SNS College of Technology(Autonomous)
Coimbatore-35
Academic Year 2023 – 2024 (Even)

UNIT 1 QUANTITATIVE ABILITY III

T10: Venn Diagrams

Set Operations

Meaning

$A \subset B$ Set A is a proper subset of B, or A is contained in B.

$A \cup B$ Set of all those elements which either belong to A or belong to B

$A \cap B$ Set of all those elements which belong to both A and B

AC or A’ Set of all those elements which are not in A

$A - B$ Set of all those elements which only belong to A

$A \ominus B$ Symmetric difference: Set of all those elements which either belong to A or belong to B, but not in both.

Some important formulae:

$n(A \cup B) = n(A) + n(B) – n(A \cap B)$

$n(A \cup B \cup C) = n(A) + n(B) + n(C) – n(A \cap B) – n(B \cap C) – n(A \cap C) + n(A \cap B \cap C)$

$A \cup U = U$; U is universal set

$A \cap U = A$; U is universal set

AC = U – A

(AC)C = A

$A \cup A' = U$

$A \cap A' = \varphi$

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

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

$U' = \varphi$

$\varphi' = U$

If A and B are two sets such that number of elements in A is 24, number of elements in B is 22 and number of elements in both A and B is 8, find:

(i) n(A ∪ B)

(ii) n(A – B)

(ii) n(B – A)

Solution:

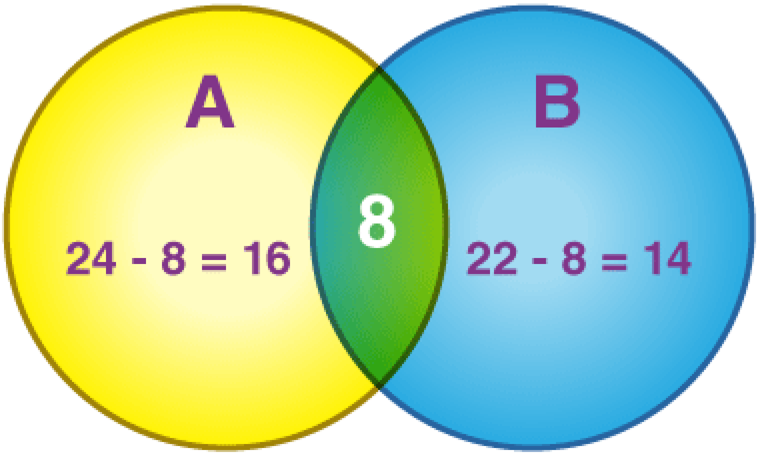
Given, n(A) = 24, n(B) = 22 and n(A ∩ B) = 8

The Venn diagram for the given information is:

(i) n(A ∪ B) = n(A) + n(B) – n(A ∩ B) = 24 + 22 – 8 = 38.

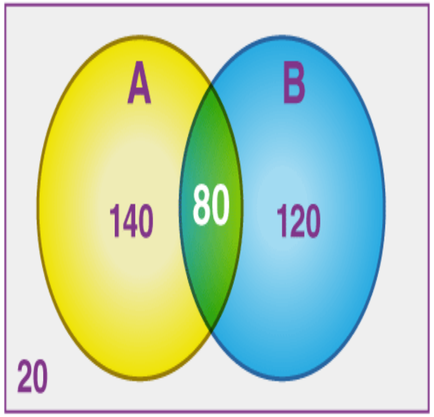
(ii) n(A – B) = n(A) – n(A ∩ B) = 24 – 8 = 16.

(iii) n(B – A) = n(B) – n(A ∩ B) = 22 – 8 = 14.



According to the survey made among 200 students, 140 students like cold drinks, 120 students like milkshakes and 80 like both. How many students like atleast one of the drinks?

Solution:



Number of students like cold drinks = n(A) = 140
Number of students like milkshake = n(B) = 120
Number of students like both = $n(A \cap B) = 80$
Number of students like atleast one of the drinks =
$n(A \cup B) = n(A) + n(B) - n(A \cap B)$
$= 140 + 120 - 80$
$= 180$.

In a group of 500 people, 350 people can speak English, and 400 people can speak Hindi. Find how many people can speak both languages?

Solution:

Let H be the set of people who can speak Hindi and E be the set of people who can speak English. Then,

$n(H) = 400$

$n(E) = 350$

$n(H \cup E) = 500$

We have to find $n(H \cap E)$.

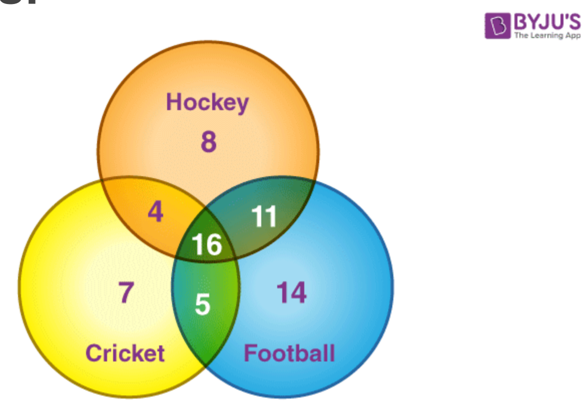
Now, $n(H \cup E) = n(H) + n(E) - n(H \cap E)$

$\Rightarrow 500 = 400 + 350 - n(H \cap E)$

$\Rightarrow n(H \cap E) = 750 - 500 = 250.$

$\therefore$ 250 people can speak both languages.

The following Venn diagram shows games played by the number of students in a class:



How many students like only cricket and only football?

Solution:

As per the given Venn diagram,

Number of students only like cricket = 7

Number of students only like football = 14

∴ Number of students like only cricket and only football = 7 + 14 = 21.

In a class of 40 students, 20 have chosen Mathematics, 15 have chosen mathematics but not biology. If every student has chosen either mathematics or biology or both, find the number of students who chose both mathematics and biology and the number of students chose biology but not mathematics.

Solution:

Let, $M \equiv$ Set of students who chose mathematics

$B \equiv$ Set of students who chose biology

$n(M \cup B) = 40$

$n(M) = 20$

$n(B) = n(M \cup B) - n(M)$

$\Rightarrow n(B) = 40 - 20 = 20$

$n(M - B) = 15$

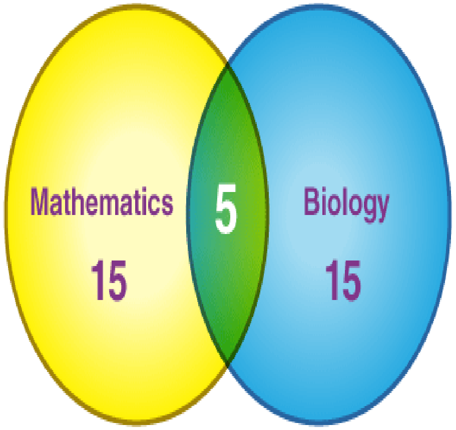
$n(M) = n(M - B) + n(M \cap B)$

$\Rightarrow 20 = 15 + n(M \cap B)$

$\Rightarrow n(M \cap B) = 20 - 15 = 5$

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

$\Rightarrow n(B - M) = 20 - 5 = 15$

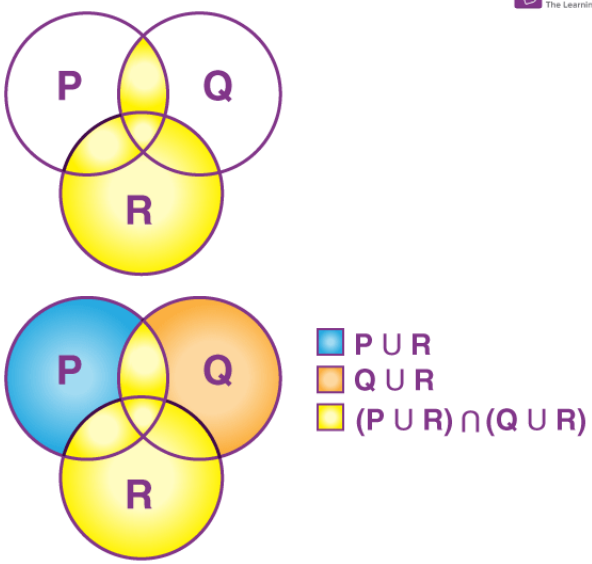


Using the Venn diagrams, verify (P ∩ Q) ∪ R = (P ∪ R) ∩ (Q ∪ R).

Solution:

The shaded portion represents (P ∩ Q) ∪ R in the Venn diagram.

Comparing both the shaded portion in both the Venn diagram, we get (P ∩ Q) ∪ R = (P ∪ R) ∩ (Q ∪ R).



Prove using the Venn diagram: (B – A) ∪ (A ∩ B) = B.

Solution:

From the Venn diagram, it is clear that (B – A) ∪ (A ∩ B) = B