Important Formulae and Key points

1. If A and B are subsets of U

| Terminology	Set Symbol
No. of only A	$n_o(A)$
No. of only B	$n_o(B)$
n(exactly one) or n(0nly one)	$n_o(A) + n_o(B)$
n(at least one)or n(either A or B or both)	$n(A \cup B)$
n(both)	$n(A \cap B)$
Some Important Formulae	
a. $n(A \cup B) = n(A) + n(B) - n(A \cap B)$	
b. $n(U) = n(A) + n(B) - n(A \cap B) + n(\overline{A \cup B})$	
c. $n(\overline{A \cup B}) = n(U) - n(A \cup B)$	
d. $n_o(A) = n(A) - n(A \cap B) = n(A - B)$	
e. $n_o(B) = n(B) - n(A \cap B) = n(B - A)$	
f. $n(A \cup B) = n_o(A) + n_o(B) + n(A \cap B)$	
g. $n(U) = n_o(A) + n_o(B) + n(A \cap B) + n(\overline{A \cup B})$	

Representation two sets in Venn- diagram
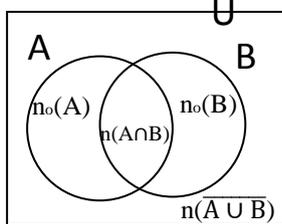
2. If A and B are subsets of U

Terminology	Set Symbol
No. of only A	$n_o(A)$
n(exactly one) or n(0nly one)	$n_o(A) + n_o(B) + n_o(C)$
n(at least one)	$n(A \cup B \cup C)$
n(like all)	$n(A \cap B \cap C)$
Some Important Formulae	
a. $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C)$ $- n(C \cap A) + n(A \cap B \cap C)$	
b. $n(U) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C)$ $- n(C \cap A) + n(A \cap B \cap C) + n(\overline{A \cup B \cup C})$	
c. $n(A \cup B \cup C) = [n_o(A) + n_o(B) + n_o(C)] + [n_o(A \cap B)$ $+ n_o(B \cap C) + n_o(C \cap A)] + n(A \cap B \cap C)$	
d. $n_o(A) = n(A) - n(A \cap B \cap C) - n_o(A \cap B) - n_o(B \cap C)$	
e. $n(A \cup B \cup C) = n(A \cup B) + n_o(C)$	

Representation two sets in Venn- diagram
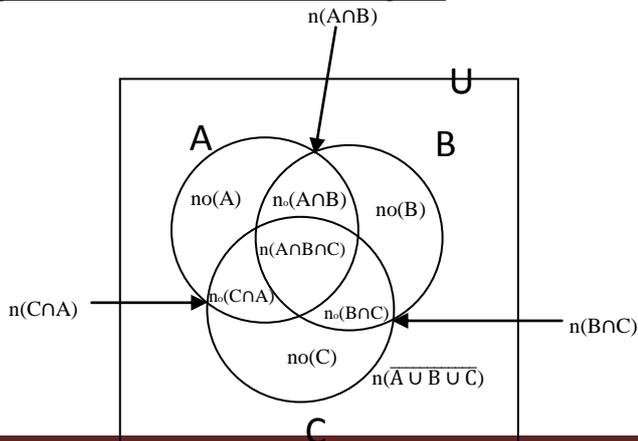
Questions:

1. a. **In a survey of 350 students of a school, 200 liked Pokhara, 220 liked Chitwan and 120 liked both places, then**
   i. Show the above information in a Venn-diagram.
   ii. Find the number of students who liked neither of two places.

Ans: Let P and C represent students who liked Pokhara and Chitwan respectively.
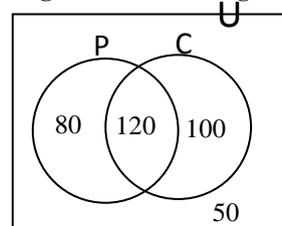Given,
$n(U) = 350$
$n(P) = 200$
$n(C) = 220$
$n(P \cap C) = 120$
$n(\overline{P \cup C}) = ?$
We know that,
$n(U) = n(P) + n(C) - n(P \cap C) + n(\overline{P \cup C})$
or, $350 = 200 + 220 - 120 + n(\overline{P \cup C})$
or, $350 = 420 - 120 + n(\overline{P \cup C})$
or, $350 = 300 + n(\overline{P \cup C})$
or, $350 - 300 = n(\overline{P \cup C})$
or, $50 = n(\overline{P \cup C})$
$\therefore n(\overline{P \cup C}) = 50$
Hence, 50 students liked neither of two places.

Showing in the Venn-diagram

b. Out of 90 civil servants, 65 were working in the office, 50 were working in the field and 35 were working in the both premises:
   i. How many civil servants were absent?
   ii. How many civil servants were working in the field only?
   iii. Represent the above information in Venn-diagram.

2. a. In a class of 55 students, 15 students liked Maths but not English and 18 students liked English but not Maths. If 5 students did not like both, how many students liked both subjects? Represent the above information in Venn-diagram.

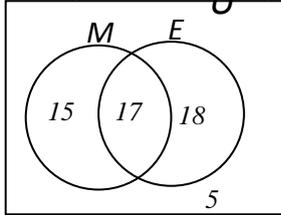Ans: *Let M and E represent students who liked Maths and English respectively.*
Given,
$n(U) = 55$
$n_o(M) = 15$
$n_o(E) = 18$
$n(\overline{M \cup E}) = 5$
$n(M \cap E) = ?$
We know that,
$n(U) = n_o(M) + n_o(E) + n(M \cap E) + n(\overline{M \cup E})$
or, $55 = 15 + 18 + n(M \cap E) + 5$
or, $55 = 38 + n(M \cap E)$
or, $55 - 38 = n(M \cap E)$
or, $17 = n(M \cap E)$
$\therefore n(M \cap E) = 17$
Hence, 17 students liked both subjects.

Showing in the Venn-diagram

b. In a group of 30 people, 10 drink only milk , 5 drink only tea and 13 drink neither milk or tea. By drawing Venn-diagram, find how many people drink both tea and milk?

3. a. In a survey of a community of 720 people, it was found that 450 liked folk song, 280 liked modern song and 40 disliked both songs:
   i. Find the number of people who liked both songs.
   ii. Find the number of people who liked modern songs only.

   b. In a survey among of 900 students, it was found that 600 liked apple, 500 liked mangoes and 125 disliked both:
   i. Find the number of people who liked both fruits.
   ii. Find the number of people who liked apple only.
   iii. Draw a Venn-diagram to show the above relations.

4. a. In a survey of 400 people, 300 people drink only one drink out of tea and coffee. 50 people drink none of them. Find the number people who drink both drinks.

Ans: *Let T and C represent people who drink Tea and Coffee respectively.*
Given,
$$n(U) = 400$$
$$n_o(T) + n_o(C) = 300$$
$$n(\overline{T \cup C}) = 50$$
$$n(T \cap C) = ?$$
We know that,
$$n(U) = n_o(T) + n_o(C) + n(T \cap C) + n(\overline{T \cup C})$$
or, $400 = 300 + n(T \cap C) + 50$
or, $400 = 350 + n(T \cap C)$
or, $400 - 350 = n(T \cap C)$
or, $50 = n(T \cap C)$
$\therefore n(T \cap C) = 50$
Hence, 50 students drink both drinks.

b. 150 students were asked whether they like cricket or basketball, 100 liked cricket and 52 liked both. If 12 did not like any of these two games. By using Venn-diagram, find:
   i. The number of students who liked basketball.
   ii. The number students who liked only one game.

5. In a school all the students play either volleyball or football or both. 300 play football, 250 play volleyball and 110 play both the games. By using Venn - diagram, find:
   i. The number of students who liked football only.
   ii. The number students who liked only volleyball

6. a. In a group students, 50% like tea, 70% like coffee, 10% don't like both and 120 like both. By using Venn-diagram, find the total number of students.

Ans: Let T and C represent people who drink Tea and Coffee respectively.

Given,
$$n(U) = 100\%$$
$$n(T) = 50\%$$
$$n(C) = 70\%$$
$$n(T \cap C) = 120$$
$$n(\overline{T \cup C}) = 10\%$$
Total number of students = ?
We know that,
$$n(U) = n(T) + n(C) - n(T \cap C) + n(\overline{T \cup C})$$
or, $100\% = 50\% + 70\% - n(T \cap C) + 10\%$
or, $100\% = 130\% - n(T \cap C)$
or, $n(T \cap C) = 130\% - 100\%$
$\therefore n(T \cap C) = 30\%$
Let x be the total number of students.
   30% of $x = 120$
or, $\dfrac{30}{100} \times x = 120$
or, $\dfrac{3x}{10} = 120$
or, $3x = 120 \times 10$
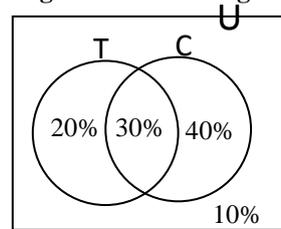or, $3x = 1200$
or, $x = \dfrac{1200}{3}$
$\therefore x = 400$
The total number of students is 400.

Showing in the Venn-diagram

b. In an examination, 40% of students passed in Maths only, 30% passes in science only and 10% failed in both subjects. If 200 students passed in science, find the number total number of students by using Venn-diagram.

c. In a survey conducted among some people of a group, it was found that 40% of them liked literature, 65% of them liked music and 10% of them liked none:
   i. Illustrate this information in Venn-diagram.
   ii. If there were 30 people liked both of them, find the number of people participated in the survey.

7. a. In a group of 54 people, each likes music or dance. If the ratio of people who like music only and dance only is 5:4 and the number who like both is 18, find the number of people who liked dance by using Venn-diagram.

Ans: Let M and D represent people who like music and dance respectively.
Given,
$$n(U) = 54$$
$$n_o(M) : n_o(D) = 5:4$$
$$n(M \cap D) = 18$$
$$n(\overline{M \cup D}) = 0$$
$$n(D) = ?$$
Let $n_o(M)$ be $5x$ and $n_o(D)$ be $4x$.
We know that,
$$n(U) = n_o(M) + n_o(D) + n(M \cap D) + n(\overline{M \cup D})$$

or, $54 = 5x + 4x + 18 + 0$

or, $54 = 9x + 18$

or, $54 - 18 = 9x$

or, $36 = 9x$

or, $\dfrac{36}{9} = x$

or, $4 = x$

$\therefore x = 4$

Now,

$n_o(M) = 5x$

$= 5 \times 4$

$= 20$

$n_o(D) = 4x$

$= 4 \times 4$

$= 16$

Again,

$n(D) = n_o(D) + n(M \cap D)$

$= 16 + 18$

$= 34$

Hence, the number student who likes dance is 34.

Showing in the Venn-diagram
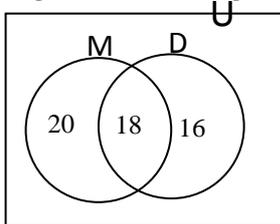
Note: This question can be done by replacing n(U) by n(M∪D)

b. In a group of 100 students, the ratio of students who like Geography and Sociology is 3:5. If 30 of them like both the subjects and 10 of them like none of them then, by using Venn-diagram find the how many students of them i. like Geography only ii. like Sociology only?

8. a. In a survey among 70 people, it was found that 50 liked football only and 10 liked both football and volleyball. The number of people who liked football is four times the number of people who liked volleyball. By using Venn-diagram, find the number of people who liked volleyball only and who did not like any of games.

Ans: Let F and V represent students who liked football and volleyball respectively.

Given,

$n(U) = 70$

$n_o(F) = 50$

$n(F \cap V) = 10$

$n(F) = 4.n(V)$

$n_o(V) = ?$

$n(\overline{F \cup V}) = ?$

We know that,

$n(F) = n_o(F) + n(F \cap V)$

$= 50 + 10$

$= 60$

Also, $n(F) = 4.n(V)$

or, $60 = 4.n(V)$

or, $\dfrac{60}{4} = n(V)$

or, $15 = n(V)$

$\therefore n(V) = 15$

Now,

$n_o(V) = n(V) - n(F \cap V)$

$= 15 - 10$

$= 5$

Again,

$n(U) = n(F) + n(V) - n(F \cap V) + n(\overline{F \cup V})$

or, $70 = 60 + 15 - 10 + n(\overline{F \cup V})$

or, $70 = 75 - 10 + n(\overline{F \cup V})$

or, $70 = 65 + n(\overline{F \cup V})$

or, $75 - 65 = n(\overline{F \cup V})$

or, $5 = n(\overline{F \cup V})$

$\therefore n(\overline{F \cup V}) = 5$

Showing in the Venn-diagram
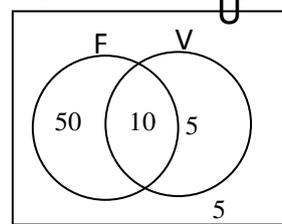
b. Out of 65 players, 11 play basketball only, 11 play both basketball and cricket. The number of players who play cricket is twice the number of players who play basketball. By using Venn-diagram find the number of players who play cricket only and don't play both the games.

c. Out of 120 students, 32 passed in Mathematics only, 8 passed in Mathematics and Nepali. The number of students who passed in Nepali is twice the number of students who passed in Mathematics. Using Venn-diagram find the number of students who passed in Nepali only and did not pass in both subjects.

d. Out of 65 players, 11 play basketball only and 33 play cricket only.If the number of players who play cricket is twice the number of players who play basketball. By using a Venn-diagram find the number of player who play both games and who do not play any of games.

9. a. In a survey of a people, showed that; 60 liked tea, 45 liked coffee, 30 liked milk, 25 liked coffee as well as tea, 20 liked tea as well as milk, 15 liked coffee as well as milk and 10 liked all the three. How many people were asked this question? Solve by drawing the Venn-diagram.

b. Of the total candidates in an examination, 40% students passed in Maths, 45% passed in science and 55 % in Health. If 10% passed in Maths and Science, 20% passed in Science and Health and 15% passed in Health and Maths.

i. Draw a Venn-diagram to show the above information.

ii. Calculate the percentage of students who passed in all the three.

10. a. Out of 100 students, 80 passed in science, 71 passed in Maths, 10 failed in both subjects and 7 did not appear in an examination. Find the number of students who passed in both subjects by using a Venn-diagram.

b. In a survey, one third children like only mango and 22 don't like mango at all. Also $\dfrac{2}{5}$ children like orange but 12 like none of them.

i. Show the above data in a Venn-diagram.

ii. How many children like both types of fruit?

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