Homework

Date: 2080/08/27

Exercise 1(B)

1. In a city of 50000 population, 20000 read The Rising Nepal, 25000 read The Kathmandu Post, 30000 read The Annapurna Post, 10000 none of these papers, 5000 read The Rising Nepal and The Kathmandu Post, 15000 read The Rising Nepal and the Annapurna Post and the 20000 read The Kathmandu Post and The Annapurna Post. Find

a) The number of readers reading all newspaper.

b) The number of readers reading The Rising Nepal only.

c) The number of readers reading The Kathmandu Post only.

d) The number of readers reading The Kathmandu post and The Annapurna Post only.

Solution

Let the set of people who read The Rising Nepal be R, The Kathmandu Post be K, The Annapurna Post be A and all three be $R \cap K \cap A$.

Then, the above information can be written as:

$n(U) = 50000$

$n(R) = 20000$

$n(K) = 25000$

$n(A) = 30000$

$n(\overline{R \cup K \cup A}) = 10000$

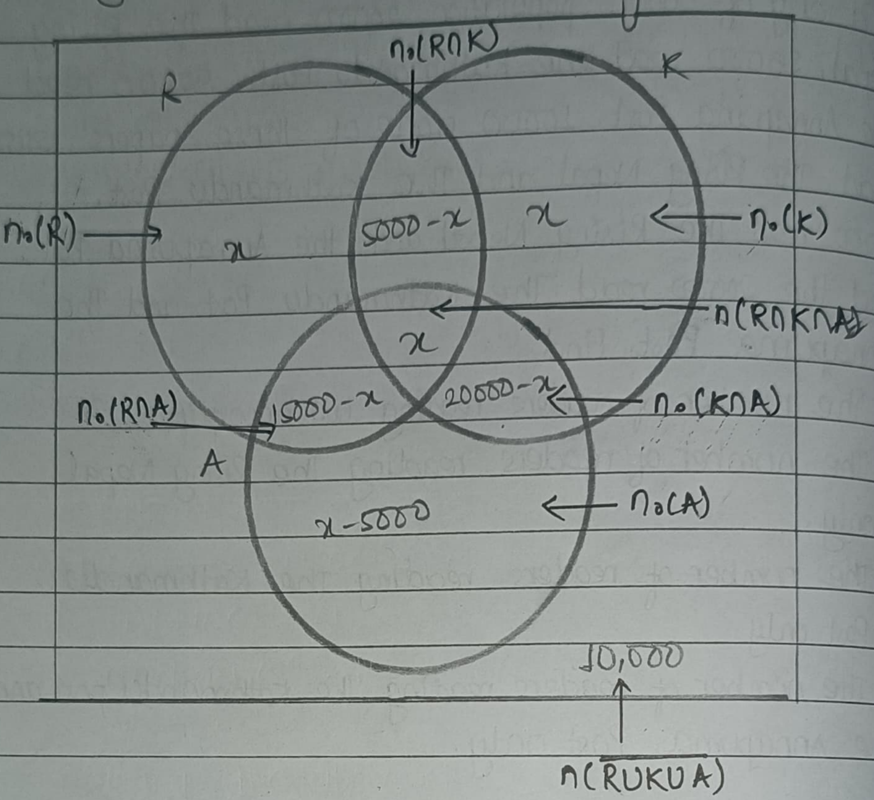
$n(R \cap K) = 5000$

$n(R \cap A) = 15000$

$n(K \cap A) = 20000$

Let $n(R \cap K \cap A) = x$

Showing the information in venn-diagram.



From the venn-diagram,

~~$n_o(R) = n(R) - n_o(R \cap K)$~~

$n_o(R) = 20000 - 5000 + x - x - 15000 + x$

$= x$

Also,

$n_o(K) = 25000 - 5000 + x - x - 20000 + x$

$= x$

Likewise,

$n_o(A) = 30000 - 15000 + x - x - 20000 + x$

$= x - 5000$

From the venn-diagram

$n(U) = \cancel{x} + 5000 - \cancel{x} + \cancel{x} + \cancel{x} + 15000 - \cancel{x} + 20000 - \cancel{x} + x - 5000 + 10000$

or, $50000 = x + 45000$

$\therefore x = 5000$

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a) The number of readers reading all newspaper $= n(R \cap K \cap A)$
$= x$
$= 5000$

b) The number of readers reading The Rising Nepal only $= n_o(R)$
$= x$
$= 5000$

c) The number of readers reading The Kathmandu Post only $= n_o(K)$
$= x$
$= 5000$

d) The number of readers reading The Kathmandu post and The Annapur Post only $= n_o(K \cap A)$
$= 20000 - x$
$= 20000 - 5000$
$= 15000$

2. In a class of 60 students, 23 play Hockey, 15 play basketball, and 20 play cricket, 7 play Hockey and basketball, ~~5 p~~ 5 play cricket & Basketball, 4 play hockey and cricket and 15 ~~do~~ students do not play any of these games. Find
a) How many play Hockey, Baseball & Cricket?
b) How many ~~to~~ play Hockey, but not cricket.
c) How many play hockey & cricket but not Basketball?

Solution

Let the set of students who play Hockey be H, Basketball be B, Cricket be C and all three be $H \cap B \cap C$.

Then, the above information can be written as:

$n(U) = 60$

$n(H) = \cancel{15}\ 23$

$\cancel{n(C)} = n(B) = 15$

$n(C) = 20$

$n(H \cap B) = 7$

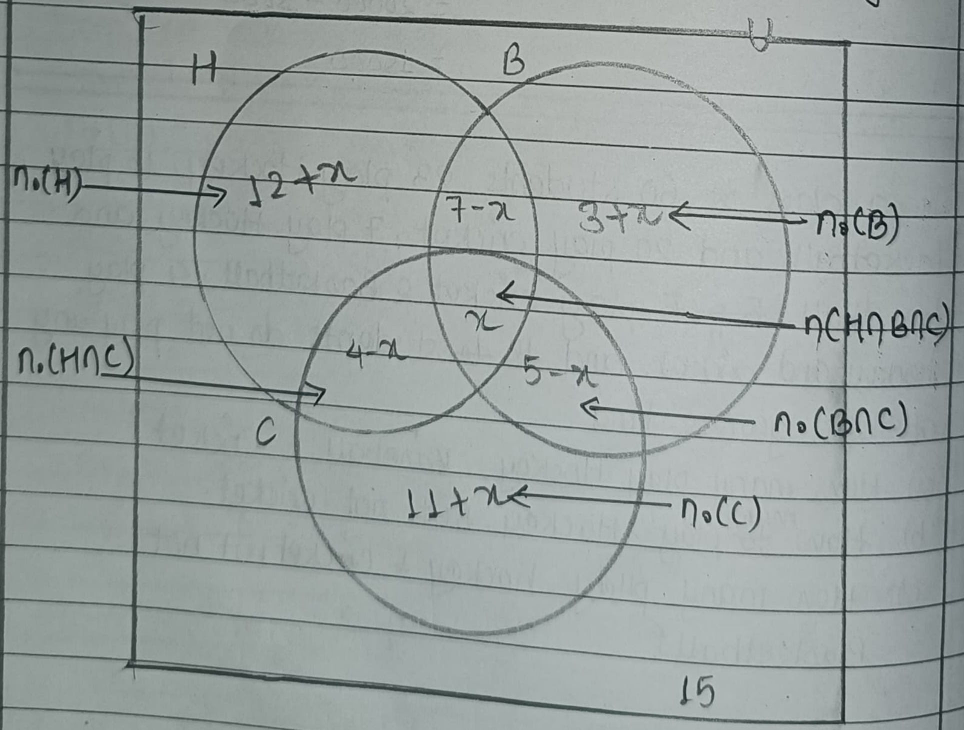
$\cancel{n(C \cap B)} = n(B \cap C) = 5$

$n(H \cap C) = 4$

$n(\overline{H \cup B \cup C}) = 15$

Let $n(H \cap B \cap C) = x$

Showing the above information in venn-diagram:



From the venn diagram, we can see that

$n_o(H) + n_o(H \cap B) + n(H \cap B \cap C) + n_o(H \cap C) = n(H)$

or, $n_o(H) + 7 - x + x + 4 - x = 23$

or, $n_o(H) + 11 - x = 23$

$\therefore$ ~~or,~~ $n_o(H) = 12 + x$

Also,

$n_o(B) + n_o(H \cap B) + n(H \cap B \cap C) + n_o(B \cap C) = n(B)$

or, $n_o(B) + 7 - x + x + 5 - x = 15$

or, $n_o(B) + 12 - x = 15$

~~or,~~ $\therefore n_o(B) = 3 + x$

Also,

$n_o(C) + n_o(H \cap C) + n(H \cap B \cap C) + n_o(B \cap C) = n(C)$

or, $n_o(C) + 4 - x + x + 5 - x = 20$

or, $n_o(C) + 9 - x = 20$

or, $n_o(C) = 20 - 9 + x$

$\therefore n_o(C) = 11 + x$

We have, from venn diagram.

$n(U) = 12 + x + 7 - x + 3 + x + 4 - x + x + 5 - x + 11 + x + 15$

or, $60 = 57 + x$

$\therefore x = 3$

a) Number of students who play Hockey, Basketball & cricket $= n(H \cap B \cap C)$

$= x$

$= 3$

b) Number of students who play Hockey but not cricket

$= n_o(H) + n_o(H\cap B)$

$= 12 + x + 7 - x$

$= 19$

~~c) Number of students who play hockey and cricket but not Basketball~~ $\cancel{= n_o(\overline{B})}$

$\cancel{= n(U) - n_o(B)}$

$\cancel{= 60 -}$

c) Number of students who play hockey and cricket but not basketball $= n(H\cap C)$

$= 4 - x$

$= 4 - 3$

$= 1$

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3. In BIM second semester, 58% failed in Account, 39% in English and 25% in statistics, 32% in Account and English, 19% in account and statistics, 17% in English and statistics and 13% in all the three subjects.

a) What % passed in all three subjects?

b) What % failed in exactly two subjects?

c) What % failed in exactly one subject?

Solution

Let the set of students who failed in Account be A, English be E ~~and~~, statistics be S and all three be $A\cap E\cap S$.

Then, the above information can be written as:

$n(U) = 100\%$

$n(A) = 58\%$

$n(E) = 39\%$

$n(S) = 25\%$

$n(A \cap E) = 32\%$

$n(A \cap S) = 19\%$

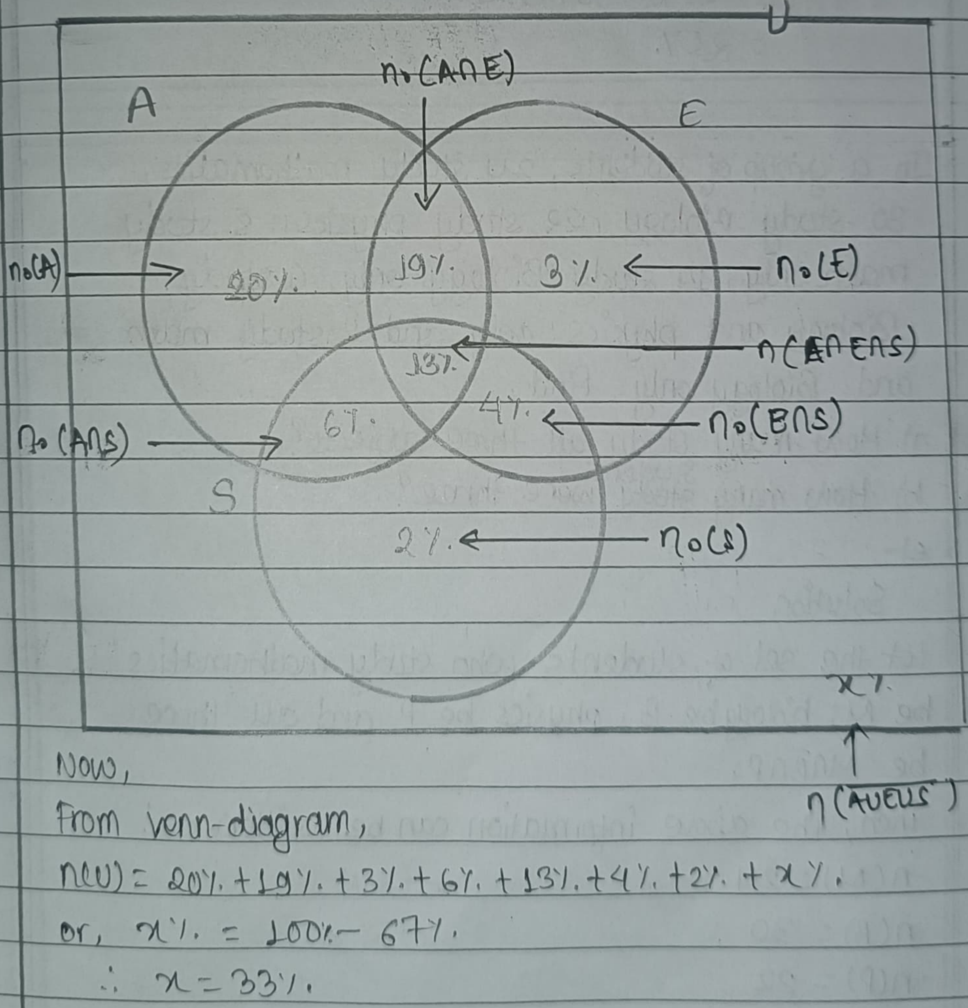
$n(E \cap S) = 17\%$

$\cancel{n(\overline{A \cup E \cup S}) = 13\%}$

$n(A \cap E \cap S) = 13\%$

Let $n(\overline{A \cup E \cup S}) = x\%$

Showing the above information in venn-diagram.



Now,

From venn-diagram,

$n(U) = 20\% + 19\% + 3\% + 6\% + 13\% + 4\% + 2\% + x\%$

or, $x\% = 100\% - 67\%$

$\therefore x = 33\%$

$\therefore n(\overline{A \cup E \cup S}) = 33\%$

Now,

a) ~~Number~~ Percentage of students who passed in all three subjects = $n(\overline{A \cup E \cup S})$
$= 33\%$

b) Percentage of students who failed in exactly two subjects = $n_o(A \cap E) + n_o(A \cap S) + n_o(B \cap S)$
$= 19\% + 6\% + 4\%$
$= 29\%$

c) Percentage of students who failed in exactly one subject = $n_o(A) + n_o(E) + n_o(S)$
$= 20\% + 3\% + 2\%$
$= 25\%$

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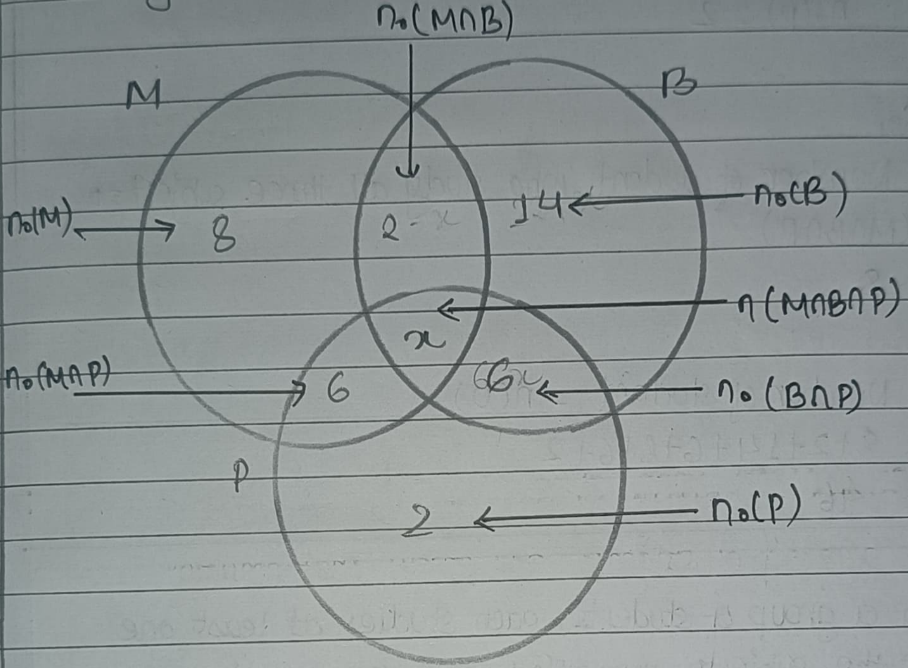
4. In a group of students, 24 study mathematics, 30 study Biology, 22 study physics, 8 study math only, 14 study Biology only, 6 study Biology and physics only and 2 study math and Biology only. Find.
a) How many study all three subjects?
b) How many ~~study~~ students were three?

Solution

Let the set of students who study mathematics be M, biology be B, physics be P and all three be $M \cap B \cap P$.
Then, the above information can be written as:
$n(M) = 24$
$n(B) = 30$
$n(P) = 22$
$n_o(M) = 8$
$n_o(B) = 14$

$n_o(B \cap P) = 6$
$n_o(M \cap B) = 2$
Let $n(M \cap B \cap P) = x$

Showing the above information in venn diagram:



From the venn diagram,

~~$n_o(B) = 30 - 2 + x - x - 6 + x$~~

~~or, $= 22 + x$~~

$n(B) = 2 + 14 + x + 6$

or, $30 = 22 + x$

$\therefore x = 8$

$\therefore n(M \cap B \cap P) = 8$

Also,

~~Let $n_o(M$~~

$n(M) = n_o(M) + n_o(M \cap B) + n(M \cap B \cap P) + n_o(M \cap P)$

or, $24 = 8 + 2 + 8 + n_o(M \cap P)$

$\therefore n_o(M \cap P) = 6$

Similarly,

$n(P) = n_o(P) + n_o(M \cap P) + n(M \cap B \cap P) + n(B \cap P)$

or, $22 = n_o(P) + 6 + 8 + 6$

or, $n_o(P) = 22 - 20$

$\therefore n_o(P) = 2$

So,

a) Number of student who study all three subject $=$ $n(M \cap B \cap P)$

$= 8$

b) Number of student $= n(U)$

$= 8+2+14+6+8+6+2$

$= 46$

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5. In a group of students, each studies at least one of the subjects: marketing, statistics and finance. It is found that 50 read marketing. 37 read statistics, 42 read finance, 22 read marketing only, 18 read finance only, 10 read marketing and finance only and 8 read statistics and finance only. How many student

a) Read all the three subjects?

b) Read marketing and statistics only?

c) Read statistics only?

d) Are there altogether?

e) Read exactly one subject?

f) Read exactly two subjects?

g) Read at least one subject?

h) Marketing and statistics?

Solution

Let the set of students studying marketing be M, statistics be S ~~and~~, finance be F and all three be $M \cap S \cap F$.

Then, the above information can be written as:

$n(M) = 50$

$n(S) = 37$

$n(F) = 42$

$n_o(M) = 22$

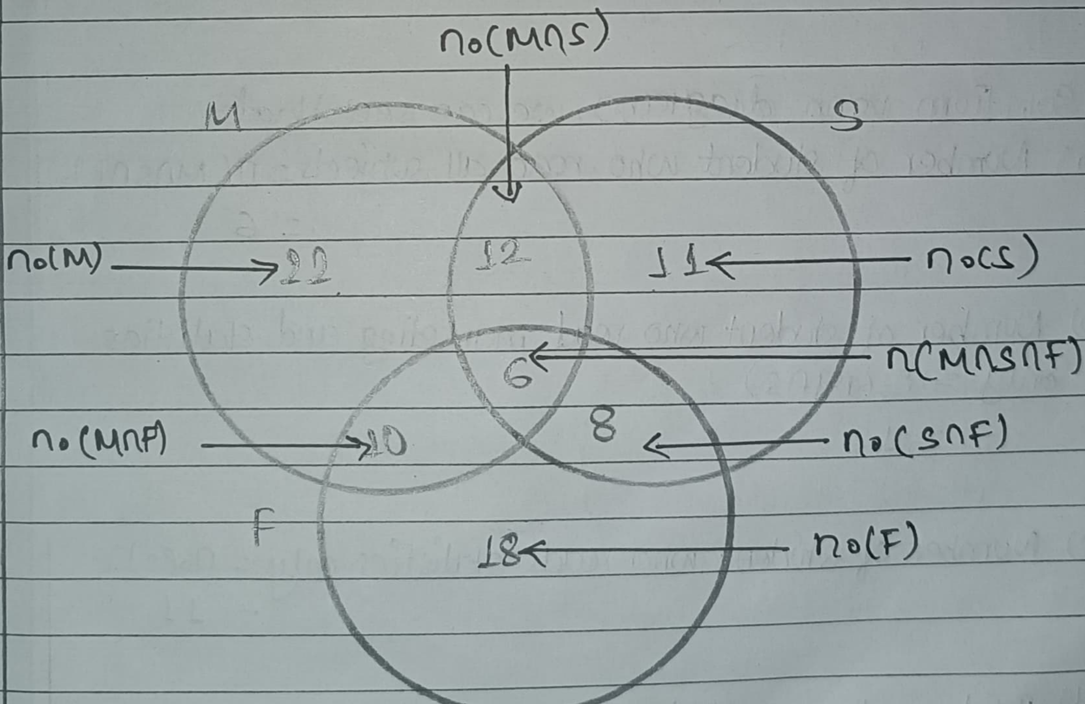
$n_o(F) = 18$

$n_o(M \cap F) = 10$

$n_o(S \cap F) = 8$

~~Let $n(M \cap S \cap F) = x$~~

Showing the above information in venn-diagram:



From the venn-diagram,

$n(F) = 10 + 8 + 18 + n(M \cap S \cap F)$

or, $42 = 36 + n(M \cap S \cap F)$

$\therefore n(M \cap S \cap F) = 6$

Also,

$n(M) = 22 + 10 + 6 + n_o(M \cap S)$

or, $50 = 38 + n_o(M \cap S)$

$\therefore n_o(M \cap S) = 12$

Forthermore,

$n(S) = 12 + 6 + 8 + n_o(S)$

or, $37 = 26 + n_o(S)$

$\therefore n_o(S) = 11$

So, from venn-diagram, we can see that

a) Number of student who read all subjects $= n(M \cap S \cap F)$
$= 6$

b) Number of student who read marketing and statistics only $= n_o(M \cap S)$
$= 12$

c) Number of student who reads statistics only $= n_o(S)$
$= 11$

d) Total number of students $= 22 + 12 + 11 + 10 + 6 + 8 + 18$
$= 87$

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e) Number of student reading exactly one subject =
$n_o(M) + n_o(S) + n_o(F)$
$= 22 + 11 + 18$
$= 51$

f) Number of students reading exactly two subjects =
$n_o(M \cap S) + n_o(M \cap F) + n_o(S \cap F)$
$= 12 + 10 + 8$
$= 30$

g) Number of students reading at least one subject =
$22 + 12 + 11 + 10 + 6 + 8 + 18$
$= 87$

h) Number of students reading marketing and statistics $= n_o(M \cap S) + n(M \cap S \cap F)$
$= 12 + 6$
$= 18$

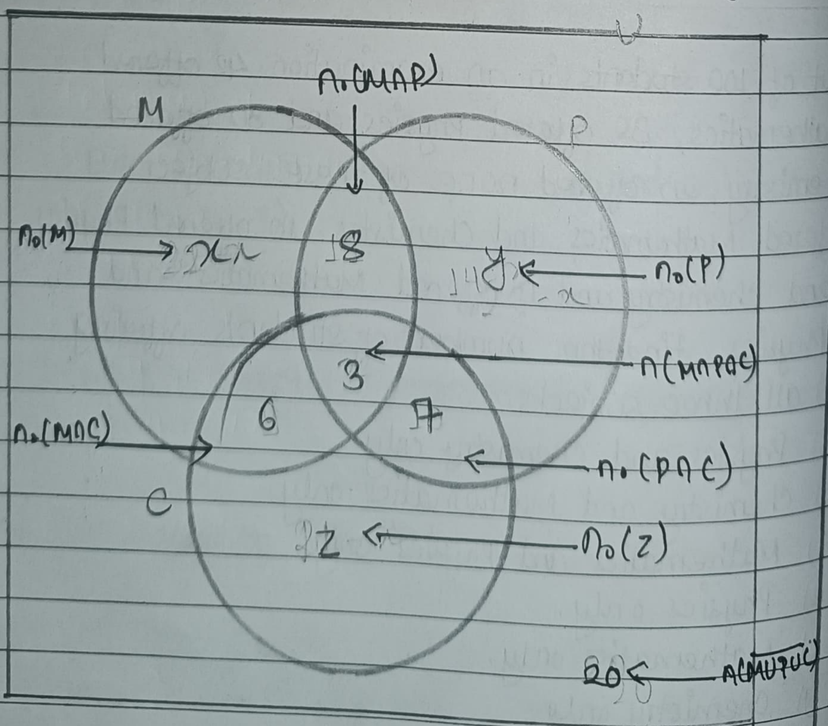
6. Out of 100 students in an examination, 42 offered Mathematics, 35 offered Physics and 30 offered Chemistry, 20 offered none of these subject, 9 offered Mathematics and Chemistry, 10 offered Physics and chemistry and 11 offered Mathematics and Physics. Find the number of students offering
a) all three subjects
b) Physics and Chemistry only
c) Chemistry and Mathematics only
d) Mathematics and Physics only
e) Physics only.
f) Mathematics only.
g) Chemistry only.
h) Exactly one subject.

i) Exactly two subject.
j) ~~A~~ At least one subject.

Solution
Let the set of students offered Mathematics be M, Physics be P, Chemistry be C and all three be $M \cap P \cap C$.
Then, the given information can be written as:

$n(U) = 100$
$n(M) = 42$
$n(P) = 35$
$n(C) = 30$
$n(\overline{M \cup P \cup C}) = 20$
$n_o(M \cap C) = 9$
$n_o(P \cap C) = 10$
$n_o(M \cap P) = 11$
Let $n(M \cap P \cap C) = x$

The above information is shown in venn-diagram as:



We know,

$n(M \cup P \cup C) = n(U) - n(\overline{M \cup P \cup C})$

$= 100 - 20$

$= 80$

Now,

$n(M \cup P \cup C) = n(M) + n(P) + n(C) - n(M \cap P) - n(P \cap C) -$

$n(M \cap C) + n(M \cap P \cap C)$

or, $80 = 42 + 35 + 30 - 11 - 10 - 9 + n(M \cap P \cap C)$

or, $80 = 107 - 30 + n(M \cap P \cap C)$

$\therefore n(M \cap P \cap C) = 3$

a) 3 students offered all three subjects.

b) Let $n_o(M) = x$

From venn-diagram,

$x + 8 + 3 + 6 = 42$

or, $x + 17 = 42$

$\therefore x = 25$

$\therefore n_o(M) = 25$

Let $n_o(P) = y$

From venn-diagram,

$y + 8 + 3 + 7 = 35$

or, $y + 18 = 35$

or, $y = 35 - 18$

$\therefore y = 17$

$\therefore n_o(P) = 17$

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Let $no(C) = z$

From the venn-diagram.

$6+3+7+z=30$

or, $16+z=30$

$\therefore z=14$

$\therefore no(C)=14$

b) 7 offered Physics and Chemistry only.

c) 6 offered Chemistry and Mathematics only.

d) 8 offered Mathematics and Physics only.

e) 25 offered Mathematics only.

f) 17 offered Physics only.

g) 14 offered Chemistry only.

h) The no. of student who offered exactly one subject $= 25+17+14$

$= 56$

i) The no. of students who offered exactly two subject $= 8+7+6$

$= 21$

j) 80 offered at least one subject.

7. In a group of students, 18 read marketing, 22 reads statistics and 16 read economics, 6 reads marketing only, 9 reads statistics only, 5 read marketing and statistics only and 5 read statistics and economics only. How many students read

a) all the subjects

b) marketing and economics only.

c) economics only

d) all together

Solution

Let the set of students who read Marketing be M, statistics be S, Economics be E and all three be $M \cap S \cap E$.

Then, the above information can be written as:

$n(M) = 18$

$n(S) = 22$

$n(E) = 16$

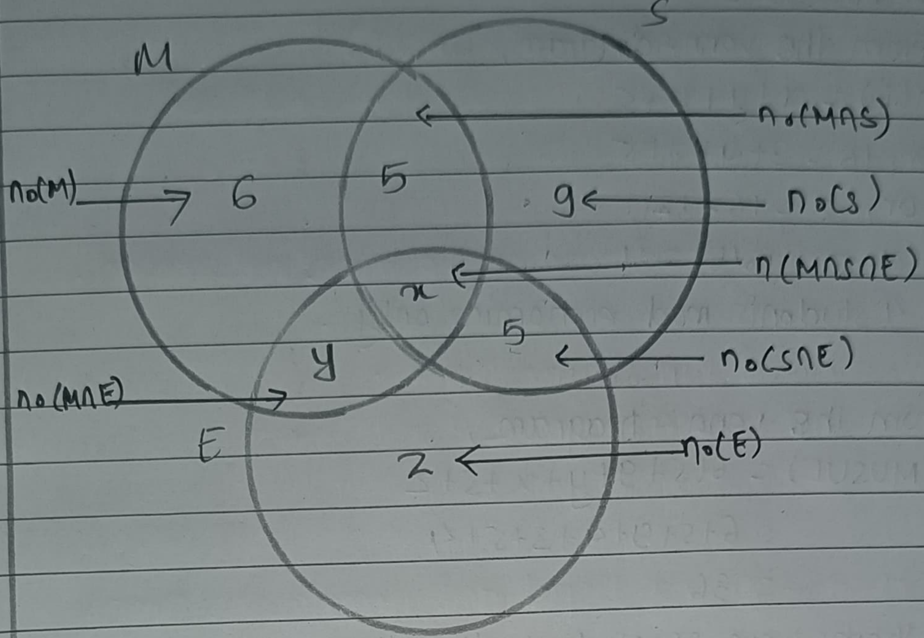
$n_o(M) = 6$

$n_o(S) = 9$

$n_o(M \cap S) = 5$

$n_o(S \cap E) = 5$

Showing the above information in venn-diagram:



let $n(M \cap S \cap E) = x$

From the venn-diagram,

$n(S) = 5 + 9 + 5 + x$

or, $22 = 19 + x$

$\therefore x = 3$

$\therefore n(M \cap S \cap E) = 3$

a) 3 students read all the subjects.

let $n_o(M \cap E) = y$

From the venn-diagram

$n(M) = 6 + 5 + x + y$

or, $18 = 6 + 5 + 3 + y$

or, $18 = 14 + y$

$\therefore y = n_o(M \cap E) = 4$

b) 4 students read marketing and Economics only.

Let $n_o(E) = z$

From the venn-diagram,

$n(E) = x + y + z + 5$

or, $16 = 3 + 4 + z + 5$

or, $z = 16 - 12$

$\therefore z = n_o(E) = 4$

c) 4 students read economics only.

From the venn-Diagram,

$n(M \cup S \cup E) = 6 + 5 + 9 + y + x + 5 + z$

$= 6 + 5 + 9 + 4 + 3 + 5 + 4$

$= 36$

d) There were 36 students altogether.

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8. In a survey of 100 students, the number of students that read various newspaper were found to be as follows:
Kathmandu post = 28; Rising Nepal = 30; Himalayan Times = 42; Kathmandu and Rising Nepal = 8; Rising Nepal and Himalayan Times = 5; Kathmandu Post and Himalayan times = 10; All three newspapers = 3.
Find,

a) How many read none of the three newspapers?

b) How many read Himalayan times?

c) How many read Rising Nepal and Himalayan times only?

d) How many read Kathmandu post and Himalayan Times only?

e) How many read Kathmandu post and Rising Nepal only?

f) How many read Kathmandu post only?

g) How many read Rising Nepal only?

h) How many read exactly one type of newspaper?

Solution

Let the set of students who liked to read Kathmandu Post be K, Rising Nepal be R, Himalayan Times be H and all three be $K \cap R \cap H$.

Then, the above information can be written as:

$n(U) = 100$

$n(K) = 28$

$n(R) = 30$

$n(H) = 42$

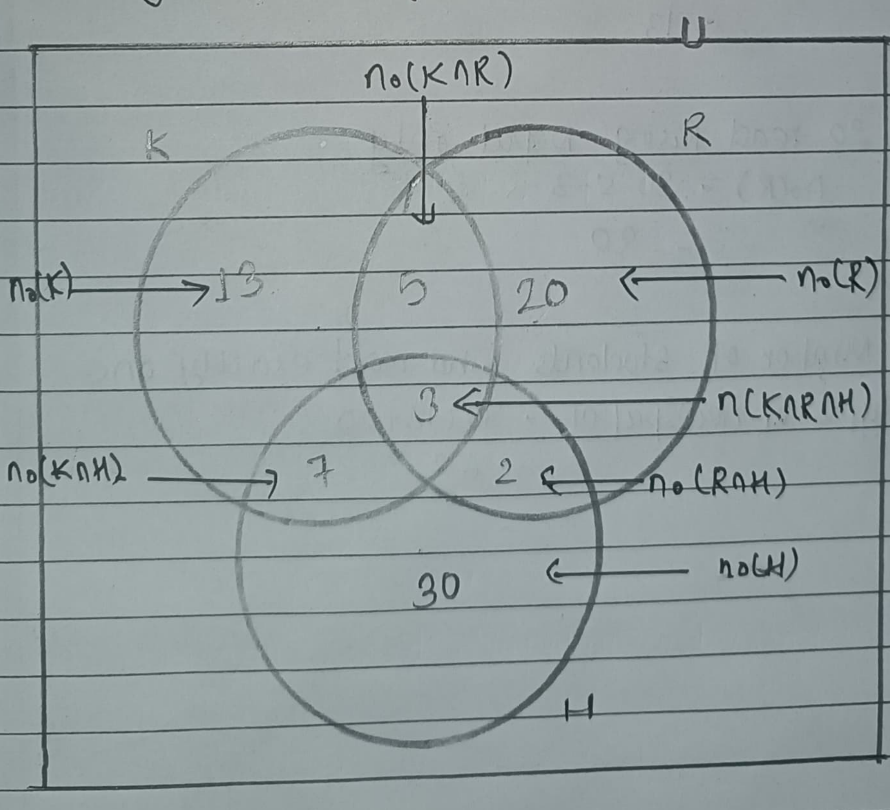
$n(K \cap R) = 8$

$n(R \cap H) = 5$

$n(K \cap H) = 10$

$n(K \cap R \cap H) = 3$

Showing the above information in venn-diagram:



we know,

$n(\overline{K \cup R \cup H}) = n(U) - n(K \cup R \cup H)$

$= 100 - (13+5+20+7+3+2+30)$

$= 100 - 80$

$= 20$

a) 20 people read none of the three newspaper.

b) 30 read Himalayan Times.

$n_o(H) = 42-7-3-2$

$= 30$

c) 2 read Rising Nepal and Himalayan Times only.

d) 7 read Kathmandu Post and Himalayan Times.

e) 5 read kathmandu post and Rising Nepal.

f) 13 read Kathmandu Post only.

$n_o(K) = 28-5-3-7$

$= 13$

g) 20 read Rising Nepal only

$n_o(R) = 30-5-3-2$

$= 20$

h) Number of students who read exactly one type of newspaper $= 30+13+20$

$= 63$