Subject – BCA301/E3.1 Mathematics and Statistics for Managers

For BCA and BMS(e-commerce)

Chapter 2 SET

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Sets

A set is an order collection of distinct object or A well define collection of object is called as Set.

Individual object in the set is called as element or member of Set. Sets are denoted by Capital letter. Ex : A, B, C etc.

The element of Set generally denoted by small alphabet.
Ex : a, b, c ... etc.

If x is element of Set X then we write as $x \in X$ & if x is not element of Set X then $x \notin X$, then $\in$ (belongs to) $\notin$ (does not belongs to)

Ex:- If A is a set of the day in a week. Then we write Monday $\in$ A, but January $\notin$ A.

* Types Of Set :-

1) Empty Set / Null Set :-

The Set which does not contain any

element is called Empty Set or Null Set it is denoted by 'ϕ' (phe). In Roster Form phe is denoted by { }. And Empty set is a Finite Set. Since the no. of elements is an empty set are Finite that is Zero (0).

Ex :- 1) The Set of whole no. less than zero.

Ans :- {0}

2) N is equal to Set of $N = \{x : x \in N, 3 < x < 4\}$

Ans :- N = {0}.

* Note :- $\phi = \{0\}$ has no elements zero is a set which has one set zero. the cardinate no of empty set that is $n[\phi] = 0$

2) Finite Set :-

A Set which contain a definite no. of element is called Finite Set. Empty Set is also Finite Set.

Ex :- The Set of all colours of rainbow.

$N = \{x : x \in N, x < 7\}$

$P = \{2, 3, 5, 7, 11, 13, 17, 19 - 97 etc\}$

3) Infinite Set :-

A set whose element cannot be listed that is a set containing element is called as Infinite set.

Ex :- Set of all points in a plane

$A = \{x : x \in N, x > 1\}$

Set of all prime numbers

$B = \{x : x \in W, x = 2n\}$

* Note :- All Infinite Set cannot be express in the Roster Form.

4) Universal Set :-

A set which contain all the element of other even sets is called the Universal set. The symbol for denoting the 'U' or 'ε'

Ex:- 1) If $A = \{1, 2, 3\}$ $B = \{2, 3, 4\}$
$C = \{3, 5, 7\}$ $U = \{1, 2, 3, 4, 5, 7\}$

Here $A \subseteq U$, $B \subseteq U$, $C \subseteq U$, OR
$U \supseteq A$, $U \supseteq B$.

2) If P is set of all whole No.
& Q is set of all negative

no. then the Universal set of all integer.

$P = \{0, 1, 2, 3 \ldots\}$

$Q = \{-1, -2, -3 \ldots\}$

$U = \{\ldots -2, -1, 0, 1, 2 \ldots\}$

5) Equal Sets :—

Two set A & B are said to be equal they contain the same elements every element of A is an element of B & every element of B is an element of A.

Ex :— $A = \{p, q, r, s\}$

$B = \{p, q, r, s\}$

$A = B$

6) Equivalent Sets :—

Two set A & B are said to be equivalent if their cardinate no. is same that is $n(A) = n(B)$

The symbol for denoting equivalent set is $A \leftrightarrow B$

7) Disjoint Set :—

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

$B = \{2, 4, 6, 8\}$

$\Rightarrow A \cap B = \phi$

Conform that both set A & B have a no common elements then we say that set A & B is disjoint set.

8) Compliment Set :—

Let $U = \{x/x$ is N , $x < 11\}$

$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$A = \{2, 5, 7, 9\}$

$A' = U - A = \{1, 3, 4, 6, 8, 10\}$

Observe that set U−A it contains all those elements of U which not or element.

The set U−A is the A'

A be the subset & U be the universal set. The set of all elements in U. which are not in A is called the complement of A or it is denoted by A' or A^c.

Thus $A' = \{x / x \in U, x \notin A\}$

Clearly if $x \notin A'$

Then $x \in A$

* Property Of Complement Set :—

1. $(A')' = A$

2. $U' = \phi$ → The Complement of Set is an empty Set.

3. $\phi' = U$ → The Complement of Empty Set is universal set

4. The set an its complement are disjoint set.

5. If $A \subseteq B$ then $B' \subseteq A'$

*Note :- 1) $A \cap A' = \phi$

2) $A \cup A' = U$

* Operation Of Sets :-

1) Union Set :-

$A = \{1, 2, 3, 4, 5\}$
$B = \{6, 7, 8\}$

$C = \{1, 2, 3, 4, 5, 6, 7, 8\}$

The set C will contain all the elements of set A & B together.

$C = \{1, 2, 3, 4, 5, 6, 7, 8\}$

The set C is the Union of set A & B

* Union Of Two Sets :-

Let A & B be two given sets then the set of all elements which are in set A or in set B is called the Union ~~set~~ of two set & it is denoted by $A \cup B$.

Thus, $A \cup B = \{x / x \in A \text{ or } x \in B\}$

If $y \in A \cup B$ & $y \in A$ or $y \in B$

& if $y \in A \cup B$ & $y \in A$ & $y \in B$

* Properties Of Union Sets :-

1) $A \cup B = B \cup A$ (Commulative ~~set~~ property)

2) $A \cup (B \cup C) = A \cup B \cup C$ (Associative)

3) $A \subset A \cup B$ & $B \subset A \cup B$

4) If $A \subseteq B$ then $A \cup B = B$ & $B \subseteq A$ then $A \cup B$ =

5) $A \cup \phi = A$

6) $A \cup A = A$

* Distribution Property :-

1) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

2) $A \cup (B \cap C) = (A \cup B) \cap (B \cup C)$

* Intersection of Set :-

Let $A = \{2, 4, 6, 8, 10\}$
$B = \{3, 6, 8, 9, 12\}$
Set C containing elements which are common to both set A & set B
$C = \{6, 8\}$

Set C is called Intersection of set A & B.

* Intersection Of Two Sets :-

Let A & B be the two sets The set of all common elements of A & B is called the intersection of A & B & it is denoted by $A \cap B$.

Thus $A \cap B = \{x / x \in A \ \& \ x \in B\}$
if $x \in A \cap B$ thus $x \in A$ & $x \in B$
if $x \notin A \cap B$ thus $x \notin A$ & $x \notin B$

* Property Of Intersection Of Set :-

1) $A \cap B = B \cap A$ (Commutative)

2) $A \cap (B \cap C) = (A \cap B) \cap C$ (Associative)

3) $A \subseteq P$, $B \subseteq P$ then $A \cap B \subseteq P$

4) if $A \subseteq B$ then $A \cap B = A$ if $B \subseteq A$ then $A \cap B = B$

5) $A \cap \phi = \phi$ & $A \cap A = A$

* **Difference Of two Sets :-**

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

$B = \{1, 2, 6, 7\}$

$C = \{3, 4, 5\}$

Consider the sets C contain all the element of ~~A = {1, 2,~~ set A but not in set B.

Set C is called the difference of set A & B & it is denoted by $A - B$ thus $A - B = \{x / x \in A$ & but $x \notin B\}$

* **Properties :-**

1) $A - B \neq B - A$

2) $A - B \subseteq A$

3) If $A \subseteq B$ then $A - B = \phi$

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4) if $A \cap B = \phi$ then $A - B = A$

De Morgan's Law

If A & B are any sets then

1) $(A \cup B)' = A' \cap B'$

2) $(A \cap B)' = A' \cup B'$

Eg $A = \{2, 3, 4, 5\}$
$B = \{1, 2, 5, 6\}$
$U = \{1, 2, 3, 4, 5, 6, 7, 8\}$

Find = A', B', $A \cup B$, $A \cap B$, $(A \cup B)'$, $(A \cap B)'$, $A' \cap B'$, $A' \cup B'$.

Ans. $A' = \{1, 6, 7, 8\}$

$B' = \{3, 4, 7, 8\}$

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

$A \cap B = \{2, 5\}$

$(A \cup B)' = \{7, 8\}$

$(A \cap B)' = \{1, 3, 4, 6, 7, 8\}$

$A' \cup B' = \{1, 3, 4, 6, 7, 8\}$

$A' \cap B' = \{7, 8\}$

* **Venn Diagram :—**

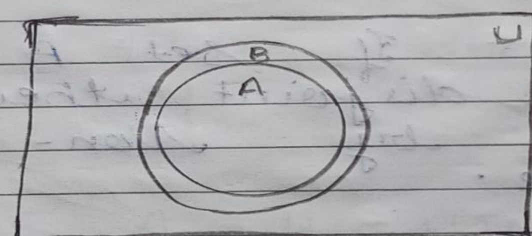
Venn Diagram are useful in solving simple logical problem. Mathematician Venn introduce the concept of representing the set picturical by means of close geometrical figure called Venn Diagram. In Venn Diagram, the Universal set 'U' is represented by rectangle. And all other sets under consideration by circles within the rectangle. Picturical representation of set represented by close figure are called set Diagrams or Venn Diagram. Venn Diagram are used to various operatio like Union, intersection &

difference. We can express the relationship on set through this way or more significant way in this.

A Rectangle is used to represent a Universal set.

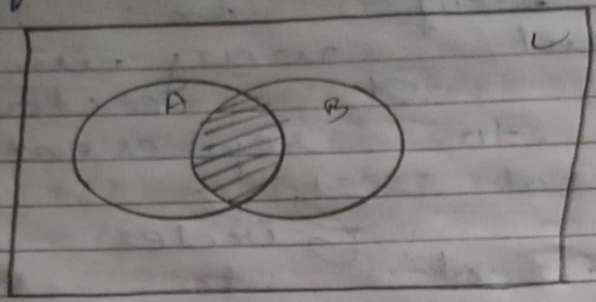
Circles or Ovals are used to represent other subset of Universal set.

Ex:- If set $A \subseteq B$



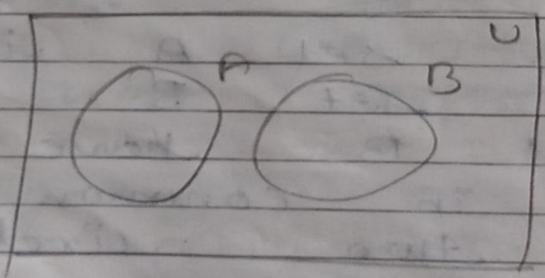
Then the circle representing set A is drawn. A circle representing set A is subset representing set B. If set A & set B have some element in common we draw two circles which are overlapping.

If set A & set · 1



If set A & set B are disjoint they are represent -ed by Non- interrepenting circle.

Observe the foll. set &



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* Observe the foll. set & Ans the foll. ques. below

1) A = set of all residents in Mum.

2) B = set of all residents in Bhopal

3) C = set of all residents in Maharashtra

4) D = set of all residents in India

5) E = set of all residents in M. P

1) Write the subset relation of set A & set B

Ans A is a subset of C

$\therefore A \subseteq C$ / $A \subset C$

2) Write the subset relation between E & Set D.

Ans E is a subset of D

$\therefore E \subset D$

3) Which set can be choosen suitabily as universal set.

Ans Set D.

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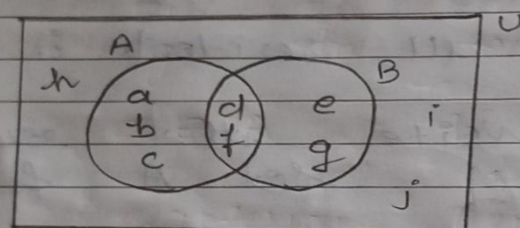
* If $x = \{1, 2, 3\}$ Write all possible subset of x.

Ans $\phi, \{1\}, \{2\}, \{3\}, \{1,2\}, \{1,3\} \{2,3\} \{1,2,3\}$

* Use Venn Diagram & find foll sets :-



a) $A \cup B$
b) $A \cap B$
c) A'
D) $B - A$
e) $(A \cap B)'$
f) $(A \cup B)'$

Ans ~~A∪B~~ = $U = \{a, b, c, d, e, f, g, h, i, j\}$

$A = \{a, b, c, d, f\}$

$B = \{d, f, e, g\}$

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$A \cup B = \{a, b, c, d, e, f, g\}$

$A \cap B = \{d, f\}$

$A' = \{e, g, h, i, j\}$

$B - A = \{e, g\}$

$(A \cap B)' = \{a, b, c, e, g, h, i, j\}$

$(A \cup B)' = \{i, h, j\}$

* Cartesian Product :—

Order Pair :—

An Order pair is the pair of object with an order associated with the If object are represented by x & y. Then we write the order pair as

$\langle x, y \rangle$,

Two order pair $\langle a, b \rangle$ $\langle c, d \rangle$ are equal if & only if $a = c$, $b = d$.

Order pair $\langle 1, 2 \rangle$ is not equal to order pair $\langle 2, 1 \rangle$

The Cartesian product of two sets A & B are the set of all order pairs A, B where the first element of order pair a belongs to first set B. And second element of order pair b belongs to second set B.

$$a \in A \quad , \quad b \in B$$

Note:- Cartesian product of set A & B is not equal to Cartesian product B & A

$$A \times B \neq B \times A$$

Cartesian product of Set A & set B is denoted by $A \times B$ & Cartesian product B & set A is denoted by $B \times A$.

eg:- Set $A = \{1, 2\}$

$B = \{3, 4\}$

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

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

Note :- If m is the no. of element in set A & n is the no. of element in set B. Then no. of element of $A \times B$ & $B \times A$ is $m \times n$.

eg :- Set A have 2 elements
B have 3 elements

The no. of elements that $A \times B$ & $B \times A$ have $3 \times 2 = 6$

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* Methods Of Describing Sets :—

1) Tabular Method :—

Under this method we inverate for list of all elements of the set within brackets. However there is no desinity about this use of even parathesis or brackets ( ) or there is any books.

In the Tabular Method we list all the elements of the set within brases { , } & sepcurate the element by comma. (,)

eg:- 1) A is a set of vowels.

Ans $A = \{a, e, i, o, u\}$

2) A set of all Natural nos.

Ans $N = \{1, 3, 5 \dots\}$

3) A set of Prime Ministers.

Ans P = { Nehru, Indira Gandhi, Modi, Obama }

4) B is a set of all days in a week

Ans B = {Sunday, Monday ----}

2) Set Builder Method / Selecter :-

Under this Method the elements are not listed but are unicated by description of there characteristics. We may state some characteristics which an object must poses in order to be an element in the set.

In the Set Builder Method we describe the element of the set by specifying the property which determines the element of the set uniquely.

Here, we choose the letter x to represent an arbitary element of the set.

eg :- 1) A = {a, e, i, o, u}

Ans A = {x/x is a vowels in Eng. Alphabet}

Ans 2) $N = \{x / x$ is an odd Natural Nos.$\}$

Ans 3) $B = \{x / x$ is a Prime Minister of World$\}$

Ans 4) $A = \{x / x$ is even natural no less than 8$\}$

OR

$A = \{x / x = 2N \ , N < 8\}$

The vertical line ('/') after x should be read as (such that) Sometimes we use ':' to read 'such that'.

eg 1) $A = \{x / x \in N \ \& \ x^2 = 4\}$

Ans $A = \{2\}$ → Single tone.

2) $N = \{x / x \in N \ , \ x < 7\}$

Ans $N = \{1, 2, 3, 4, 5, 6\}$

3) $A = \{x / x \in N \ , \ x > 1\}$

Ans $A = \{$

(44) (45) (54) (55)

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* $B^2 = \{4, 5\}$

→ $B \times B = \{(4,4), (4,5), (5,4), (5,5)\}$

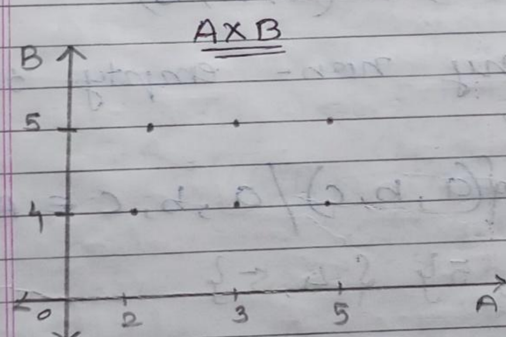
* $A \times B = \{(a,b) \mid a \in A \ \& \ b \in B\}$

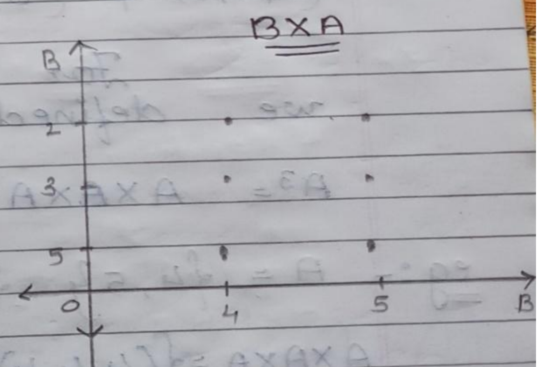
$A = \{2, 3, 5\}$ $B = \{4, 5\}$

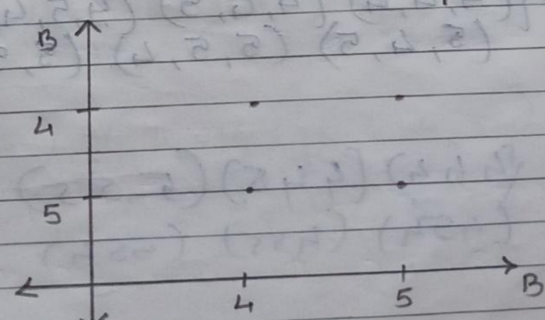
$A \times B = \{(2,4)(2,5)(3,4)(3,5)(5,4)(5,5)\}$

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

$B^2 = B \times B = \{(4,4)(4,5)(5,4)(5,5)\}$







$B \times B = B^2$

Thank You !!