Lecture -1-

Chapter one:

1-1 Basic set theory

1-1-1 Definitions:

1) **Set:** A set is collection of objects. The objects are called elements or points of the set, The elements may be numbers, Letters, or anything else. A set is usually denoted by a capital letters, e.g. $A, B, C, \dots$ and so forth (وهكذا), while the elements are represented in Small Letters.

If a is a point (element) belonging to the set A, we shall write $a \in A$; If a is not an element of A, we shall write $a \notin A$. [there are two methods for specifying the contents of the set: either by listing its elements or by stating Properties which characterize the elements of the set] بذكر الخصائص التي تميز العناصر

EX: (1)

$A = \{0, 1, 2, 3\}$

and $B = \{x : x$ is a positive integer and $x < 8\}$

Then

$B = \{1, 2, 3, 4, 5, 6, 7\}$

2) **Empty set:** A set is said to be an empty set or the null set if it has no elements, and is denoted by ϕ.

3) **Complement** of the Set A with respect to the space S, denoted by (A', A^c or $\bar{A}$), it is the set of all elements that are in S but not in A i.e.

$A' = \{x : x \in S$ and $x \notin A\}$

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4) **Subset**: The set A is said to be a subset of B if every element of A is also an element of B; this denoted by $A \subset B$ or $B \supset A$; read "A is contained in B" or read "B contains A":
محتواه تحتوي

5) **Universal set** المجموعة الشاملة: The set ~~has~~ which contains all objects that want to study, and denoted by (S, U or Ω). هي مجموعة التي تحتوي جميع الاشياء المراد دراستها

6) **Equal set**: Two sets A and B are said to be equal if every elements in A are contained in B also

$$A \subset B \text{ and } B \subset A \implies A = B$$

فرق المجموعة (المتلاف المجموعة)

7) Set Difference: Let A and B be any two subset of S. The set of all elements in A that are not in B will be denoted by $(A-B)$ or (A/B).

That is mean

$$A-B = \{x : x \in A \text{ and } x \notin B\}$$

$$A' = S - A$$

$$A' = \{x : x \in S \text{ and } x \notin A\}$$

EXP: Let S be the set of all natural numbers.

$S = \{1, 2, 3, \dots\}$

define: $A = \{x : x \text{ is an even number}, x \in S\}$

and $B = \{y : y \text{ is a multiple of } 3, y \in S\}$.

find: A', B', $A-B$, B/A

Sol:

$A = \{2, 4, 6, \dots\}$

$B = \{3, 6, 9, \dots\}$

$A' = \{1, 3, 5, 7, \dots\}$

$B' = \{1, 2, 4, 5, 7, 8, \dots\}$

$A - B = \{2, 4, 8, \dots\}$

$B / A = \{3, 9, 15, \dots\}$

8) Product sets: Let A and B be two sets, Then the Product of A and B is denoted by $A \times B$, is the set of all ordered pairs (X, Y) where $x \in A$ and $y \in B$, i.e.

$$A \times B = \{(x, y) : x \in A \text{ and } y \in B\}$$

* The Product of a set A with itself is denoted by A^2
* The product of n sets, $A_1, A_2, \dots, A_n$ as

$$A_1 \times A_2 \times A_3 \times \dots \times A_n = \{(x_1, x_2, \dots, x_n) : x_i = A_i \text{ for } i = 1, 2, \dots, n\}$$

Exp:

Let $A = \{1, 2, 3\}$, $B = \{4, 5\}$, Then

$$A \times B = \{(1, 4), (1, 5), (2, 4), (2, 5), (3, 4), (3, 5)\}$$

9) union of sets : اتحاد مجموعات

Let A and B be any two subset of S
the union of A and B denoted by $(A \cup B)$,
is the set of all elements belonging
either to A or B or both.

$A \cup B = \{x : x \in A \text{ or } x \in B \text{ or Both}\}$

$x \in A \cup B = x \in A \text{ or } x \in B$ ... (1)

$x \notin A \cup B = x \notin A \text{ and } x \notin B$ ... (2)

10) Intersection of sets:

Let A and B be any two subset of S
the Intersection denoted by $(A \cap B)$ is the
set of all elements that are in both A and B.

$A \cap B = \{x : x \in A \text{ and } x \in B\}$

$x \in A \cap B = x \in A \text{ and } x \in B$ ... (3)

$x \notin A \cap B = x \notin A \text{ or } x \notin B$ ... (4)

متنافية

11) Mutually exclusive: Two sets A and B are
said to be disjoint or mutually exclusive
if have no common element.

$A \cap B = \phi$