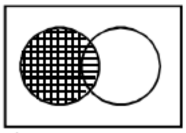
$\therefore A - B = B' - A'$ ...(ii)

Clearly (a) is not correct. Also from (i) (c) is not correct.

Next let $x \in A - (A - B)$



$\Leftrightarrow x \in A$ and $x \notin A - B$

$\Leftrightarrow x \in A$ and $[x \notin A$ or $x \in B]$

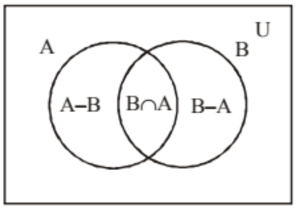
$A - (A - B) = A \cap B$

$\Leftrightarrow [x \in A$ and $x \notin A]$ or $[x \in A$ and $x \in B]$

$\therefore A - (A - B) = \phi \cup (A \cap B) = A \cap B$

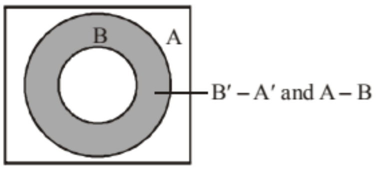
$\therefore$ (b) is also incorrect

The result (d) is correct as can be seen in the following Venn diagram



$A \cup B = (A - B) \cup (A \cap B) \cup (B - A)$

13. (a)



14. (d) Let P = set of families buying A,
Q = set of families buying B
and R = set of families buying C.

$\therefore n(P) = 40\%$ of $10,000 = 4,000$, similarly

$n(Q) = 2,000$, $n(R) = 1,000$

$n(P \cap Q) = 500$, $n(Q \cap R) = 300$

$n(P \cap R) = 400$ and $n(P \cap Q \cap R) = 200$

(i) Number of families buying only $A = n(P \cap Q' \cap R')$

$= n(P \cap (Q \cup R)') = n(P) - n(P \cap (Q \cup R))$

$= n(P) - [n(P \cap Q) + n(P \cap R) - n((P \cap Q) \bigcap (P \cap R))]$

$= n(P) - n(P \cap Q) - n(P \cap R) + n(P \cap Q \cap R)$.

$= 4,000 - 500 - 400 + 200 = 3,300$.

(ii) Number of families buying only B

$= n(Q) - n(P \cap Q) - n(Q \cap R) + n(P \cap Q \cap R)$

[see (i)]

$= 2,000 - 500 - 300 + 200 = 1,400$.

(iii) Number of families buying none of A, B and $C = n(P' \cap Q' \cap R') = n(P' \cap (Q \cup R)')$

$= n\{(P \cup (Q \cup R))'\} = 10000 - n(P \cup Q \cup R)$

$= 10,000 - [n(P) + n(Q) + n(R) - n(P \cap Q)$

$- n(Q \cap R) - n(P \cap R) + n(P \cap Q \cap R)]$

$= 10,000 - [4,000 + 2,000 + 1,000 - 500 - 300 - 400 + 200]$

$= 10,000 - 6,000 = 4,000$.

Note : For sets A, B, we have

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

and $(A \cap B) \cap (A \cap B') = A \cap (B \cap B') = A \cap \phi = \phi$

$\therefore n(A) = n(A \cap B) + n(A \cap B')$ or $n(A \cap B')$

$= n(A) - n(A \cap B)$

Replacing A by P and B by $Q \cup R$, we have

$n(P \cap (Q \cup R)') = n(P) - n(P \cap (Q \cup R))$ *etc.*

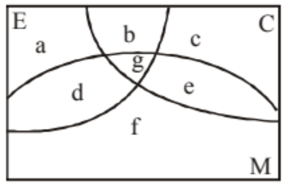
Hence all options are correct.

15. (a) Minimum value of $n = 100 - (30 + 20 + 25 + 15)$
$= 100 - 90 = 10$

16. (c) $n(A' \cap B') = n(A \cup B)' = n(U) - n(A \cup B)$
$= n(U) - [n(A) + n(B) - n(A \cap B)]$
$= 700 - [200 + 300 - 100] = 300$

17. (d) Here first statement is true wheareas the second statement is false.

18. (b) C stands for set of students taking economics



$a + b + c + d + e + f + g = 40$; $a + b + d + g = 16$

$b + c + e + g = 22$; $d + e + f + g = 26$

$b + g = 5$; $e + g = 14$; $g = 2$

Go by backward substitution

$e = 12, b = 3, d + f = 12, c + e = 17 \Rightarrow c = 5$;

$a + d = 11$

$a + d + f = 18 \Rightarrow f = 7 \quad \therefore d = 12 - 7 = 5$

19. (c) Numbers which are divisible by 5 are 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80 they are 16 in numbers. Now, Numbers which are divisible by 7 are 7, 14, 21, 28, 35, 42, 49, 56, 63, 70, 77 they are 11 in numbers.

Also, total odd numbers = 40

Let C represents the students who opt. for cricket, F for football and H for hockey.

$\therefore$ we have $n(C) = 40$, $n(F) = 16$, $n(H) = 11$

Now, $C \cap F$ = Odd numbers which are divisible by 5.

$C \cap H$ = Odd numbers which are divisible by 7.

$F \cap H$ = Numbers which are divisible by both 5 and 7.

$n(C \cap F)$, 8, $n(C \cap H) = 6$,

$n(F \cap H) = 2$, $n(C \cap F \cap H) = 1$

We Know

$n(C \cup F \cup H) = n(C) + n(F) + n(H)$

$- n(C \cap F) - n(C \cap H)$

$- n(F \cap H) + n(C \cap H \cap F)$

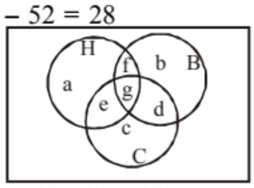
$n(C \cup F \cup H) = 67 - 16 + 1 = 52$

$\therefore n(C' \cap F' \cap H')$

= Total students $- n(C \cup F \cup H)$

$n(C' \cap F' \cap H') = 80 - 52 = 28$

20. (c) $a + e + f + g = 23$



$b + d + f + g = 15$

$c + d + e + g = 20$

$f + g = 7$; $d + g = 5$

$e + g = 4$

$a + b + c + d + e + f + g = 60 - 15 = 45$

By substitutions,

$a + e = 16$, $b + d = 8$, $b + f = 10$, $c + e = 15$, $c + d = 16$

Also, $b + c + d = 22$

$a + c + e = 30$, $a + b + f = 25$