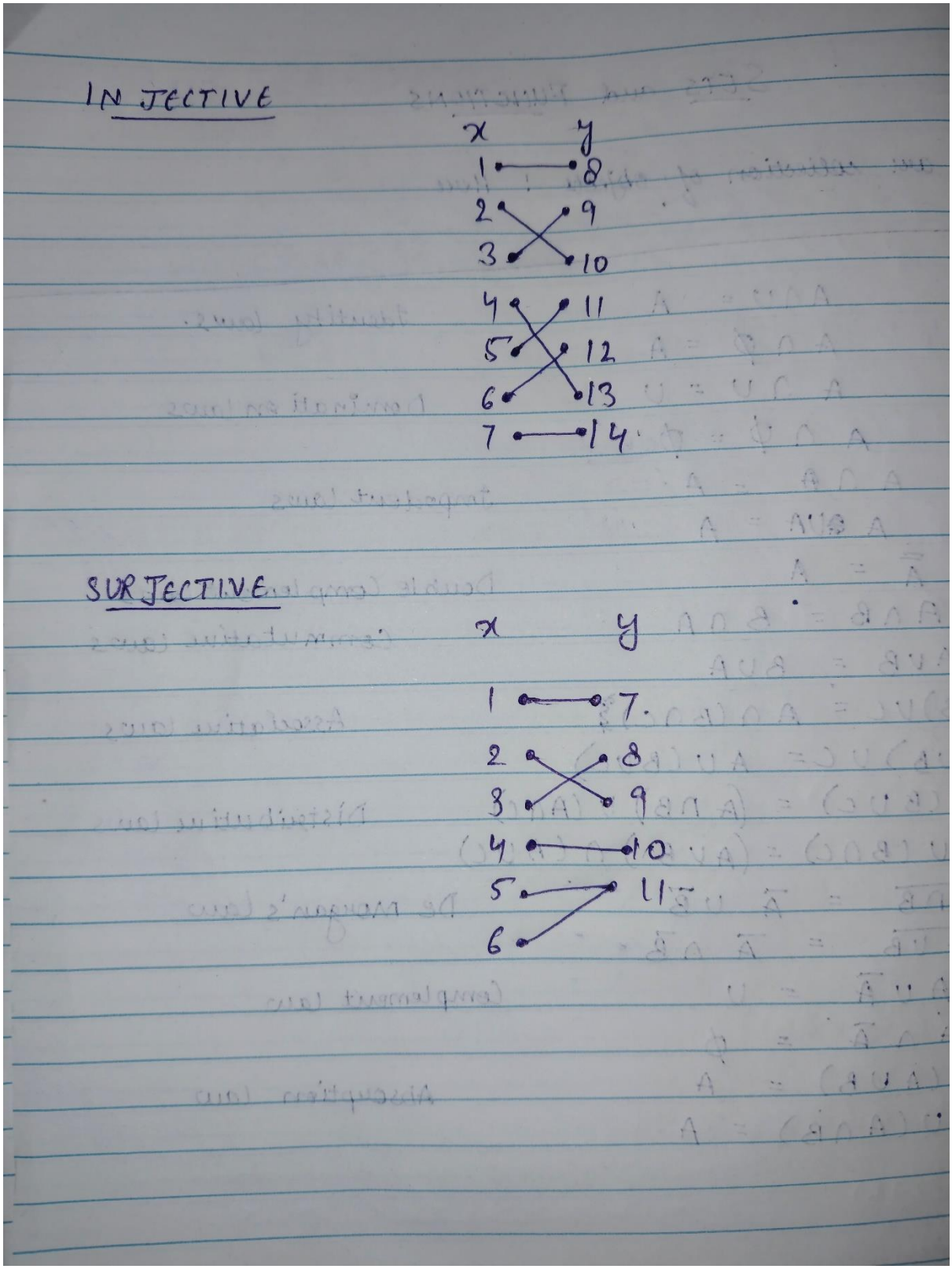
For example f (5.5)= [5.5] = 6

INJECTIVE FUNCTIONS

a function is called an injective function when all the elements in the codomain have at most one pre image in the domain.

SURJECTIVE FUNCTIONS

A function is called a surjective function when all the elements in the codomain have atleast one pre image in the domain.



REFLECTIONS

WHAT IS THE MOST IMPORTANT THING YOU LEARNED FROM THIS MODULE ?

The most important thing I learned from this module was the operation with sets.

HOW IS THIS USEFUL ?

It is useful as it kind of makes segregating the data quite easily.

HOW DOES THIS RELATE TO WHAT YOU ALREADY KNOW ?

This whole task was based on sets and functions and except for one or two new concepts I was already familiar with everything as I studied it in school.

Why do you think your course teams wants you to learn the content of this module ?

I think this module is the basis of discrete mathematics and since this topic works with data. It will be quite useful in future.