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Set Theory (Miscellaneous Exercise)

Q.14 In a group of students, 100 students know Hindi, 50 know English and 25 know both. Each of the students knows either Hindi or English, how many students are there in the group?

Soln Let H and E denote the students who know Hindi and English respectively.

Given,  $n(H) = 100$ ,  $n(E) = 50$  and  $n(H \cap E) = 25$

By formula,  $n(H \cup E) = n(H) + n(E) - n(H \cap E)$

$$= 100 + 50 - 25 = 150 - 25 = 125 \text{ Ans.}$$

Q.15 In a survey it was found that 21 people liked product A, 26 liked product B and 29 liked product C. If 14 people liked products A and B, 12 people liked products C and A, 14 people liked products B and C and 8 liked all the three products. find how many liked product C only?

Soln Let A, B and C denote the people liked the products A, B and C, respectively. Here,  $n(A) = 21$ ,  $n(B) = 26$ ,  $n(C) = 29$ .

$$n(A \cap B) = 14, n(C \cap A) = 12, n(B \cap C) = 14, n(A \cap B \cap C) = 8$$

$$n(C \text{ only}) = n(C) - n(C \cap A) - n(C \cap B) + n(A \cap B \cap C)$$
$$= 29 - 12 - 14 + 8 = 39 - 26 = 11 \text{ Ans.}$$

Q.16 If  $y = \sum x$ :  $x$  is possible factor of the number  $2^p - 1$  ( $2^p - 1$ ), where  $2^p - 1$  is a prime number. Write  $y$  in the Roster form.

Soln  $y = 1, 2, 2^2, 2^3, 2^4, \dots, 2^{p-1}, 2^p - 1$

Ans.



Q.17. In a survey of 60 people, it was found that 25 people read newspaper H, 26 read newspaper T, 26 read newspaper I, 9 read both H and I, 11 read both H and T, 8 read both T and I, 3 read all three newspapers. Find.

- (i) the number of people who read at least one of the newspapers.
- (ii) the number of people who read exactly one newspaper.

Soln: Let H, T and I denote the people who read the newspaper H, T and I, respectively.

$$\begin{aligned} \text{Here, } n(H) &= 25, n(T) = 26, n(I) = 26 \\ n(H \cap I) &= 9, n(H \cap T) = 11, n(T \cap I) = 8 \\ n(H \cap T \cap I) &= 3. \end{aligned}$$

(i) Number of people who read at least one newspaper

$$\begin{aligned} &= n(H \cup T \cup I) \\ &= n(H) + n(T) + n(I) - n(H \cap T) - n(T \cap I) \\ &\quad - n(H \cap I) + n(H \cap T \cap I) \\ &= 25 + 26 + 26 - 11 - 8 - 9 + 3 \\ &= 77 - 28 + 3 = 80 - 28 = 52 \text{ Ans} \end{aligned}$$

(ii) Number of people who read exactly one newspaper.

$$\begin{aligned} &= n(H \text{ only}) + n(T \text{ only}) + n(I \text{ only}) \\ &= n(H) - n(H \cap T) - n(H \cap I) + n(H \cap T \cap I) \\ &\quad + n(T) - n(T \cap H) - n(T \cap I) + n(H \cap T \cap I) \\ &\quad + n(I) - n(I \cap H) - n(I \cap T) + n(H \cap T \cap I) \\ &= n(H) + n(T) + n(I) \\ &\quad - 2[n(H \cap I) + n(H \cap T) + n(T \cap I)] + 3n(H \cap T \cap I) \\ &= 25 + 26 + 26 - 2[9 + 11 + 8] + 3 \times 3 \\ &= 77 - 2 \times 28 + 9 = 86 - 56 = 30 \text{ Ans} \end{aligned}$$