Chapter 1: Set Theory

Terminology

Set: A collection or group of distinguishable objects.

Element: An object in a set. (Symbol ∈ - "belongs to"). The number of elements in the set A is denoted by $n(A)$.

Universal Set: A set of all the elements under consideration for a particular context (also called the sample space).

Subset: A set whose elements all belong to another set. (Symbol ⊂)

Complement: All the elements of a universal set that do not belong to a subset of it.

The sum of the number of elements in a set and its complement is equal to the number of elements in the universal set:

$$n(A) + n(A') = n(U)$$

Empty Set: A set with no elements. Notation {} or ∅

Disjoint Sets: Two or more sets having no elements in common.

When two sets A and B are disjoint, $n(A \text{ or } B) = n(A) + n(B)$

*The events that describe disjoint sets are **mutually exclusive**. They are two or more events that cannot occur at the same time.*

A **finite set** is a set with a countable number of elements.

An **infinite set** is a set with an infinite number of elements.

Other Terminology

Natural Numbers = N = 1,2,3,4,5,...
Whole Numbers = W = 0,1,2,3,4,5,...
Integers = I = ...-3,-2,-1,0,1,2,3,...

Prime numbers: divisors are 1 and itself
number has to be larger than 1

NOTE: 1 IS NOT PRIME!....1 IS ODD

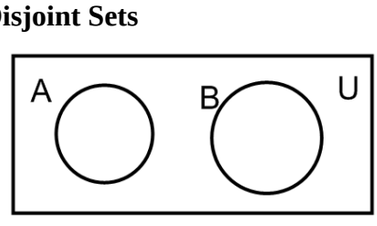
Even Number: divisible by 2
Odd Numbers: Even +1

Know these symbols

Union (or): ∪
intersection (and): ∩
Subse: ⊂
empty set: {} or ∅
not a subset of: ⊄
A only: A\B
B only: B\A
the number in set A: n(A)
Is an element of: ∈

Exploring what different regions of a Venn Diagram Represent

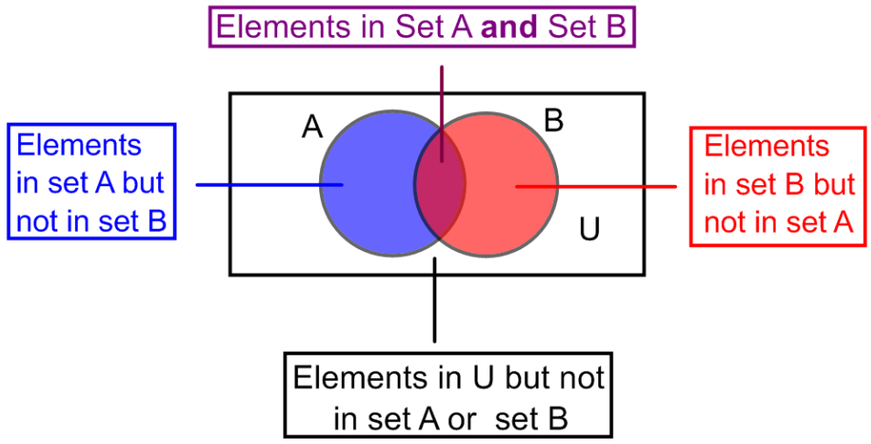
1. Disjoint Sets



A ⊂ U
B ⊂ U
A and B are **disjoint sets** because they do not share common elements.

n(A ∪ B) = n(A) + n(B)

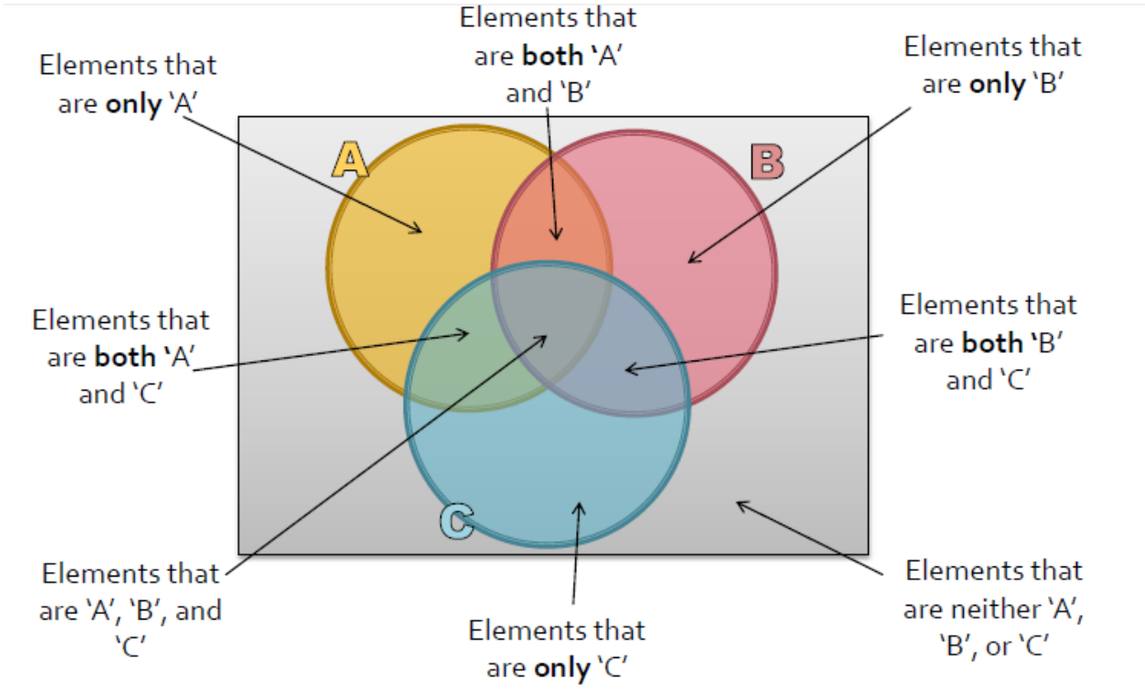
2. Non-Disjoint Sets



To find the number of elements in A or B, you count the elements in each region of the diagram once.

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

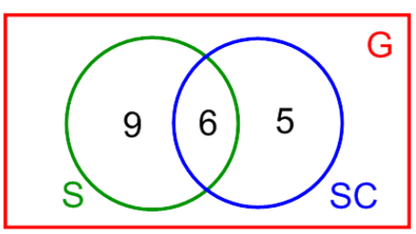
3. Non-Disjoint Sets



$$n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$$

Examples:

1. There are 28 students in a Grade 12 class. The number of students involved in sports and student council are illustrated in the Venn diagram. Use the diagram to answer the following questions:



a) How many students are in both sports and student council?

b) How many students are in sports but not in student council?

c) How many students are in student council but not in sports?

d) How many students are in sports?

e) How many are in student council?

f) How many students are in at least one of sports or student council?

g) How many students are in neither sports nor student council?

2. There are 100 members of a country club. Of these members, 40 play tennis and 47 play golf. There are 25 members that do not play tennis or golf.

a) Determine how many members play both tennis and golf.

b) Determine how many members play tennis only.

c) Determine how many members only play golf.

3. There are 30 students in a class. 16 have iphones, 10 students have an ipad, and 6 students have both. How many students in the class have an iphone or an ipad?

4. Jason asked 100 people if they liked Pepsi or 7-UP.

- 12 people didn't like either drink
- 18 liked both Pepsi and 7-UP
- 25 people liked only 7-UP

Determine how many people liked only Pepsi.

5. There are 36 students who study science. 14 study physics, 18 study chemistry, 24 study Biology, 5 study physics and chemistry, 8 study physics and biology, 10 study biology and chemistry, 3 study all three subjects.

(i) Determine the number of students who study Physics and Biology only.

(ii) Determine the number of students who study at least two subjects.

(iii) Determine the number of students who study biology only.

6. 40 members in a sports club were surveyed:

2 play all three sports	23 play ball hockey
24 play tennis	18 play golf
14 play tennis and ball hockey	8 play tennis and golf

1 member makes the refreshments and does not play any sport

Determine the number of people who play ball hockey and golf.

7. In a survey of 55 people, the following results were recorded:

13 people like Hawaiian pizza
19 people like pepperoni pizza
26 people like cheese pizza
15 people do not like pizza
5 people like Hawaiian pizza and pepperoni pizza, but not cheese pizza
2 people like all types of pizza
2 people like Hawaiian pizza and cheese pizza, but not pepperoni pizza

Determine how many people like only cheese pizza.

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