2.1 Sets

A set is an unordered collection of objects called elements or members of a set.

A set is said to contain elements

‘a’ E ‘A’ = a is an element of set A

‘a’ E/ ‘A’ = a is not an element of set A

Uppercase letters are used to indicate a set

Lowercase letter are used to indicate elements in a set

**Roster Method:**

All members of the set are indicated between braces

Ex. {a,b,c,d}

Eq. set ‘v’ is of all vowels in the English alphabet

‘V’ = {a,e,I,o,u}

Set ‘O’ of all the odd positive integers less than 10

‘O’ = {1,3,5,7,9}

Set ‘A’ of positive integers less than 100

‘A’ = {1,2,3…, 99}

**Set Builder Notation:**

We characterize all those elements in a set by stating the property or properties they must have to be a member

V = {x | x is a vowel}

O = x | x is an odd positive integer less than 10}

Set of natural numbers ‘N’ = {0,1,2…}

Set of integers ‘Z’ = {… -2, -1, 0, 1, 2…}

Set of positive integer Z^+ = {1, 2, 3…}

Set of rational numbers ‘Q’ = {p/q | p E Z , q E z and q =/ 0}

‘R’ set of real numbers

R^+ set of positive real numbers

‘C’ set of complex numbers

Intervals:

Of real numbers when a and b are real numbers with a <= b

Closed intervals: [a, b] = {x | a <= x <= b} including the endpoints

Open intervals: (a, b) = {x | a < x < b} excluding the endpoints

Def: two sets are equal if and only if they have the same elements

Therefore if A and B are sets then a and b are equal if and only if x (x E A 🡨🡪 x E b)

Empty set is denoted by { } (an empty set… go figure)

Singleton set is denoted by { 0/ }

**Venn diagram:** A graphical representation of a set

In a Venn diagram the universal set ‘U’ which contains all the object under consideration is represented by a rectangle

* Inside the rectangle circle or other geometric shapes are used to represent a set
* Sometimes points are used to represent the particular element of the set.

Note 1. Set ‘s’ is granted to have at least two subsets.

To show that two sets are equal show that a subset b and b subset a

Size of set:

If there are exactly n distinct elements in set s where n is a non negative integer we say that s is a finite set also that ‘n’ is cardinality of ‘S’

Cardinality 🡪 cardinal number as the size of the set

A set is said to be infinite when or if it is not finite

‘S’ empty set and set itself

If a set has n elements then its power set has 2^n elements

**Cartesian Product:**

You want order

The ordered n **tuple** (a1, a2, a3… an) is the ordered collection that has a as it’s first element and a2 as its second element

Tuples are only equal if and only if ai = bi for i = 1, 2, … n

Cartisian product is labeled by A x B

**2.2**

A and B are a set and are denoted A U B and they are a set that contains those elements that are either in A or B or in both

Counting formula |A U B| = |A| + |B| - |A ^U B|

Identity laws

Dominational laws

Idempotent laws

Complementation law

Commutative law

Associative law

Distributive law

De Morgan’s law

Absorption law

Complement laws

Computer representation of sets:

Arbitrary ordering

Assume universal is finite

Arbitrary ordering of U

Represent subset A of u with bit string of length n where the ith bit in this string is 1

If ai belongs to A and is ‘o’ if ai does not belong to A

Eg: U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

All odd numbers {1, 3, 5, 7, 9}

1010101010

Functions:

Def: If A and B are sets a function ‘f’ from A and B is an assignment of exactly one element of B to each element of A

Terminology:

F is a function A to B

F Maps A to B

Range is the set of all images of elements of ‘A’

If f is a function it is 1 to 1 or injunction if f(a) = f(b) 🡪 a = b for all a and b in domain of f

The function that maps between two real numbers is called increasing if f of x is less than of equal to f of y where x is less than y

A function f from A to B then we say it’s on to or subjection if and only if for every A E B there is an element a E A with f(a) = f(b)

Bijection.

Fog =/ gof