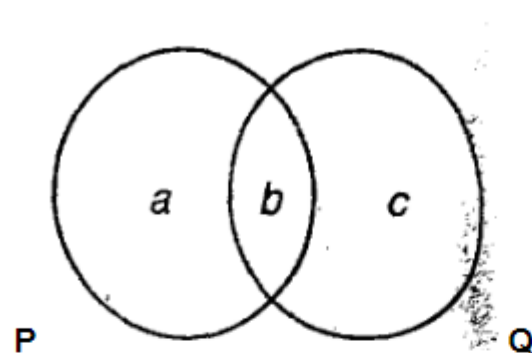


Percentile Classes

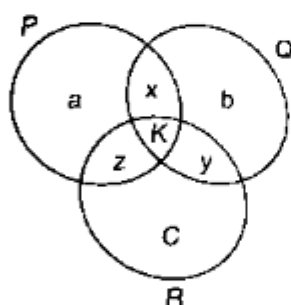
Set Theory and Venn Diagram

Venn Diagrams containing two circles



$a \rightarrow$ number of people reading only P
 $c \rightarrow$ number of people reading only Q
 $b \rightarrow$ number of people reading P and Q both but not R
 $a + b \rightarrow$ number of people reading P
 $b + c \rightarrow$ number of people reading Q

Venn Diagrams containing three circles



Let P, Q, R be three books, then

$a \rightarrow$ number of people reading only P
 $b \rightarrow$ number of people reading only Q
 $c \rightarrow$ number of people reading only R
 $x \rightarrow$ number of people reading P and Q both but not R
 $y \rightarrow$ number of people reading Q and R both but not P
 $z \rightarrow$ number of people reading P and R both but not Q
 $k \rightarrow$ number of people reading all the three books
 $x + k \rightarrow$ number of people reading P and Q both
 $y + k \rightarrow$ number of people reading Q and R both
 $z + k \rightarrow$ number of people reading P and R both
 $a + x + k + z \rightarrow$ number of people reading P
 $b + x + k + y \rightarrow$ number of people reading Q

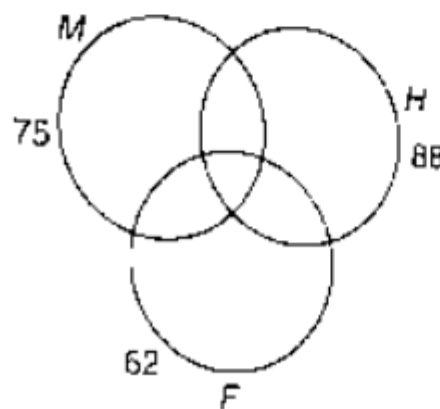
$c + t + k + z \rightarrow$ number of people reading R
 $a + x + b \rightarrow$ number of people reading P or Q but not R
 $b + y + c \rightarrow$ number of people reading Q or R but not P
 $c + z + a \rightarrow$ number of people reading P or R but not Q/
 $a + b + c \rightarrow$ Number of people reading only one book
 $k \rightarrow$ number of people reading all of three books
 $(a+b+c) + (x+y+z) + (k) \rightarrow$ number of people reading atleast one book
 $(x+t+z) + (k) \rightarrow$ number of people reading atleast two books
 $(a+b+c) + (x+y+z) + (k) \rightarrow$ total number of readers.

Concept of Maximum or Minimum

Type 1. In a Business school there are 3 electives and atleast one elective is compulsory to opt. 75% students opted to marketing, 62% students opted for finance and 88% students opted for HR. A student can have dual or triple racialization

- (a) What is the minimum number of students that are specialize in all three streams?
- (b) What is the maximum number of students that can specialize in all three streams?

Solution: (a) 75% students opted for marketing, it means atleast 25% students opted to HR or Finance or HR and finance both.



Similarly atleast 12% students opted for marketing or Finance or Marketing and finance Both.

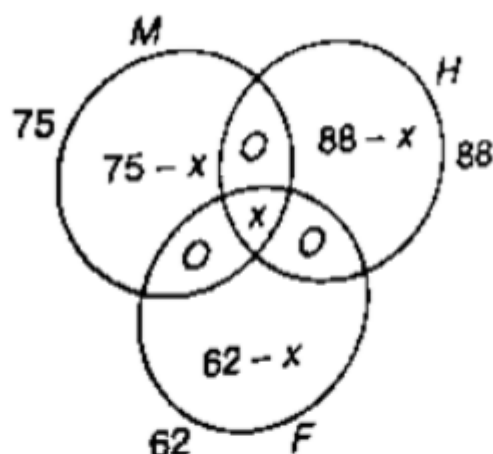
Again atleast 38% students opted for marketing or HR or marketing and HR both.

$$\therefore 25 + 12 + 38 = 75\%$$

It means that if there is no intersection in these three courses, 75 % would be maximum number of students in M, H, alone or $(M \cap H)$, $(M \cap F)$, $(H \cap F)$

Thus it gives atleast 25 % = $(100-75)$ students in all 3 departments.

$$(b) (75-x) + (88-x) + (62-x) + x = 100 \rightarrow x = 62.5\%$$



Type – 2: In a Business school there are 3 electives offered to the students, where students have a choice of not choosing any electives

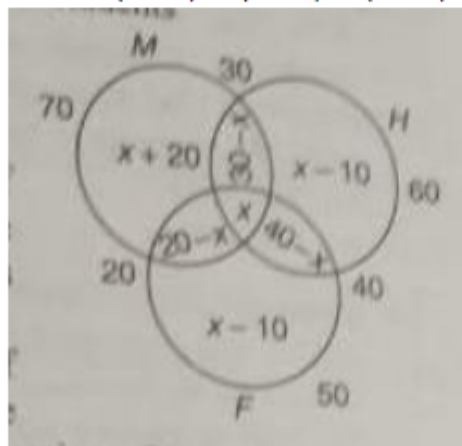
70% students opted for marketing, 60% students opted for HR and 50% students opted for Finance. 30% Students opted for Marketing and HR both, 40% opted for HR and Finance both, 20% opted for Marketing and Finance both.

(a) what is the minimum number of students opted for all 3 electives?

(b) What is the maximum number of students opted for all 3 electives?

Solution: Total number of Students

$$= 70 + (x-10) + (40-x) + (x-10) = 90 + x$$



(a) The minimum value of x so that none of the categories becomes negative = 10

(b) The maximum value of x so that none of the categories becomes negative = 20

Type 3. In a hostel there are 250 students, 120 watch news channels, 80 watch sports channels and 90 watch music channels. Each channel telecasts the content as per their nature 50 students watch both news and sports channel 60 students both news and music channels.

(a) What is the minimum number of students who watch atleast one of the given channel?

(b) what is the maximum number of students who watch atleast one of the given channels?

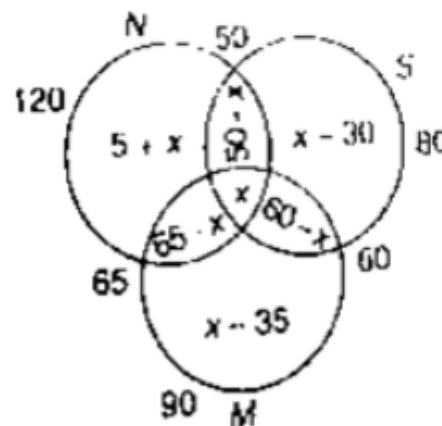
(c) What is the minimum number of students who watch all the three types of channels?

(d) What is the maximum number of students who watch all the three types of channels?

Solution: Since the number of students cannot be negative

$$\therefore \begin{cases} x - 30 \geq 0 \\ x - 35 \geq 0 \end{cases}$$

$$\begin{aligned} 50 - x &\geq 0 \\ \text{Also } 60 - x &\geq 0 \\ 65 - x &\geq 0 \end{aligned}$$



Total number of students playing atleast one game

$$= 120 + (x-30) + (60-x) + (x-35) = 115 + x$$

(a) Minimum number of students watching atleast one channel = $115 + 35 = 150$

(b) Maximum number of students watching atleast one channel = $115 + 50 = 165$

(c) Minimum number of students watching all the 3 channels = 35

(d) Maximum number of students watching all the 3 channels = 50

Set Theory Exercise

1. In a survey of 100 people, it was found that 60 people read India Today, 55 read Outlook, and 10 read neither of the two magazines. How many people read both the magazines?
(a) 45 (b) 35 (c) 25 (d) None of these
2. In a class of 50 students, 28 like pop music and 20 like classical music. If 10 students like one of the two kinds of music, then find the number of the students who like both kinds of music?
(a) 8 (b) 5 (c) 7 (d) 6
3. In a class of 120 students, students are participating in the Sudoku or crossword classes. The ratio of students who participate in Sudoku to the number of students who participate in crossword is 2:1. Forty-five students do not participate in any of these two. What is the number of students who participate in Sudoku?
(a) 50 (b) 80 (c) 70 (d) 84
4. Thirty monkeys went to a picnic. Twenty-five monkeys chose to irritate buffaloes, and 20 monkeys chose to irritate cows. How many monkeys chose to irritate both buffaloes and cows?
(a) 10 (b) 15 (c) 5 (d) 20
5. A survey shows that 89% of the Australians like butter, whereas 79% like chocolate. It is known that they like at least one of the two. What is the percentage of Australians who like both butter and chocolate?
(a) 13% (b) 15% (c) 11% (d) None of these
6. If S and T are two sets such that S has 21 elements, T has 32 elements, and $S \cap T$ has 11 elements, then how many elements does $S \cup T$ have?
(a) 36 (b) 38 (c) 42 (d) 40
7. In a group of 52 persons, 16 drink tea but not coffee and 33 drink tea. Then, what is the number of persons who take coffee but not tea?
(a) 11 (b) 19 (c) 23 (d) Cannot be determined
8. A group of 50 students appeared for Physics and Mathematics examinations. Thirty-eight students passed in Physics and 37 students passed in Mathematics. If 30 students passed in both the subjects, then what is the number of students who failed in both the subjects?
(a) 2 (b) 3 (c) 4 (d) 5
9. In a group of 70 people, 37 like coffee, 52 like tea, and each person likes at least one of the two drinks. How many people like both coffee and tea?
(a) 19 (b) 21 (c) 17 (d) 15
10. In a party, 70% of the people drank coffee, 65% drank soft drinks, 27% did not drink anything, whereas 248 people drank both. What is the number of people who attended the party?

- (a) 400 (b) 600 (c) 800 (d) 900

11. In a class of 25 students, at least one of Mathematics or Statistics is taken by everybody. Twelve have taken Mathematics, and 8 have taken Mathematics but not Statistics. Find the difference in the number of students who have taken mathematics and Statistics and those who have taken statistics but not Mathematics?
 (a) 13 (b) 9 (c) 5 (d) cannot be determined
12. In a city 45% of the people read English and Hindi newspapers. 15% read only Urdu newspaper and 75% read Hindi newspaper. If nobody reads all the three newspapers and everybody read at least one newspaper out of English, Hindi and Urdu newspapers, How many read Urdu newspaper?
 (a) Max 45% (b) Max. 55% (c) Min 25% (d) Min 30%
13. In a group of 80 employees, the number of employees who are engineers is twice that of the employees who are MBAs. The number of employees who are not engineers is 32 and that of those who are not MBAs is 56. The number of employees who are both engineers and MBAs is twice that of the employees who are only MBAs. How many employees are neither engineer (B. Tech) nor MBAs?
 (a) 24 (b) 38 (c) 36 (d) can't be determined
14. In a survey among 80 people, 50 people like arranged marriage and 70 people like love marriage. What is the minimum and maximum number of people like both the marriages respectively?
 (a) 40,45 (b) 40,50 (c) 30,40 (d) can't be determined

Directions for Questions 15 and 16: Refer to the data below and answer the questions that follow.

In a test in which 120 students appeared, 90 passed in History, 65 passed in Sociology and 75 passed in Political Science, 30 students passed in only one subject and 55 students in only two. 5 students passed no subjects.

15. How many students passed in all the three subjects?
 (a) 25 (b) 30 (c) 35 (d) Data insufficient
16. Find the number of students who passed in at least two subjects.
 (a) 85 (b) 95 (c) 90 (d) Data insufficient

Directions for Questions 17 to 23: Refer to the data below and answer the questions that follow.

In a survey among students at all the HMs, it was found that 48% preferred coffee, 54% liked tea and 64% smoked. Of the total, 28% liked coffee and tea, 32% smoked and drank tea and 30% smoked and drank coffee. Only 6% did none of these. If the total number of students is 2000 then find

17. The ratio of the number of students who like only coffee to the number who like only tea is
 (a) 5:3 (b) 8:9 (c) 2:3 (d) 3:2
18. Number of students who like coffee and smoking but not tea is
 (a) 600 (b) 240 (c) 280 (d) 360
19. The percentage of those who like coffee or tea but not smoking among those who like at least one of these is
 (a) more than 30 (b) less than 30
 (c) less than 25 (d) None of these

20. The percentage of those who like at least one of these is
 (a) 100 (b) 90 (c) Nil (d) 94
21. The two items having the ratio 1:2 are
 (a) Tea only and tea and smoking only.
 (b) Coffee and smoking only and tea only.
 (c) Coffee and tea but not smoking and smoking but not coffee and tea.
 (d) None of these
22. The number of persons who like coffee and smoking only and the number who like tea only bear a ratio
 (a) 1:2 (b) 1:1 (c) 5:1 (d) 2:1
23. Percentage of those who like tea and smoking but not coffee is
 (a) 14 (b) 14.9 (c) less than 14 (d) more than 15

Directions for Questions 24 to 28: Refer to the data below and answer the questions that follow.

In the McGraw-Hill Mindworkzz Quiz held last year, participants were free to choose their respective areas from which they were asked questions. Out of 880 participants, 224 chose Mythology, 240 chose Science and 336 chose Sports, 64 chose both Sports and Science, 80 chose Mythology and Sports, 40 chose Mythology and Science and 24 chose all the three areas.

24. The percentage of participants who did not choose any area is
 (a) 23.59% (b) 30.25% (c) 37.46% (d) 27.27%
25. Of those participating, the percentage who choose only one area is
 (a) 60% (b) more than 60% (c) less than 60% (d) more than 75%
26. Number of participants who chose at least two areas is
 (a) 112 (b) 24 (c) 136 (d) None of these
27. Which of the following areas shows a ratio of 1:8?
 (a) Mythology & Science but not Sports: Mythology only
 (b) Mythology & Sports but not Science: Science only
 (c) Science: Sports
 (d) None of these
28. The ratio of students choosing Sports & Science but not Mythology to Science but not Mythology & Sports is
 (a) 2 : 5 (b) 1 : 4
 (c) 1 : 5 (d) 1 : 2
29. A bakery sells three kinds of pastries—pineapple, chocolate and black forest. On a particular day, the bakery owner sold the following number of pastries: 90 pineapple, 120 chocolate and 150 black forest. If none of the customers bought more than two pastries of each type, what is the minimum number of customers that must have visited the bakery that day?
 (a) 80 (b) 75 (c) 60 (d) 90
30. A school has 180 students in its senior section where foreign languages are offered to students as part of their syllabus. The foreign languages offered are: French, German and Chinese and the numbers of people studying each of these subjects are 80, 90 and 100 respectively. The number of students who study more than one of the three subjects is 50% more than the number of students who study all the three subjects.

There are no students in the school who study none of the three subjects. Then how many students study all three foreign languages?

- (a) 18 (b) 24 (c) 36 (d) 40

Directions for Questions Q31 to Q33: In the Stafford Public School, students had an option to study none or one or more of three foreign languages viz: French, Spanish and German. The total student strength in the school was 2116 students out of which 1320 students studied French and 408 students both French and Spanish. The number of people who studied German was found to be 180 higher than the number of students who studied Spanish. It was also observed that 108 students studied all three subjects,

31. What is the maximum possible number of students who did not study any of the three language?
(a) 890 (b) 796 (c) 720 (d) None of these
32. What is the minimum possible number of students who did not study any of the three language?
(a) 316 (b) 0 (c) 158 (d) None of these
33. If the number of students who used to speak only French was 1 more than the number of people who used to speak only German, then what could be the maximum number of people who used to speak only Spanish?
(a) 413 (b) 398 (c) 403 (d) 431

Direction for Questions 34 to 38: Read the passage below and solve the questions based on it.

A newspaper agent delivers the morning papers to 240 families. Ninety buy only Times of India, 15 buy Times of India and The Telegraph, 100 buy The Telegraph, 30 buy The Telegraph and The Hindu, and 30 buy only The Hindu. No family buys all the three papers.

34. many buy the Times of India?
(a) 120 (b) 110 (c) 125 (d) 150
35. How many buy The Telegraph only?
(a) 50 (b) 55 (c) 45 (d) 65
36. How many people read only one paper?
(a) 165 (b) 175 (c) 145 (d) 195
37. Which newspaper is the most popular?
(a) The Hindu (b) The Telegraph (c) Times of India (d) None of these
38. is the least popular newspaper?
(a) The Hindu (b) The Telegraph (c) Times of India (d) None of these

Direction for Questions 39 and 40: Read the passage below and solve the questions based on it.

The following are the statistics of 22 students of Career Zone who appeared for CAT. Fifteen students got calls from IIM-A, 12 students got calls from IIM-B, and 8 students got calls from IIM-C. Six students got calls from IIM-A and IIM-B, 7 students got calls from IIM-B and IIM-C, and 4 students got calls from IIM-A and IIM-C, and 4 students got calls from all the three IIMs.

Similarly, number of students who got calls from IIM-B and IIM-C only = $7 - 4 = 3$

Similarly, number of students who got calls from IIM-A and IIM-C only = $4 - 4 = 0$

39. How many students of Career Zone got a call from IIM-A only?
(a) 12 (b) 9 (c) 7 (d) None of these

40. How many students of Career Zone got a call from IIM-C only?
 (a) 3 (b) 4 (c) 1 (d) 2
41. The market research department of a certain breakfast cereal firm interviewing 100 persons found that on a certain morning for breakfast (i) 72 had cereals, 39 had fruits, and 75 had toast, (ii) 32 had fruits and cereals, 53 had cereals and toast, and 26 had toast and fruits, (iii) 21 had all the three.
 How many of those interviewed had neither cereals nor toast nor fruits?
 (a) 1 (b) 2 (c) 4 (d) None of these

Direction for Questions 42 to 45: Read the passage below and solve the questions based on it,

Out of 10,000 persons surveyed, 3700 liked City A, 4000 liked City B, and 5000 liked City C. Seven hundred persons liked Cities A and B, 1200 liked Cities A and C, and 1000 liked Cities B and C. Each person liked at least one city.

42. Find the number of persons who liked all the three cities.
 (a) 100 (b) 200 (c) 300 (d) 400
43. Find the number of persons who liked at least two cities as a percentage of number of persons who liked exactly one city.
 (a) 32.4% (b) 29.8% (c) 20.83% (d) 3333%
44. Find the number of persons who liked exactly two cities as a percentage of the number of persons who liked at least one city.
 (a) 21.5% (b) 19.16% (c) 25.5% (d) None of these
45. Find the number of persons who liked City A and City B but not City C.
 (a) 400 (b) 5500 (c) 600 (d) None of these
46. Of the members of three athletic teams in a certain school, 21 are on the basketball team, 26 on the hockey team, and 29 on the football team. Fourteen play hockey and football, 12 play football and basketball, 15 play hockey and football, and 8 are on all the three teams. How many members are there altogether?
 (a) 38 (b) 47 (c) 51 (d) 43

Directions Q47 to Q50: Read the passage below and solve the questions based on it.

CAT 2010 was having four section, namely QA, LR, EU, and RC. Following is the data pertaining to CAT 2010:

Answer the following questions based on the following information:

- The number of students who appeared = 1857
- The number of students who passed in exactly two sections = 232
- The number of students who passed in exactly one section = 132
- The number of students who failed in all the four sections = 292
- The number of students who failed in QA only = 200
- The number of students who failed in LR only = 177
- The number of students who failed in EU only = 108
- The number of students who failed in RC only = 211

A student is assumed to be pass in CAT Examination if he is passed in all the four sections. Further, a student can either pass or fail in the exam.

47. What is the number of students who passed CAT 2010?

- (a) 508 (b) 1011 (c) 812 (d) None of these
48. What is the number of students who failed because of failing in more than two sections?
(a) 108 (b) 324 (c) 672 (d) None of these
49. What is the number of students who failed in QA?
(a) 200 (b) 492 (c) 711 (d) None of these
50. What is the number of students who failed in EU?
(a) 400 (b) 108 (c) 732 (d) Cannot be determined
51. In a class of 200 students, 70 played chess, 60 played hockey, and 80 played football. Thirty played chess and football, 30 played hockey and football, and 40 played chess and hockey. If 130 people played at least one game, then what is the number of people who played all the three games?
(a) 40 (b) 20 (c) 10 (d) None of these

Directions for Q52 and Q53: Read the passage below and solve these questions based on it.

Following is the result of an examination.

Out of 100 students who appeared

- (a) 658 failed in Physics.
(b) 166 failed in physics and Chemistry
(c) 372 failed in Chemistry, and 434 failed in Physics and Biology
(d) 590 Failed in Biology, and 126 failed in Biology and chemistry.
Assuming that none of them passed in all the subjects.
52. Find the number of students who failed in Chemistry but not Physics.
(a) 312 (b) 226 (c) 266 (d) 206
53. Find the number of students who failed in Physics or Biology but not in Chemistry.
(a) 560 (b) 710 (c) 620 (d) None of these

Directions for Q54 and Q55: A survey shows that 41%, 35% and 60% of the people watch "*Maine Pyaar Kiya*" "*Maine Pyaar Kyun Kiya*" and "*Pyaar to Hona Hi Tha*" respectively. 27% people watch exactly two of the three movies and 3% watch none.

54. What percentage of people watch all the three movies ?
(a) 40% (b) 6% (c) 9% (d) 12%
55. If another survey indicates that 16% of the people watch *Maine Pyaar Kiya* and *Pyaar to Hona Hi Tha*, and 14% watch *Maine Pyaar Kyun Kiya* and *Pyaar to Hona Hi Tha*, then what percentage of the people watch only *Maine Pyaar Kyun Kiya* ? (Use the data from the previous question, if necessary)
(a) 10% (b) 8% (c) 12% (d) 15%
56. Find the number of positive integers up to 100 which are not divisible by any 2, 3 and 5 ?
(a) 24 (b) 25 (c) 26 (d) 27

Direction for question number Q57 – Q59: There are 60 Workers who work for M/s. Nottan Dibbawala Pvt. Ltd. Mumbai, out of which 25 are women. Also :

- (i) 28 workers are married
(ii) 26 workers are graduate
(iii) 20 married workers are graduate of which 9 are men

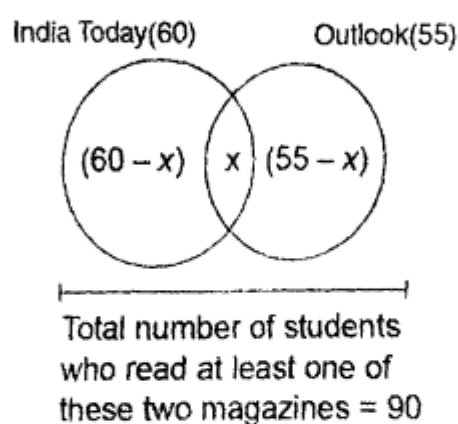
- (iv) 15 men are graduate
(v) 15 men are married.

57. How many unmarried women are graduate ?
(a) 20 (b) 8 (c) 0 (d) can't be determined
58. How many unmarried women work in the company ?
(a) 11 (b) 12 (c) 9 (d) none of these
59. How many graduate men are married ?
(a) 9 (b) 15 (c) 13 (d) none of these

Answer Key & Solution

1. Ans. (c)

Solution: From the following figure:



Method 1

Number of people who read at least one of the magazines

$$= n(\text{India Today} \cup \text{Outlook}) = 100 - 10 = 90$$

$$90 = 60 + 55 - n(\text{India Today} \cap \text{Outlook})$$

$n(\text{India Today} \cap \text{Outlook}) = 25$ Hence, option (c) is the answer.

Method 2

Assume that the number of people who read both magazines = x.

So, the number of people who read only India Today = (60 - x)

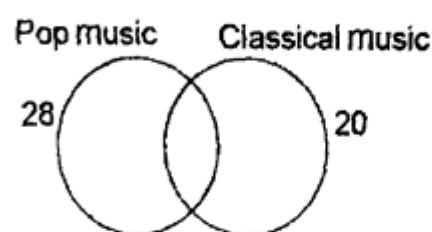
and the number of people who read only Outlook = (55 - x)

$$\text{So, } 60 - x + x + 55 - x = 90 \text{ or } x = 25$$

Hence, option (c) is the answer.

2. Ans. (a)

Solution:



Let the number of people who like both pop and classical music be x.

$$\therefore \text{People who like only pop music} = 28 - x$$

$$\text{People who like only classical music} = 20 - x$$

$$\text{It is given that } 28 - x + 20 - x = 10$$

$$48 - 2x = 10 \text{ or } 2x = 38$$

$$\text{Hence, } x = 19$$

3. Ans. (a)

$$\text{Solution: } n(\text{Sudoku} \cup \text{Crossword}) = 120 - 45 = 75$$

Let the total number of people in Sudoku be $2x$ and Crossword be x .

$$2x + x = 75$$

$$x = 25$$

So, the number of students participating in Sudoku = $2x = 50$ and number of students participating in Crossword = $x = 25$

Hence, option (a) is the answer.

4. Ans. (b)

$$\text{Solution: } n(\text{buffaloes}) = 25 \text{ and } n(\text{cows}) = 20$$

$$n(\text{buffaloes} \cup \text{cows}) = 30$$

$$n(\text{buffaloes} \cup \text{cows}) = n(\text{buffaloes}) + n(\text{cows}) - n(\text{buffaloes} \cap \text{cows})$$

$$30 = 25 + 20 - n(\text{buffaloes} \cap \text{cows}) \text{ or } n(\text{buffaloes} \cap \text{cows}) = 15$$

Hence, option (b) is the answer.

5. Ans. (d)

Solution: $n(\text{butter} \cup \text{chocolate}) = n(\text{butter}) + n(\text{chocolates}) - n(\text{butter} \cap \text{chocolate})$
 Given that every Australian likes at least one of the two, and hence, $n(\text{butter} \cup \text{chocolate}) = 100\%$ or $100\% = 89\% + 79\% - n(\text{butter} \cap \text{chocolate})$

Therefore, $n(\text{butter} \cap \text{chocolate}) = 68\%$

Hence, option (d) is the answer.

6. Ans. (c)

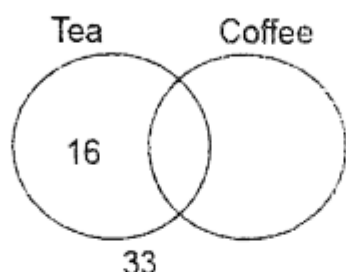
Solution: $n(S \cup T) = n(S) + n(T) - n(S \cap T)$

$n(S \cup T) = 21 + 32 - 11 = 42$

So, option (c) is the answer.

7. Ans. (d)

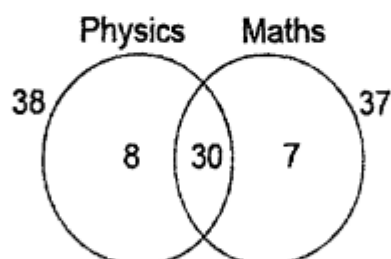
Solution:



Clearly, we cannot find out the number of people who drink only coffee because it is not known how many people drink at least one of the two.

8. Ans. (d)

Solution:



Number of students who failed in both the subjects $= 50 - 45 = 5$.

Hence, option (d) is the answer.

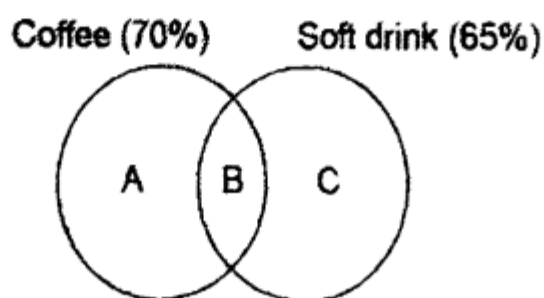
9. Ans. (a)

Solution: $n(\text{tea} \cup \text{coffee}) = n(\text{tea}) + n(\text{coffee}) - n(\text{tea} \cap \text{coffee})$

10. Ans. (a)

Solution:

Method I:



From the diagram $A + 2B + C = 70 + 65$

$A + 2B + C = 135\%$

(i)

It is given that $A + B + C = 100 - 27 = 73\%$

(ii)

Then, from equation (i) and equation (ii) $B =$

62% of the people and $B = 248$

Since 62% of the people = 248

Then, 100% of the people $= \frac{248}{62} \times 100 = 400$

Method 2

$n(\text{coffee} \cup \text{soft drink}) = n(\text{coffee}) + n(\text{soft drink}) - n(\text{coffee} \cap \text{soft drink})$

$73 = 70 + 65 - n(\text{coffee} \cap \text{soft drink})$

$n(\text{coffee} \cap \text{soft drink}) = 62\%$

62% = 248

$\therefore 100\% = \frac{248}{62} \times 100 = 400$

Hence, option (a) is the answer.

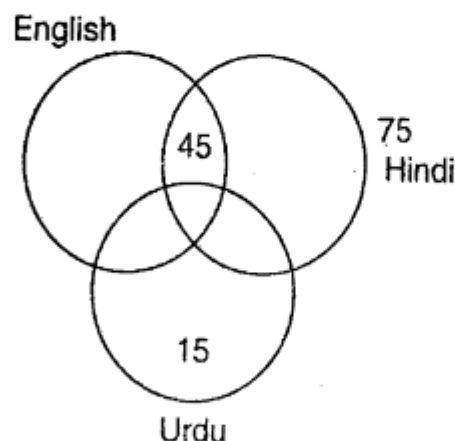
11. Ans. (b)

Solution: solution to this question requires only the application of

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

12. Ans. (b)

Solution:



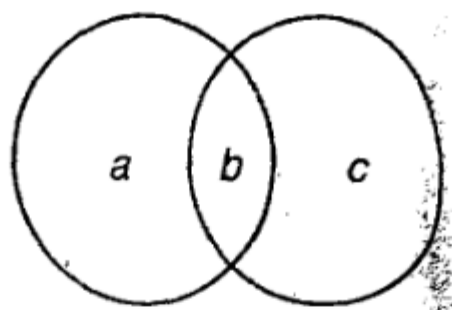
It is clear that 45% people cannot read another third (i.e., Urdu) newspaper. Besides them all of the rest people can read Urdu newspaper. Hence maximum 55% $(100 - 45)$ people can read Urdu newspaper.

13. Ans. (a)

Solution: Let a be the number of engineers only
 c be the number of MBAs only

b be the number of employees who are both engineers and MBAs and

d be the number of employees who are neither engineer nor MBA



$$\therefore a + b + c + d = 80$$

....(1)

$$(a+b) = 2(b+c) \rightarrow (a-b) = 2c$$

....(2)

$$\text{And } c + d = 32$$

.... (3)

$$\text{And } a + d = 56$$

.... (4)

$$\text{And } b = 2c$$

.... (5)

From eq. (2) and (5), we get

$$a = 2b$$

.... (6)

From eq. (1) and (3), we get

$$a + b = 48$$

From eq. (6), we get

$$b = 16$$

$$a = 32$$

(from eq. 6)

$$\text{and } c = 8$$

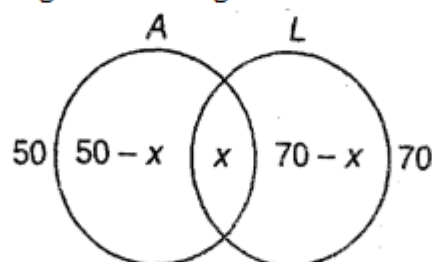
(from eq. 5)

$$\text{and } d = 24$$

(from eq. 5)

14. Ans. (b)

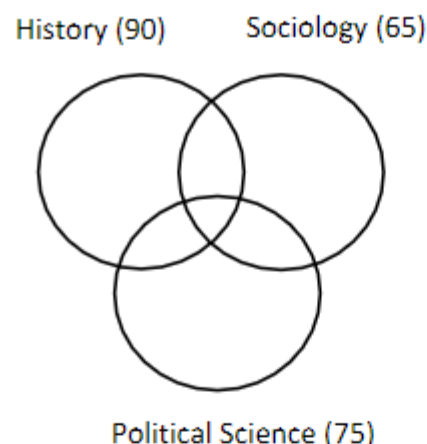
Solution: For the minimum value of x people who like only arrange marriage and only love marriage must be greater



$$x = (70 + 50) - 80 = 40$$

For the maximum value of x : $(50 - x)$ and $(70 - x)$ must not be negative, therefore max, possible value of x is 50.

Solution for Question 15 and 16



The given situation can be read as follows:

115 students are being counted $75+65+90 = 230$ times.

This means that there is an extra count of 115.

This extra count of 115 can be created in 2 ways.

- By putting people in the 'passed exactly two subject' category. In such a case each person would get counted 2 times (double counted), i.e. an extra count of 1.
- By putting people in the 'all three' category, each person put there would be triple counted. 1 person counted 3 times- meaning an extra count of 2 per person.

The problem tells us that there are 55 students who passed exactly two subjects. This means an extra count of 55 would be accounted for.

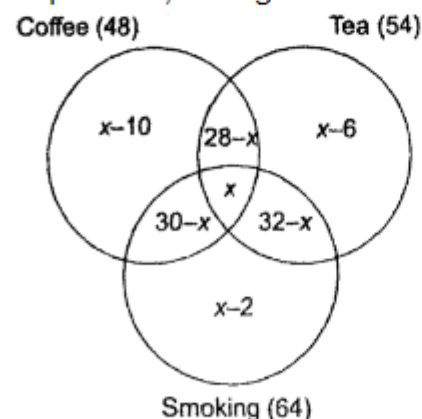
This would leave an extra count of $115 - 55 = 60$ more to be accounted for by 'passed all three' category. This can be done by using 30 people in the 'all 3' category.

Hence, the answers are:

15. Ans: (b)

16. Ans: (a)

Solution for (Q17 to Q23): If you try to draw a figure for this question, the figure would be something like:



We can then solve this as:

$$x-10 + 28-x + x + 30-x + x + 2 + 32-x + x - 6 = 94 \rightarrow x + 76 = 94 \rightarrow x = 18.$$

Note: In this question, since all the values for the use of the set theory formula are given, we

can find the missing value of students who liked all three as follows:

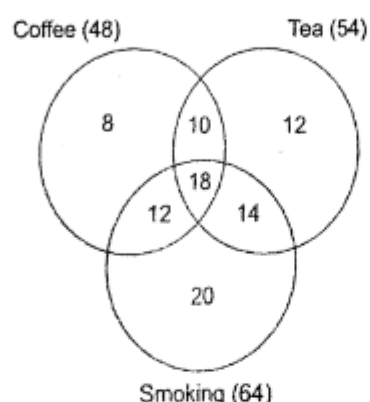
$$94 = 48 + 54 + 64 - 28 - 32 - 30 + \text{All three} \rightarrow$$

all three = 18

As you can see this is a much more convenient way of solving this question, and the learning you take away for the 3 circle situation is that whenever you have all the values known and the only unknown value is the center value - it is wiser and more efficient to solve for the unknown using the formula rather than trying to solve through a Venn diagram.

Based on this value of x we get the diagram

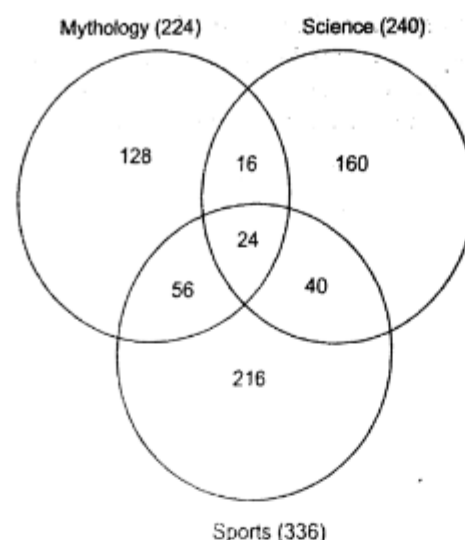
completed as:



The answers then are:

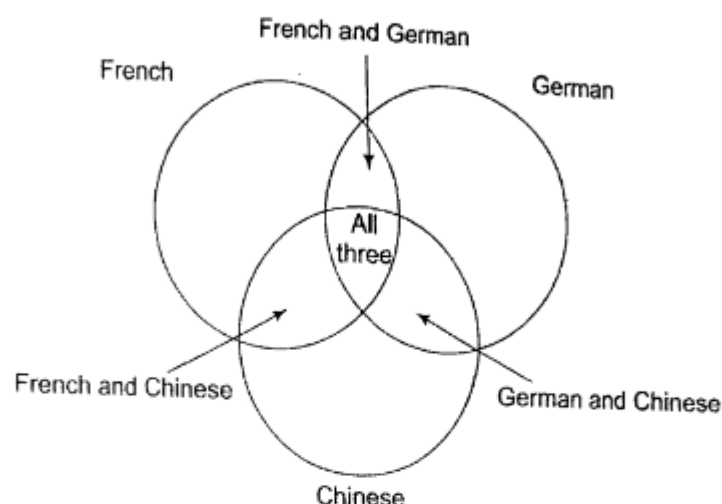
17. Ans. (c)
Solution: $8:12 = 2:3 \rightarrow$ Option (c) is correct.
18. Ans. (b)
Solution: 12 % of 2000 = 240. Option (b) is correct.
19. Ans. (a)
Solution: $30/94 \rightarrow$ more than 30%. Option (a) is correct.
20. Ans. (d)
Solution: 94%. Option (d) is correct.
21. Ans. (c)
Solution: Option (c) is correct as the ratio turns out to be 10:20 in that case.
22. Ans. (b)
Solution: $12:12 = 1:1 \rightarrow$ Option (b) is correct.
23. Ans. (a)
Solution: 14%. Option (a) is correct.

Solution for Q24 to Q28: The following figure would emerge on using all the information in the question:



24. Ans. (d)
Solution: $240/880 = 27.27\%$ option (d) is correct.
25. Ans. (c)
Solution: $504/880 = 57.27\%$ Hence, less than 60. Option (c) is correct.
26. Ans. (c)
Solution: $40 + 16 + 56 + 24 = 136$, option (c) is correct.
27. Ans. (a)
Solution: Option a gives us $16:128 = 1:8$ option (a) is hence correct.
28. Ans. (b)
Solution: $40:160 \rightarrow 1:4$. Option (b) is correct.
29. Ans. (b)
Solution: (b) In order to estimate the minimum number of customers we need to assume that each customer must have bought the maximum number of pastries possible for him to purchase. Since, the maximum number of pastries an individual could purchase is constrained by the information that no one bought more than two pastries of any one kind—this would occur under the following situation First 45 people would buy 2 pastries of all three kinds, which would completely exhaust the 90 pineapple pastries and leave the bakery with 30 chocolate and 60 black forest pastries. The next 15 people would buy 2 pastries each of the available kinds and after this we would be left with 30 black forest pastries. 15 people would buy these pastries, each person buying 2 pastries each. Thus, the total number of people (minimum) would be: $45 + 15 + 15 = 75$.
30. Ans. (c)
Solution: (c) In order to think about this question, the best way is to use the process of slack thinking. In this question, we have 180

students counted 270 times. This means that there is an extra count of 90 students. In a three circle venn diagram, extra counting can occur only due to exactly two regions (where 1 individual student would be counted in two subjects leading to an extra count of 1) and the exactly three region (where 1 individual student would be counted in 3 subjects leading to an extra count of 2). This can be visualised in the figure below:



A student placed in the all three area will be counted three times when you count the number of students studying French, the number of students studying German and the number of students studying Chinese independently. Hence, HE/SHE would be counted three times—leading to an extra count of 2 for each individual places here.

A person placed in any of the three 'Exactly two' areas would be counted two times when we count the number of students studying French, the number of students studying German and the number of students studying Chinese independently. Hence, HE/ SHE would be counted two times—leading to an extra count of 1 for each individual placed in any of these three areas.

The thought chain leading to the solution would go as follows:

- (i) 180 students are counted $80 + 90 + 100 = 270$ times.
- (ii) This means that there is an extra count of 90 students.
- (iii) Extra counts can fundamentally occur only from the 'exactly two' areas or the all three area in the figure.
- (iv) We also know that 'The number of students who study more than one of the three

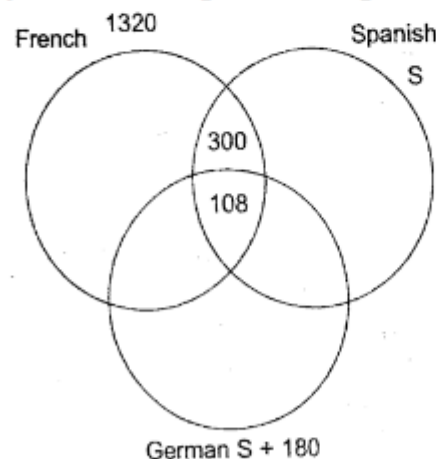
subjects is 50% more than the number of students who study all the three subjects' hence we know that if there are a total of V students studying all three subjects, there would be $1.5n$ students studying more than one subject. This in turn means that there must be $0.5n$ students who study two subjects.

(Since, number of students studying more than 1 subject = number of students studying two subjects + number of students studying three subjects,
i.e. $1.5n = n + \text{number of students studying 2 subjects} \rightarrow \text{number of students studying 2 subjects} = 1.5n - n = 0.5n$)

- (v) The extra counts from the n students studying 3 subjects would amount to $n \times 2 = 2n$ - since each student is counted twice extra when he/she studies all three subjects.
- (vi) The extra counts from the $0.5n$ students who study exactly two subjects would be equal to $0.5n \times 1 = 0.5n$.
- (vii) Thus extra count = $90 = 2n + 0.5n \rightarrow 90/2.5 = 36$.
- (viii) Hence, there must be 36 people studying all three subjects.

31. Ans. (b)

Solution: In order to think about the possibility of the maximum and/or the minimum number of people who could be studying none of the three languages, you need to first think of the basic information in the question. The basic information in the question can be encapsulated by the following Venn diagram:



At this point we have the flexibility to try to put the remaining numbers into this Venn diagram while maintaining the constraints the question has placed on the relative numbers in the figure. In order to do this, we need to think of the

objective with which we have to fill in the remaining numbers in the figure. At this stage you have to keep two constraints in mind while filling the remaining numbers:

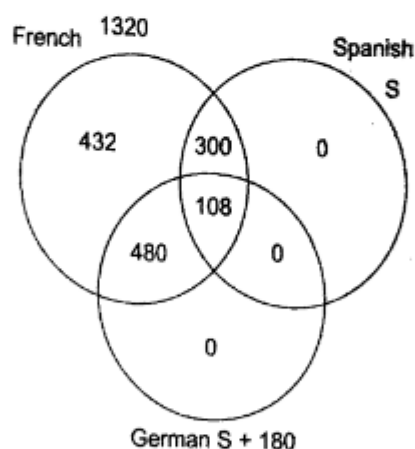
(a) The remaining part of the French circle has to total $1320 - 408 - 912$;

(b) The German circle has to be 180 more than the Spanish circle.

When we try to fill in the figure for making the number of students who did not study any of the three subjects maximum:

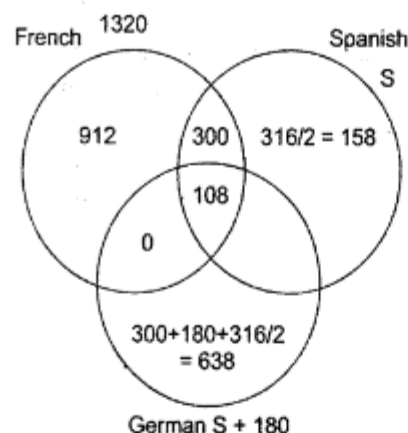
You can think of first filling the French circle by trying to think of how you would want to distribute the remaining 912 in that circle. When we want to maximise the number of students who study none of the three, we would need to use the minimum number of people inside the three circles—while making sure that all the constraints are met. Since we have to forcefully fit in 912 into the remaining areas of the French circle, we need to see whether while doing the same we can also meet the second constraint.

This thinking would lead you to see the following solution possibility:



In this case we have ensured that the German total is 180 more than the Spanish total (as required) and at the same time the French circle has also reached the desired 1320. Hence, the number of students who study none of the three can be $2116 - 1320 = 796$ (at maximum).

When minimising the number of students who have studied none of the three subjects, the objective would be to use the maximum number of students who can be used in order to meet the basic constraints. The answer in this case can be taken to as low as zero in the following case:

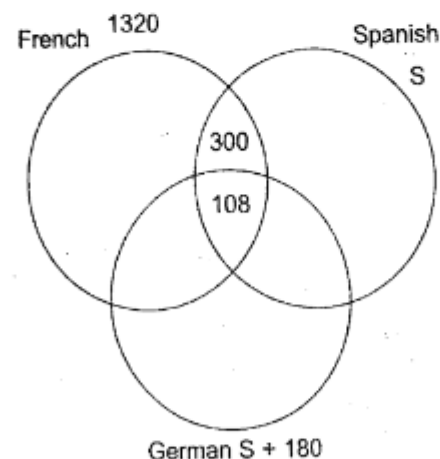


Note: While thinking about the numbers in this case, we first use the 912 in the 'only French' area. At this point we have 796 students left to be allocated. We first make the German circle 180 more than the Spanish circle (by taking the only German as $300 + 180$ to start with, this is accomplished). At this point, we are left with 316 more students, who can be allocated equally as $316 \div 2$ for both the 'only German' and the 'only Spanish' areas.

Thus, the minimum number of students who study none of the three is 0.

32. Ans. (b)

Solution: In order to think about the possibility of the maximum and/or the minimum number of people who could be studying none of the three languages, you need to first think of the basic information in the question. The basic information in the question can be encapsulated by the following Venn diagram:



At this point we have the flexibility to try to put the remaining numbers into this Venn diagram while maintaining the constraints the question has placed on the relative numbers in the figure. In order to do this, we need to think of the objective with which we have to fill in the remaining numbers in the figure. At this stage

you have to keep two constraints in mind while filling the remaining numbers:

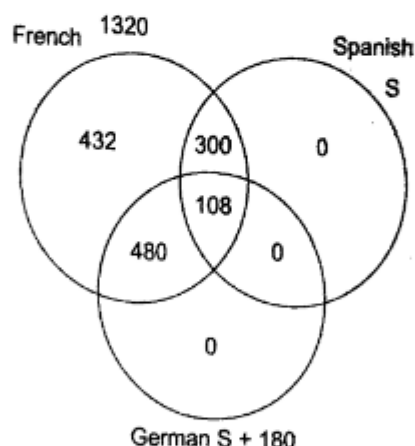
(a) The remaining part of the French circle has to total $1320 - 408 - 912$;

(b) The German circle has to be 180 more than the Spanish circle.

When we try to fill in the figure for making the number of students who did not study any of the three subjects maximum:

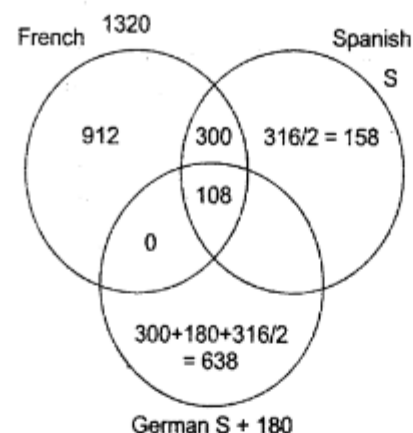
You can think of first filling the French circle by trying to think of how you would want to distribute the remaining 912 in that circle. When we want to maximise the number of students who study none of the three, we would need to use the minimum number of people inside the three circles—while making sure that all the constraints are met. Since we have to forcefully fit in 912 into the remaining areas of the French circle, we need to see whether while doing the same we can also meet the second constraint.

This thinking would lead you to see the following solution possibility:



In this case we have ensured that the German total is 180 more than the Spanish total (as required) and at the same time the French circle has also reached the desired 1320. Hence, the number of students who study none of the three can be $2116 - 1320 = 796$ (at maximum).

When minimising the number of students who have studied none of the three subjects, the objective would be to use the maximum number of students who can be used in order to meet the basic constraints. The answer in this case can be taken to as low as zero in the following case:



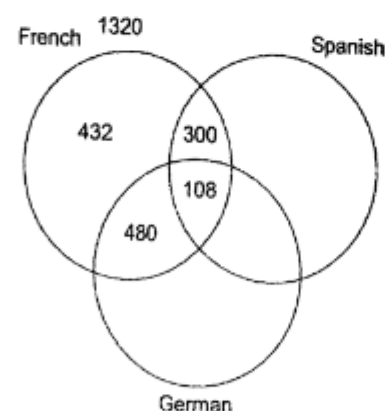
Note: While thinking about the numbers in this case, we first use the 912 in the 'only French' area. At this point we have 796 students left to be allocated. We first make the German circle 180 more than the Spanish circle (by taking the only German as $300 + 180$ to start with, this is accomplished). At this point, we are left with 316 more students, who can be allocated equally as $316 \div 2$ for both the 'only German' and the 'only Spanish' areas.

Thus, the minimum number of students who study none of the three is 0.

33. Ans. (d)

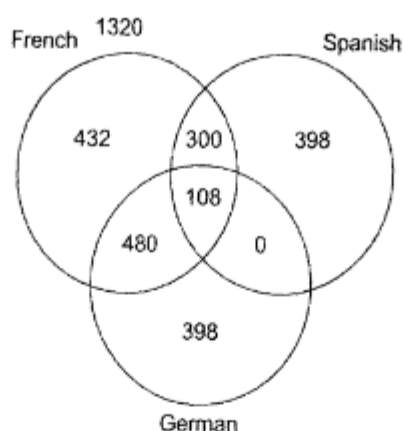
Solution: In order to think about this question, let us first see the situation we had in order to maintain all constraints.

If we try to fit in the remaining constraints in this situation we would get:

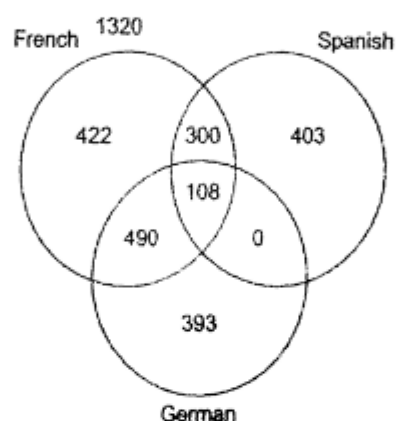


This leaves us with a slack of 796 people which would need to be divided equally since we cannot disturb the equilibrium of German being exactly 180 more than Spanish.

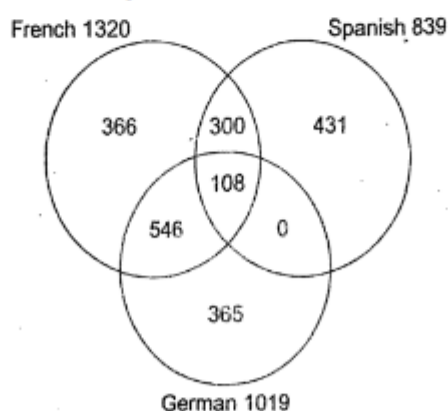
This gives us the following figure:



When you think about this situation, you realise that it is quite possible to increase Spanish if we reduce the only French area and reallocate the reduction into the 'only French' and German area. A reduction of 10 from the 'only French' area can be visualised as follows:

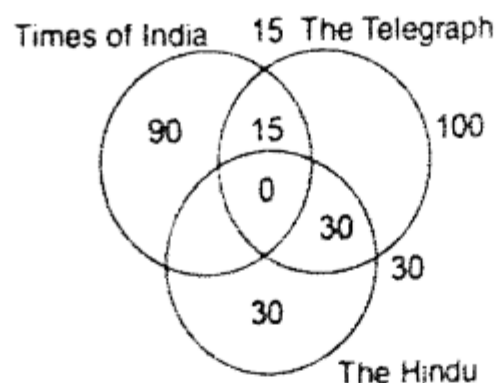


In this case, as you can see from the figure above, the number of students who study only Spanish has gone up by 5 (which is half of 10). Since, there is still some gap between the 'only German' and the 'only French' areas in the figure, we should close that gap by reducing the 'only French' area as much as possible. The following solution figure would emerge when we think that way:



Hence, the maximum possible for the only Spanish area is 431.

Solution for (Q34 to Q38)



Families who buy The Telegraph only = $100 - 30 - 15 = 55$

Similarly, families who buy Times of India and The Hindu both

$$= 240 - (100 + 30 + 90) = 20$$

34. Ans. (c)

35. Ans. (b)

Solution: Hence, option (b) is the answer.

36. Ans. (b)

Solution: Families who read only one newspaper = $90 + 30 + 55 = 175$ Hence, option (b) is the answer.

37. Ans. (c)

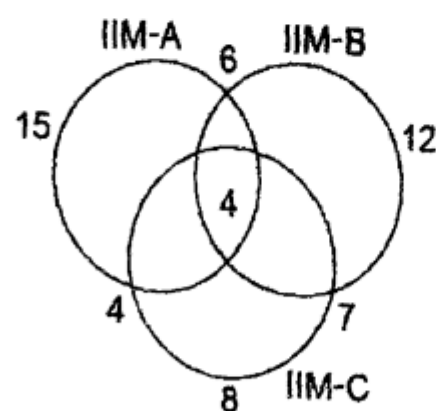
Solution: Clearly, Times of India is the most popular newspaper as it is read by 125 families. Hence, option (c) is the answer.

38. Ans. (b)

Solution: The Hindu is the least popular newspaper as it is read by 80 families only. Hence, option (a) is the answer.

Solution for Q39 and 40:

Solution:



Since 6 students got calls from both IIM-A and IIM-B and 4 students got calls from all the three IIMs, number of students who got calls from IIM-A and IIM-B only = $6 - 4 = 2$

Similarly, number of students who got calls from IIM-B and IIM-C only = $7 - 4 = 3$

Similarly, number of students who got calls from IIM-A and IIM-C only = $4 - 4 = 0$

39. Ans. (b)

Solution: Students who got call from IIM-A only
 $= 15 - [6 + 0] = 9$

Hence, option (b) is the answer.

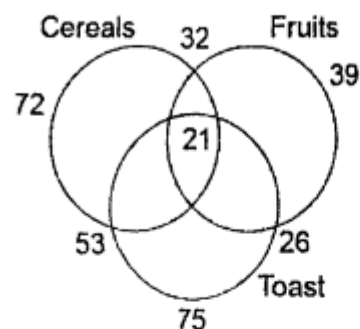
40. Ans. (c)

Solution: Students who got call from IIM-C only
 $= 8 - 7 = 1$.

Hence, option (c) is the answer.

41. Ans. (c)

Solution:



Only cereals and fruits $= 32 - 21 = 11$

Only fruits and toast $= 26 - 21 = 5$

Only cereals and toast $= 53 - 21 = 32$

Only cereals $= 72 - 32 - 32 = 8$

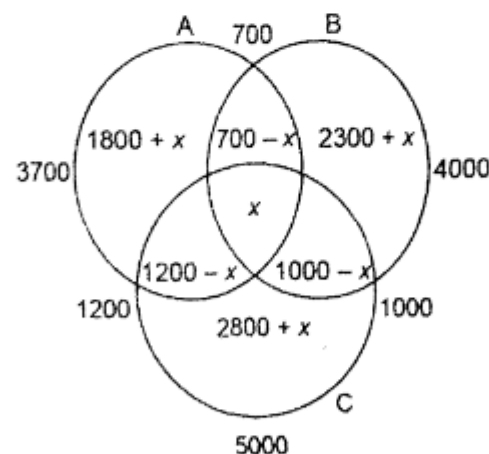
Only fruits $= 39 - 32 - 5 = 2$

Neither of the three \rightarrow only toast $= 75 - 53 - 5 = 17$

$100 - [72 + 2 + 5 + 17] = 4$

Hence, option (c) is the answer.

Solution for Q42 to Q45



42. Ans. (b)

Solution:

Let the number of people who liked all the three cities be x .

$3700 + 2300 + x + 1000 - x + 2800 + x = 10,000$
 $x = 200$

Hence, option (b) is the answer.

43. Ans. (d)

Solution: Number of persons who liked at least 2 cities $= 500 + 800 + 1000 + 200 = 2500$

Number of persons who liked exactly 1 city $= 2000 + 2500 + 3000 = 7500$

\therefore Required percentage $= \frac{2500}{7500} \times 100 = 33.33\%$

Hence, option (d) is the answer.

44. Ans. (b)

Solution: Number of persons who liked exactly 2 cities $= 500 + 800 + 1000 = 2300$

\therefore Required percentage $= \frac{2300}{1000} \times 100 = 23\%$

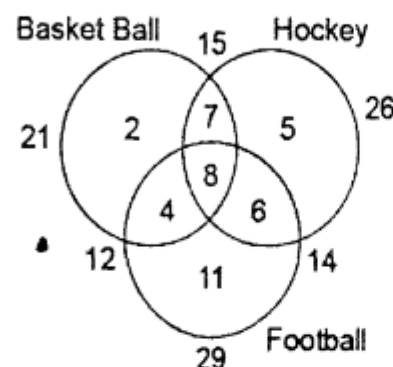
45. Ans. (a)

Solution: Number of persons who liked Cities A and B but not City

$C = 2000 + 500 + 2500 = 5000$

46. Ans. (d)

Solution:



Total number of members $= 21 + 11 + 11 = 43$

Hence option (d) is the answer.

47. Ans. (d)

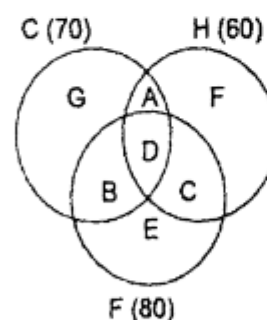
48. Ans. (d)

49. Ans. (d)

50. Ans. (d)

51. Ans. (b)

Solution:



From the diagram, it is given that

$A + D = 40$, $C + D = 30$ and $B + D = 30$

It is also given that,

$A + B + C + D + E + F + G = 130$ and $G + B + A + D = 70$

$F + A + C + D = 60$

$B + C + D + E = 80$

Then from these equations, we can find D, which is equal to 10.

52. Ans. (d)

Solution: It is a simple application of the formula:

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

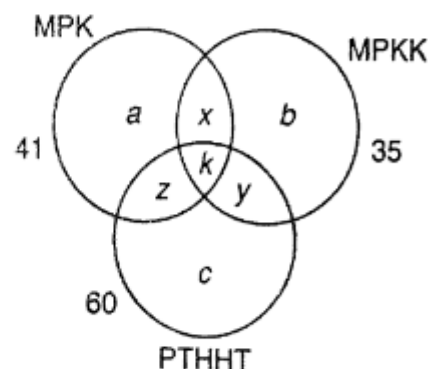
53. Ans. (d)

Solution: It is a simple application of the formula:

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

54. Ans. (b)

$$\text{Solution: } \alpha + \beta + \gamma = 97\%$$



$$\alpha + 2\beta + 3\gamma = 41 + 35 + 60 = 136\%$$

$$\text{but } \beta = (x + y + z) = 27\%$$

$$\therefore (\alpha + 2\beta + 3\gamma) - (\alpha + \beta + \gamma) = \beta + 2\gamma = 39\%$$

$$(\beta + 2\gamma) - \beta = 2\gamma = 39 - 27 = 12\%$$

$$\gamma = 6\% = (k)$$

$$\therefore 6\% \text{ People watch all the three movies}$$

55. Ans. (c)

$$\text{Solution: } z + k = 16 \rightarrow z = 10$$

$$\{\therefore \gamma = k = 6\}$$

$$y + k = 14 \rightarrow y = 8$$

$$x = 9$$

$$\{\therefore x + y + z = 27\}$$

$$\therefore b = 35 - (x + k + y) = 35 - (9 + 6 + 8) = 12\%$$

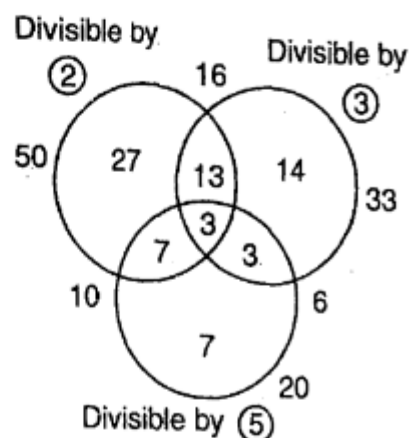
56. Ans. (c)

Solution: Total numbers divisible by 2 upto 100 = 50

Total numbers divisible by 3 upto 100 = 33

Total numbers divisible by 5 upto 100 = 20

Total numbers divisible by 2 and 3 i.e., 6 upto 100 = 16



Total numbers divisible by 3 and 5 i.e., 15 upto 100 = 6

Total numbers divisible by 2 and 5 i.e., 10 upto 100 = 10

Total numbers divisible by 2, 3 and 5 i.e., 30 upto 100 = 3

\therefore Total number of numbers upto 100 which are divisible by at least one of 2, 3 and 5 = 74

\therefore Total number of numbers upto 100 which are not divisible by any 2, 3 or 5 = 100 - 74 = 26

Solution for Q57 – Q59: Total number of employees = 60

Women = 25

Men = 35

Married workers = 28

Graduate workers = 26

a \rightarrow unmarried men who are not graduate

b \rightarrow married women who are not graduate

c \rightarrow unmarried women who are graduate

x \rightarrow married men who are not graduate

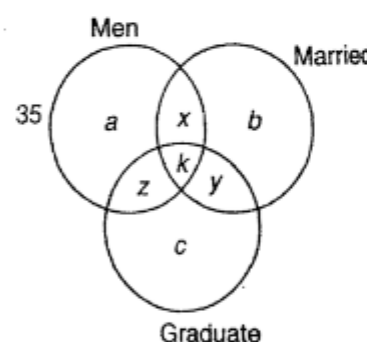
y \rightarrow married women who are graduate

z \rightarrow unmarried men who are graduate

k \rightarrow married men who are graduate

p \rightarrow unmarried women who are not graduate

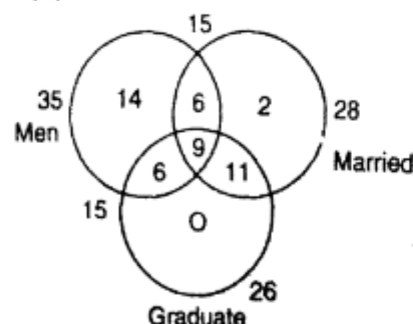
According to the given information the Venn diagram can be completed as given below.



57. Ans. (c)

Solution: No one unmarried woman is graduate.

Hence (c)



58. Ans. (b)

Solution: Number of unmarried women

$$= 60 - [14 + 2 + 6 + 6 + 11 + 9] = 12$$

59. Ans. (a)

Solution: There are 9 graduate men who are married