

Activity 1

OBJECTIVE

To find the number of subsets of a given set and verify that if a set has n number of elements, then the total number of subsets is 2^n .

MATERIAL REQUIRED

Paper, different coloured pencils.

METHOD OF CONSTRUCTION

1. Take the empty set (say) A_0 which has no element.
2. Take a set (say) A_1 which has one element (say) a_1 .
3. Take a set (say) A_2 which has two elements (say) a_1 and a_2 .
4. Take a set (say) A_3 which has three elements (say) a_1, a_2 and a_3 .

DEMONSTRATION

1. Represent A_0 as in Fig. 1.1

Here the possible subsets of A_0 is A_0 itself only, represented symbolically by ϕ . The number of subsets of A_0 is $1 = 2^0$.

2. Represent A_1 as in Fig. 1.2. Here the subsets of A_1 are $\phi, \{a_1\}$. The number of subsets of A_1 is $2 = 2^1$

3. Represent A_2 as in Fig. 1.3

Here the subsets of A_2 are $\phi, \{a_1\}, \{a_2\}, \{a_1, a_2\}$. The number of subsets of A_2 is $4 = 2^2$.

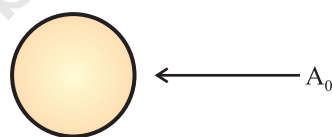


Fig. 1.1

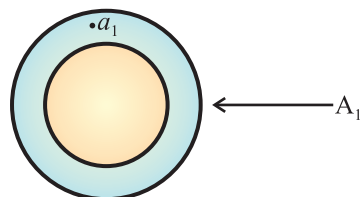


Fig. 1.2

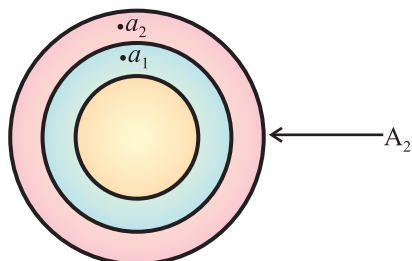


Fig. 1.3

4. Represent A_3 as in Fig. 1.4

Here the subsets of A_3 are ϕ , $\{a_1\}$, $\{a_2\}$, $\{a_3\}$, $\{a_1, a_2\}$, $\{a_2, a_3\}$, $\{a_3, a_1\}$ and $\{a_1, a_2, a_3\}$. The number of subsets of A_3 is $8 = 2^3$.

5. Continuing this way, the number of subsets of set A containing n elements $a_1, a_2, \dots, a_n$ is 2^n .

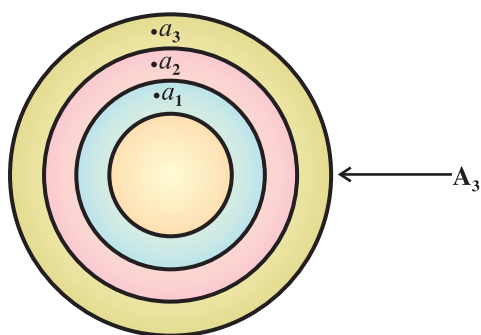


Fig. 1.4

OBSERVATION

1. The number of subsets of A_0 is _____ = 2 ☐
2. The number of subsets of A_1 is _____ = 2 ☐
3. The number of subsets of A_2 is _____ = 2 ☐
4. The number of subsets of A_3 is _____ = 2 ☐
5. The number of subsets of A_{10} is = 2 ☐
6. The number of subsets of A_n is = 2 ☐

APPLICATION

The activity can be used for calculating the number of subsets of a given set.

Activity 3

OBJECTIVE

To represent set theoretic operations using Venn diagrams.

MATERIAL REQUIRED

Hardboard, white thick sheets of paper, pencils, colours, scissors, adhesive.

METHOD OF CONSTRUCTION

1. Cut rectangular strips from a sheet of paper and paste them on a hardboard. Write the symbol U in the left/right top corner of each rectangle.
2. Draw circles A and B inside each of the rectangular strips and shade/colour different portions as shown in Fig. 3.1 to Fig. 3.10.

DEMONSTRATION

1. U denotes the universal set represented by the rectangle.
2. Circles A and B represent the subsets of the universal set U as shown in the figures 3.1 to 3.10.
3. A' denote the complement of the set A , and B' denote the complement of the set B as shown in the Fig. 3.3 and Fig. 3.4.
4. Coloured portion in Fig. 3.1. represents $A \cup B$.

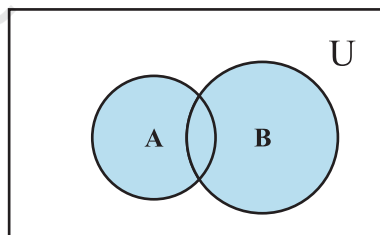


Fig. 3.1

5. Coloured portion in Fig. 3.2. represents $A \cap B$.

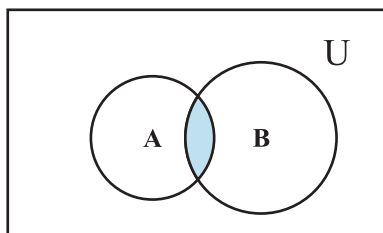


Fig. 3.2

6. Coloured portion in Fig. 3.3 represents A'

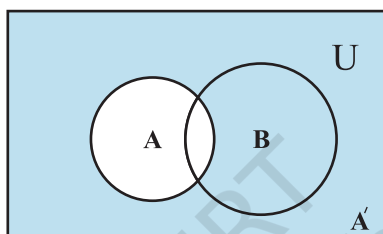


Fig. 3.3

7. Coloured portion in Fig. 3.4 represents B'

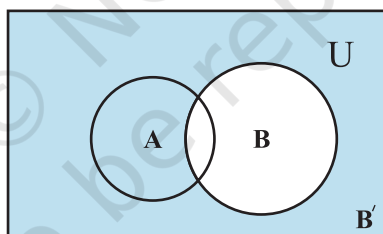


Fig. 3.4

8. Coloured portion in Fig. 3.5 represents $(A \cap B)'$

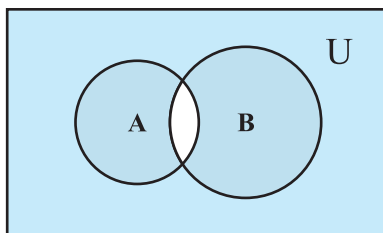


Fig. 3.5

9. Coloured portion in Fig. 3.6 represents $(A \cup B)'$

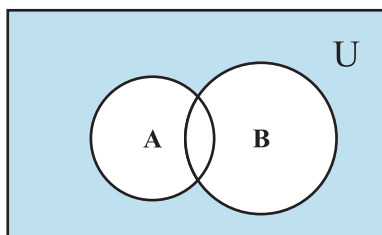


Fig. 3.6

10. Coloured portion in Fig. 3.7 represents $A' \cap B$ which is same as $B - A$.

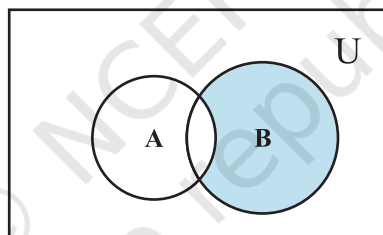


Fig. 3.7

11. Coloured portion in Fig. 3.8 represents $A' \cup B$.

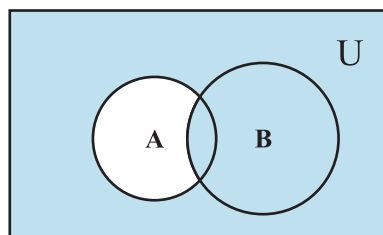


Fig. 3.8

12. Fig. 3.9 shows $A \cap B = \phi$

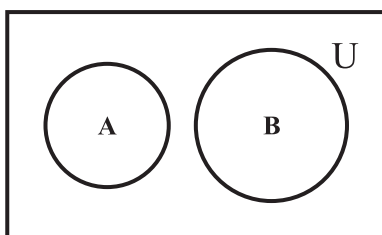


Fig. 3.9

13. Fig. 3.10 shows $A \subset B$

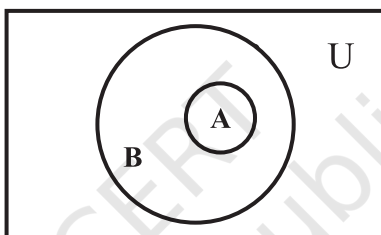


Fig. 3.10

OBSERVATION

1. Coloured portion in Fig. 3.1, represents _____
2. Coloured portion in Fig. 3.2, represents _____
3. Coloured portion in Fig. 3.3, represents _____
4. Coloured portion in Fig. 3.4, represents _____
5. Coloured portion in Fig. 3.5, represents _____
6. Coloured portion in Fig. 3.6, represents _____
7. Coloured portion in Fig. 3.7, represents _____
8. Coloured portion in Fig. 3.8, represents _____
9. Fig. 3.9, shows that $(A \cap B) =$ _____
10. Fig. 3.10, represents A _____ B .

APPLICATION

Set theoretic representation of Venn diagrams are used in Logic and Mathematics.

Activity 4

OBJECTIVE

To verify distributive law for three given non-empty sets A, B and C, that is, $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

MATERIAL REQUIRED

Hardboard, white thick sheets of paper, pencil, colours, scissors, adhesive.

METHOD OF CONSTRUCTION

1. Cut five rectangular strips from a sheet of paper and paste them on the hardboard in such a way that three of the rectangles are in horizontal line and two of the remaining rectangles are also placed horizontally in a line just below the above three rectangles. Write the symbol U in the left/right top corner of each rectangle as shown in Fig. 4.1, Fig. 4.2, Fig. 4.3, Fig. 4.4 and Fig. 4.5.
2. Draw three circles and mark them as A, B and C in each of the five rectangles as shown in the figures.
3. Colour/shade the portions as shown in the figures.

DEMONSTRATION

1. U denotes the universal set represented by the rectangle in each figure.
2. Circles A, B and C represent the subsets of the universal set U.

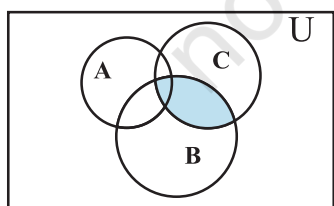


Fig. 4.1

$B \cap C$

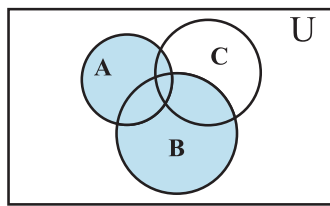


Fig. 4.2

$A \cap B$

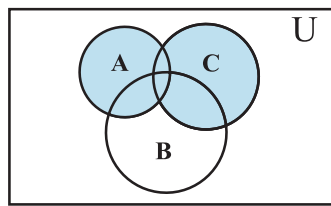


Fig. 4.3

$A \cap C$

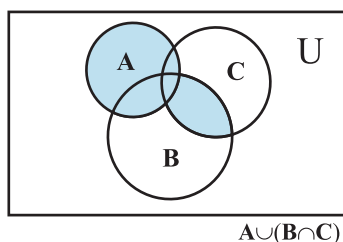


Fig. 4.4

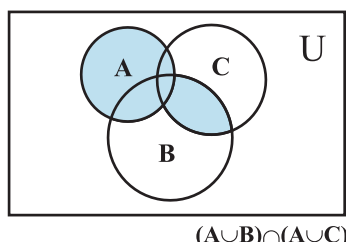


Fig. 4.5

3. In Fig. 4.1, coloured/shaded portion represents $B \cap C$, coloured portions in Fig. 4.2 represents $A \cup B$, Fig. 4.3 represents $A \cup C$, Fig. 4.4 represents $A \cup (B \cap C)$ and coloured portion in Fig. 4.5 represents $(A \cup B) \cap (A \cup C)$.

OBSERVATION

1. Coloured portion in Fig. 4.1 represents _____.
2. Coloured portion in Fig. 4.2, represents _____.
3. Coloured portion in Fig. 4.3, represents _____.
4. Coloured portion in Fig. 4.4, represents _____.
5. Coloured portion in Fig. 4.5, represents _____.
6. The common coloured portions in Fig. 4.4 and Fig. 4.5 are _____.
7. $A \cup (B \cap C) =$ _____.

Thus, the distributive law is verified.

APPLICATION

Distributivity property of set operations is used in the simplification of problems involving set operations.

NOTE

In the same way, the other distributive law

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ can also be verified.