	SETS ***Class XI***
Q.1)	There are 200 individuals with skin disorder, 120 has exposed to chemical C_1, 50 to C_2 and 30 to both $C_1 and\ C_2$. Find the number of individuals exposed to (i) C_1 but not C_2 (ii) C_2 but not C_1 (iii) C_1 or C_2 (iv) neither C_1 nor C_2.
Sol.1)	Given, n$(C_1) = 120$ = n$(C_2) = 50$ = n$(C_1 \cap C_2) = 30$ and n$(\cup) = 200$ (i)n$(C_1 \cap C_2) = n(C_1) -$ n$(C_1 \cap C_2)$ $= \ 120 - 30 = 90$ ∴ 90 persons exposed to chemical C_1 but not C_2. (ii) n$(C_2 \cap C_1) =$ n$(C_2) -$ n$(C_1 \cap C_2)$ $= \ 50 - 30 = 120$ ∴ 20 persons exposed to chemical C_2 but not C_1 (iii) n$(C_1 \cup C_2) = n(C_1) + n(C_2) -$ n$(C_1 \cap C_2)$ $= 120 + 50 - 30 = 140$ ∴ 140 persons exposed to chemical C_1 or C_2. (iv) n$(C_1 \cap C_2) =$ n$(\cup) - n$ n$(C_1 \cup C_2)$ $= \ 200 - 140 = 60$ ∴ 60 persons exposed to chemical C_1 nor C_2.
Q.2)	In a class of 35 students 17 have taken mathematics, 10 have taken mathematics but not economics. Find the number of students who have taken economics but not n mathematics, if it is given that each student has taken either maths or economics or both.
Sol.2)	Let A → set of students taken mathematics B→ set of students taken economics Given, $n(A \cup B) = 35$ $n(A) = 17$ $n(A \cap B^1) = 10$ Now, $n(A \cap B^1) = n(A) - n(A \cap B)$ $\Rightarrow 10 = 17 - n(A \cap B)$ $\Rightarrow n(A \cap B) = 7$ Now, $n(A \cup B) = \ n(A) + n(B) - n(A \cap B)$ $\Rightarrow 35 = 17 + n(B) - 7$ $\Rightarrow 35 = 10 + n(B)$ $\Rightarrow n(B) = 25$ Now, $n(B \cap A) = \ n(B) - n(A \cap B)$ $n(B \cap A^1) = \ 25 - 7 = 18$ ∴ 18 students have taken economics but not mathematics. Ans.
Q.3)	A market research group conducted a survey of 2000 consumers and reported that 1720 consumers liked product P_1 and 1450 consumers liked product P_2. What is the least number that must have liked both the products?
Sol.3)	Let A → set of consumers who liked product P_1 B→ set of consumers who liked product P_2 Given, $n(\cup) = 2000$ $n(A) = 1720$ $n(B) = 1450$

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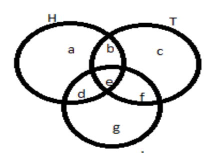
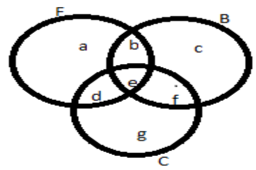
	We have, $n(A \cup B) \leq n(\cup)$ $\Rightarrow n(A) + n(B) - n(A \cap B) \leq n(\cup)$ $\Rightarrow 1720 + 1450 - n(A \cap B) \leq 2000$ $\Rightarrow 3170 - 2000 \leq n(A \cap B)$ $\Rightarrow 1170 \leq n(A \cap B)$ OR $n(A \cap B) \geq 1170$ $\therefore$ the least number of $n(A \cap B)$ is 1170 ans.
Q.4)	A survey shows that 63% of the Americans like cheese whereas 76% like apples. If x% of the Americans like both cheese & apples, find the value of x.
Sol.4)	Let A → set of Americans who like cheese B→ set of Americans who like Apples Let the population of America is 100 i.e., $n(\cup) = 100$ $\therefore n(A) = 63$, $n(B) = 76$ and $n(A \cap B) = x$ We have, $n(A \cup B) \leq n(\cup)$ $\Rightarrow n(A) + n(B) - n(A \cap B) \leq n(\cup)$ $\Rightarrow 63 + 76 - x \leq 100$ $\Rightarrow 139 - x \leq 100$ $\Rightarrow -x \leq -39$ $\Rightarrow x \geq 39$ ……… $(multiply\ by - ve\ \&\ sign\ change)$ $\therefore x \geq 39$ ………. (1) Now, $n(A \cap B) \leq n(A)$ also $n(A \cap B) \leq n(B)$ $\Rightarrow x \leq 63$ and $x \leq 76$ $\Rightarrow x \leq 63$ …….. (2) ……….. $\{\because$ a number less than 63 also less than 76$\}$ From (1) and (2), $39 \leq x \leq 63$ ans.
Q.5)	In a town of 10,000 families, it was found that 40% families buy newspaper H, 20% families buy newspaper T, 10% families buy newspaper I, 5% buy H & T, 3% buy T & I and 4% buy H & I. If 2% buy all the here newspapers, find the numbers of families which buy: (i) Exactly 1 newspaper, (ii) Exactly 2 newspapers, (iii) At least newspaper, (iv) Only newspaper H, (v) Only newspaper I, (vi) H & T but not I, (vii) None of the newspaper.
Sol.5)	Given, $n(\cup) = 10000$ $n(H) = 40\%\ of\ 10000 = 4000 = a + b + e + d$ $n(T) = 20\%\ of\ 10000 = 2000 = b + c + e + f$ $n(I) = 10\%\ of\ 10000 = 1000 = d + e + f + g$ $n(H \cap T) = 5\%\ of\ 10000 = 500 = b + e$ $n(T \cap I) = 3\%\ of\ 10000 = 300 = e + f$ $n(H \cap I) = 4\%\ of\ 10000 = 400 = d + e$ $n(H \cap T \cap I) = 2\%\ of\ 10000 = 200 = e$  venn diagram Solving above seven equation we get, $e = 200, d = 200, f = 100, b = 300, g = 500, c = 1400, a = 3300$ (i) Exactly one newspaper = $a + c + g$ = $3300 + 1400 + 500 = 600$ (ii) Exactly two newspaper = $b + d + f$ = $300 + 200 + 100 = 600$ (iii) At least one newspaper = $a + b + c + d + e + f + g$ = $3300 + 300 + 1400 + 200 + 200 + 100 + 500 = 6000$ (iv) Only newspaper $H = a = 3300$ (v) Only newspaper $T = c = 1400$

	(vi) H and T but not $I = (b+e) - e = b$ $= 300$ (vii) None of the newspaper $= 10000 - (at\ least\ one)$ $= 10000 - 6000 = 4000$ ans.
Q.6)	A college awarded 38 medals in football, 15 in Basketball and 20 in Cricket. If these medals went to a total of a 58 men and only three men got medals in all the three sports, how many received medals in exactly two of the three sports?
Sol.6)	Given, $n(F \cup B \cup C) = 58$ $n(F) = 38$ $n(B) = 15$ $n(C) = 20$ $n(F \cap B \cap C) = 3(also\ e)$  We have, $n(F \cup B \cup C) = n(F) + n(B) + n(C) - n(F \cap B) - n(B \cap C) - n(F \cap C) + n(F \cap B \cap C)$ $\Rightarrow 58 = 38 + 15 + 20 - n(F \cap B) - n(B \cap C) - n(F \cap C) + 3$ $\Rightarrow 58 = 76 - n(F \cap B) - n(B \cap C) - n(F \cap C)$ $\Rightarrow n(F \cap B) + n(B \cap C) + - n(F \cap C) = 18$ $\Rightarrow (b+e) + (e+f) + (d+e) = 18$ $\Rightarrow b + d + f + 3e = 18$ $\Rightarrow b + d + f + 3(3) = 18$ .... $\{\because e = n(F \cap B \cap C) = 3\}$ $\Rightarrow b + d + r = 18 - 9 = 9$ $\therefore$ 9 man received medals in exactly two of the three sports.
Q.7)	A survey of 500 television viewers produced the following information: 285 watch football, 195 watch hockey, 115 watch basketball, 45 watch football & basketball, 70 watch football & hockey, 50 watch hockey & basketball, 50 do not watch any of the three games. How many watch all the three games? How many watch exactly one of the three games? How many watch exactly two the three games?
Sol.7)	Given, $n(\cup) = 500$ universal $n(F) = 285 = a + b + e + d$ $n(H) = 195 = b + c + e + f$ $n(B) = 115 = d + e + f + g$ $n(F \cap B) = 45 = d + e$ $n(F \cap H) = 70 = b + e$ $n(H \cap B) = 50 = e + f$ $n(F^1 \cap B^1 \cap H^1) = 50$ We have, $n(F^1 \cap B^1 \cap H^1) = n(\cup) - n(F \cup B \cup H)$ $(none) = (universal) - (at\ least\ one)$ $\Rightarrow 50 = 500 - n(F \cup B \cup H)$ $\Rightarrow n(F \cup B \cup H) = 450$ Now, $n(F \cup B \cup H) = n(F) + n(B) + n(H) - n(F \cap B) - n(B \cap H) - n(F \cap H) + n(F \cap B \cap H)$ $\Rightarrow 450 = 285 + 195 + 115 - 45 - 50 - 70 + n(F \cap B \cap H)$ $\Rightarrow 450 = 430 + n(F \cap B \cap H)$ $\Rightarrow n(F \cap B \cap H) = 20$ i.e., $e = 20$ $\therefore f = 30, b = 50, d = 25, g = 40, c = 95, a = 190$ 20 percent watch all the three games Exactly one of the games $= a + c + g$

	$= 190 + 95 + 40 = 325$ Exactly two of the games $= b + d + f$ $= 50 + 25 + 30 = 105$ ans.
Q.8)	Show that $A \cup B = A \cap B \Rightarrow A = B$.
Sol.8)	Given, $A \cup B = A \cap B$ To prove: $A = B$ Let $x \in A$ $\Rightarrow x \in (A \cup B)$ $\Rightarrow x \in (A \cap B)$ .... $\{given\ A \cup B = A \cap B\}$ $\Rightarrow x \in A\ and\ x \in B$ $\Rightarrow A \subset B$ .... (1) Let $y \in B$ $\Rightarrow y \in (A \cup B)$ $\Rightarrow y \in (A \cap B)$ .... $\{given\ A \cup B = A \cap B\}$ $\Rightarrow y \in A\ and\ y \in B$ $\Rightarrow B \subset A$ .... (2) From (1) and (2), $A = B$ (proved)
Q.9)	Show that $P(A \cap B) = P(A) \cap P(B)$
Sol.9)	Let $X \in P(A \cap B)$ $\Rightarrow X \subset (A \cup B)$ $\Rightarrow X \subset A\ and\ X \subset B$ $\Rightarrow X \in P(A)\ and\ X \in P(B)$ $\Rightarrow X \in P(A) \cap P(B)$ $\Rightarrow P(A \cap B) \subset P(A) \cap P(B)$ .... (1) Let $Y \in P(A) \cap P(B)$ $\Rightarrow Y \in P(A)\ and\ Y \in P(B)$ $\Rightarrow Y \subset A\ and\ Y \subset B$ $\Rightarrow Y \subset (A \cap B)$ $\Rightarrow Y \subset P(A \cap B)$ $\Rightarrow P(A) \cap P(B) \subset P(A \cap B)$ .... (2) From (1) and (2), $P(A \cap B) = P(A) \cap P(B)$ (proved)
Q.10)	Assume that, $P(A) = P(B)$. Show that, $A = B$.
Sol.10)	Given, $P(A) = P(B)$ To prove: $A = B$ Let $x \in A$ $\Rightarrow x \subset A$ $\Rightarrow x \in P(A)$ $\Rightarrow x \in P(B)$ .... $\{given\ P(A) = P(B)\}$ $\Rightarrow x \subset B$ $\Rightarrow x \in B$ $\Rightarrow A \subset B$ .... (1) Let, $y \in B$ $\Rightarrow y \subset B$ $\Rightarrow y \in P(B)$ $\Rightarrow y \in P(A)$ .... $\{given\ P(A) = P(B)\}$ $\Rightarrow y \subset A$ $\Rightarrow y \in A$ $\Rightarrow B \subset A$ .... (2)

	From (1) and (2), $A = B$ (proved)	