

0.1 Sets. / Part 1

A **set** is a collection of well-defined objects.

Examples:

- 1) The set of all female students in this lecture.
- 2) The set of all odd numbers between 2 and 8.
- 3) The set of all the digits of the number 2620.

There are two ways to write a set:

- 1) By listing its elements.
- 2) By describing its elements.

Examples:

- 1) The set of all female students in this lecture:
 - listing: $\{ \text{Sondos, Ola, Abir, ..., Suad} \}$
 - Describing: $\{ x : x \text{ is a female student in this lecture} \}$
- 2) The set of all odd numbers between 2 and 8
 - listing: $\{ 3, 5, 7 \}$
 - Describing: $\{ x : x \text{ is odd and } 2 < x < 8 \}$

3) The set of Natural numbers :

→ listing : $\{1, 2, 3, 4, \dots\}$

→ Describing : $\{x : x \text{ is a natural number}\}$

4) The set of all digits of the number 2620

listing : $\{2, 6, 0\}$ or $\{6, 2, 0\}$

Describing : $\{x : x \text{ is a digit of the number 2620}\}$

Note that: 1) Repetition is not allowed التكرار غير مسموح
2) Order is not important. الترتيب غير مهم

* Sets can be classified as:

1) Finite sets : If all of its element can be listed

Example: $A = \{1, 2, 3, 4\}$

$B =$ The set of all odd integers between 3 and 999.
 $= \{3, 5, 7, 9, \dots, 999\}$

2) Infinite sets : If all of its elements can not be listed

$A : \{x : x \text{ is an odd number}\} = \{1, 3, 5, 7, \dots\}$

$B : \{x : x \text{ is a Natural number}\} = \{1, 2, 3, 4, \dots\}$

A set is empty (Null) if it has no elements.

Example:

$$A = \{x : x \text{ is a chinese student in this lecture}\}$$
$$= \{\} = \emptyset$$

Question: Indicate whether the following sets are finite or infinite.

1) $\{x : x \text{ is a natural number less than } 8\}$

$$= \{1, 2, 3, 4, 5, 6, 7\} \rightarrow \text{finite}$$

2) $\{10, 12, 14, \dots\} \rightarrow \text{infinite}$

$$= \{x : x \text{ is an even integer greater or equal } 10\}$$
$$\{x : x \text{ is an even integer and } x \geq 10\}$$

To indicate that an element belong (or not belong) to a set we use the symbols $\in$ (or $\notin$)

Example:

$$\text{If } A = \{3, 4, 11, 12\}$$

$$11 \in A$$

$$7 \notin A$$

$$15 \notin A$$

$$4 \in A$$

Relations between Sets:

1) Two Sets are **equal** if they contain the same numbers.

Ex: $A = \{3, 4, a, b\}$, $B = \{4, b, a, 3\}$

then $A = B$

2) Two sets are **disjoint** if they have no common elements

Ex: If $A = \{1, 2, 3, 9\}$, $B = \{\frac{1}{2}, 4, 8\}$ then
A and B are disjoint.

3) The set A is a **Subset** of the set B if every element of A is an element of B.

Ex: If $A = \{5, 9, 71\}$, $B = \{x: x \text{ is an odd number}\}$

$C = \{1, 2, 3\}$

then $A \subseteq B$ and $C \not\subseteq B$.

Notes: 1) Every set is a subset of its self

$$A \subseteq A , B \subseteq B , C \subseteq C$$

2) The empty set $\emptyset$ is a subset of any set

$$\emptyset \subseteq A , \emptyset \subseteq B , \emptyset \subseteq C$$

Question: If $A = \{0, 1, 2\}$, List all the subsets of A
 $\emptyset, \{0\}, \{1\}, \{2\}, \{0, 1\}, \{0, 2\}, \{1, 2\}, \{0, 1, 2\}$