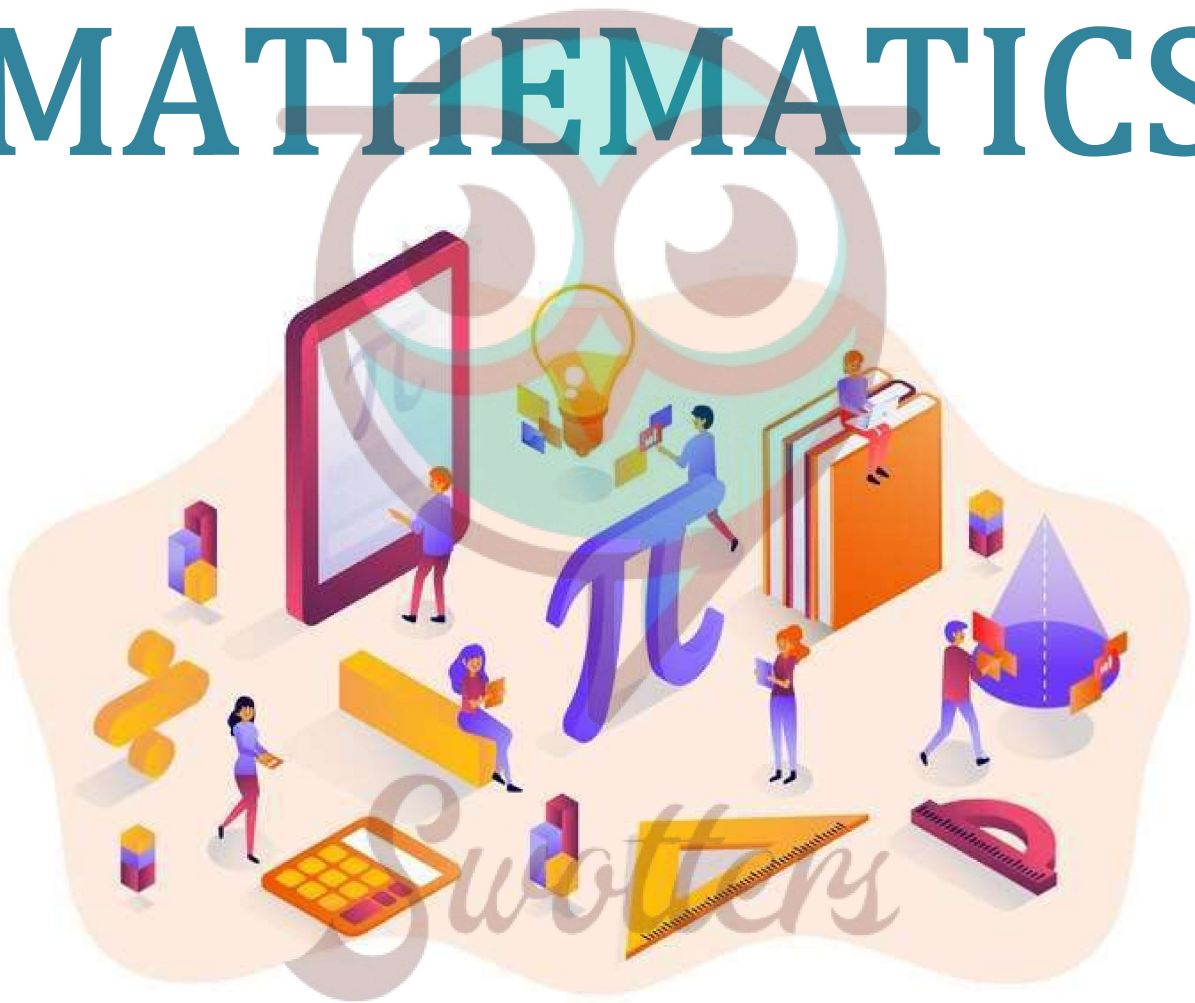


MATHEMATICS



Important Questions

Multiple Choice questions-

1. Cumulative frequency curve is also called

- (a) histogram
- (b) ogive
- (c) bar graph
- (d) median

2. The relationship between mean, median and mode for a moderately skewed distribution is

- (a) mode = median – 2 mean
- (b) mode = 3 median – 2 mean
- (c) mode = 2 median – 3 mean
- (d) mode = median – mean

3. The median of set of 9 distinct observations is 20.5. If each of the largest 4 observations of the set is increased by 2, then the median of the new set

- (a) is increased by 2
- (b) is decreased by 2
- (c) is two times of the original number
- (d) Remains the same as that of the original set.

4. Mode and mean of a data are 12k and 15A. Median of the data is

- (a) 12k
- (b) 14k
- (c) 15k
- (d) 16k

5. The times, in seconds, taken by 150 athletes to run a 110 m hurdle race are tabulated below:

| Class | Frequency |
|-------------|-----------|
| 13.8 – 14.0 | 2 |
| 14.0 – 14.2 | 4 |
| 14.2 – 14.4 | 5 |
| 14.4 – 14.6 | 71 |
| 14.6 – 14.8 | 48 |
| 14.8 – 15.0 | 20 |

The number of athletes who completed the race in less than 14.6 seconds is:

- (a) 11
- (b) 71
- (c) 82
- (d) 130

6. The abscissa of the point of intersection of the less than type and of the more than type cumulative frequency curves of a grouped data gives its

- (a) mean
- (b) median
- (c) mode
- (d) all the three above

7. While computing mean of grouped data, we assume that the frequencies are:

- (a) evenly distributed over all the classes
- (b) centred at the classmarks of the classes
- (c) centred at the upper limits of the classes
- (d) centred at the lower limits of the classes

8. Mean of 100 items is 49. It was discovered that three items which should have been 60, 70, 80 were wrongly read as 40, 20, 50 respectively. The correct mean is
- (a) 48
 - (b) 49
 - (c) 50
 - (d) 60
9. While computing mean of grouped data, we assume that the frequencies are
- (a) centred at the upper limits of the classes
 - (b) centred at the lower limits of the classes
 - (c) centred at the classmarks of the classes
 - (d) evenly distributed over all the classes
10. Which of the following can not be determined graphically?
- (a) Mean
 - (b) Median
 - (c) Mode
 - (d) None of these

Very Short Questions:

1. In a continuous frequency distribution, the median of the data is 21. If each observation is increased by 5, then find the new median.
2. From the following frequency distribution, find the median class:

| <i>Cost of living index</i> | <i>No. of weeks</i> |
|-----------------------------|---------------------|
| 1400-1550 | 8 |
| 1550-1700 | 15 |
| 1700-1850 | 21 |
| 1850-2000 | 8 |

3. Consider the following distribution, find the frequency of class 30-40.

| Marks obtained | No. of Students |
|----------------|-----------------|
| 0 or more | 63 |
| 10 or more | 58 |
| 20 or more | 55 |
| 30 or more | 51 |
| 40 or more | 48 |
| 50 or more | 42 |

4. Following table shows sale of shoes in a store during one month:

| Size of shoe | No. of pairs sold |
|--------------|-------------------|
| 3 | 4 |
| 4 | 18 |
| 5 | 25 |
| 6 | 12 |
| 7 | 5 |
| 8 | 1 |

Find the modal size of the shoes sold.

5. Weekly household expenditure of families living in a housing society are shown below:

| Weekly expenditure (in ₹) | No. of families (f) |
|---------------------------|---------------------|
| Up to 3000 | 4 |
| 3000-6000 | 25 |
| 6000-9000 | 31 |
| 9000-12000 | 48 |
| 12000-15000 | 10 |

Find the upper limit of the modal class.

- Find the class mark of the class 10 – 25.
- Find the mean of the first five natural numbers.
- A data has 13 observations arranged in descending order. Which observation represents the median of data?
- If the mode of a distribution is 8 and its mean is also 8, then find median.
- In an arranged series of an even number of $2n$ terms which term is median?

Short Questions :

1. If x_i 's are the mid-points of the class intervals of a grouped data. f_i 's are the corresponding frequencies and \bar{x} is the mean, then find $\sum f_i (x_i - \bar{x})$.
2. Consider the following frequency distribution.

| | | | | | |
|------------------|-----|------|-------|-------|-------|
| Class | 0-5 | 6-11 | 12-17 | 18-23 | 24-29 |
| Frequency | 13 | 10 | 15 | 8 | 11 |

3. Find the median class of the following distribution:

| | | | | | | | |
|------------------|------|-------|-------|-------|-------|-------|-------|
| Class | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 |
| Frequency | 4 | 4 | 8 | 10 | 12 | 8 | 4 |

4. Find the class marks of classes 15.5 – 18.5 and 50 – 75.
5. If the mean of the following distribution is 6, find the value of p .

| | | | | | |
|-----------------------|---|---|---|----|---------|
| x | 2 | 4 | 6 | 10 | $p + 5$ |
| f | 3 | 2 | 3 | 1 | 2 |

6. Find the mean of the following distribution:

| | | | | | |
|-----------------------|---|----|----|----|----|
| x | 4 | 6 | 9 | 10 | 15 |
| f | 5 | 10 | 10 | 7 | 8 |

7. The following data gives the information on the observed lifetimes (in hours) of 225 electrical components:

| | | | | | | |
|----------------------------|------|-------|-------|-------|--------|---------|
| Lifetime (in hours) | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 | 100-120 |
| Frequency | 10 | 35 | 52 | 61 | 38 | 29 |

Determine the modal lifetimes of the components.

8. The distribution below gives the weights of 30 students of a class. Find the median weight of the students.

| | | | | | | | |
|---------------------------|-------|-------|-------|-------|-------|-------|-------|
| Weight (in kg) | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | 65-70 | 70-75 |
| Number of students | 2 | 3 | 8 | 6 | 6 | 3 | 2 |

Long Questions :

1. The following table gives the literacy rate (in percentage) of 35 cities. Find the mean literacy rate.

| | | | | | |
|-----------------------------|-------|-------|-------|-------|-------|
| Literacy rate (in %) | 45-55 | 55-65 | 65-75 | 75-85 | 85-90 |
| Number of Cities | 3 | 10 | 11 | 8 | 3 |

2. The following distribution shows the daily pocket allowance of children of a locality. The mean pocket allowance is ₹ 18. Find the missing frequency f.

| | | | | | | | |
|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Daily pocket allowance (in ₹) | 11-13 | 13-15 | 15-17 | 17-19 | 19-21 | 21-23 | 23-25 |
| Number of children | 7 | 6 | 9 | 13 | f | 5 | 4 |

3. The mean of the following frequency distribution is 62.8. Find the missing frequency x.

| | | | | | | |
|------------------|------|-------|-------|-------|--------|---------|
| Classes | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 | 100-120 |
| Frequency | 5 | 8 | x | 12 | 7 | 8 |

4. The distribution below gives the marks of 100 students of a class.

| | | | | | | | | |
|---------------------------|-----|------|-------|-------|-------|-------|-------|-------|
| Marks | 0-5 | 5-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 |
| Number of students | 4 | 6 | 10 | 10 | 25 | 22 | 18 | 5 |

5. During the medical check-up of 35 students of a class, their weights were recorded as follows:

| Weight (in kg) | Number of students | Weight (in kg) | Number of students |
|-----------------------|---------------------------|-----------------------|---------------------------|
| Less than 38 | 0 | Less than 46 | 14 |
| Less than 40 | 3 | Less than 48 | 28 |
| Less than 42 | 5 | Less than 50 | 32 |
| Less than 44 | 9 | Less than 52 | 35 |

Draw a less than type ogive for the given data. Hence, obtain the median weight from the graph and verify the result by using the formula.

Case Study Questions:

1. A petrol pump owner wants to analyse the daily need of diesel at the pump. For this he

collected the data of vehicles visited in 1hr. The following frequency distribution table shows the classification of the number of vehicles and quantity of diesel filled in them.

| | | | | | |
|---------------------------|-----|-----|-----|------|-------|
| Diesel Filled (in Litres) | 3-5 | 5-7 | 7-9 | 9-11 | 11-13 |
| Number of vehicles | 5 | 10 | 10 | 7 | 8 |



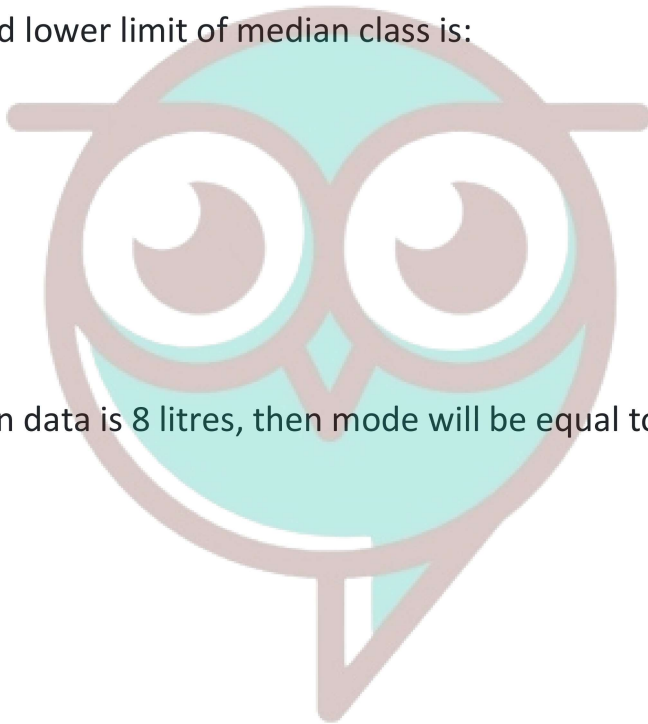
i. Which of the following is correct?

- a. If x_i and f_i are sufficiently small, then direct method is appropriate choice for calculating mean.
- b. If x_i and f_i are sufficiently large, then direct method is appropriate choice for calculating mean.
- c. If x_i and f_i are sufficiently small, then assumed mean method is appropriate choice for calculating mean.
- d. None of the above.

ii. Average diesel required for a vehicle is:

- a. 8.15 litres
- b. 6 litres
- c. 7 litres
- d. 5.5 litres

- iii. If approximately 2000 vehicles comes daily at the petrol pump, then how much litres of diesel the pump should have?
- 16200 litres
 - 16300 litres
 - 10600 litres
 - 15000litres
- iv. The sum of upper and lower limit of median class is:
- 22
 - 10
 - 16
 - None of this.
- v. If the median of given data is 8 litres, then mode will be equal to:
- 7.5 litres
 - 7.7 litres
 - 5.7 litres
 - 8 litres



2. A bread manufacturer wants to know the lifetime of the product. For this, he tested the lifetime of 400 packets of bread. The following tables gives the distribution of the lifetime of 400 packets.

| Lifetime (in hours) | Number of packets (Cumulative frequency) |
|---------------------|--|
| 150-200 | 14 |
| 200-250 | 70 |
| 250-300 | 130 |
| 300-350 | 216 |
| 350-400 | 290 |
| 400-450 | 352 |
| 450-500 | 400 |

- i. If m be the class mark and b be the upper limit of a class in a continuous frequency distribution, then lower limit of the class is:

- a. $2m + \sqrt{b}$
- b. $2m + b$
- c. $m - b$
- d. $2m - b$

ii. The average lifetime of a packet is:

- a. 341hrs
- b. 300hrs
- c. 340hrs
- d. 301hrs

iii. The median lifetime of a packet is:

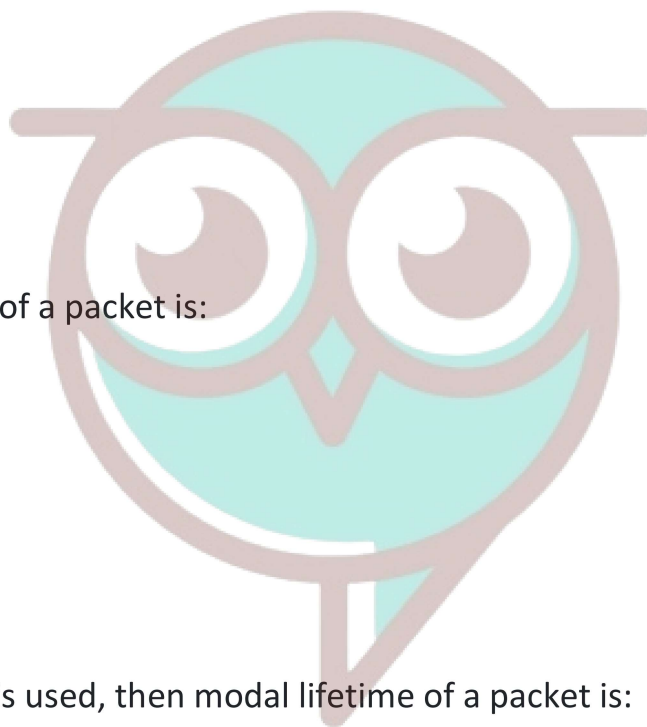
- a. 347hrs
- b. 340hrs
- c. 346hrs
- d. 342hrs

iv. If empirical formula is used, then modal lifetime of a packet is:

- a. 340hrs
- b. 341hrs
- c. 348hrs
- d. 349hrs

v. Manufacturer should claim that the lifetime of a packet is:

- a. 346hrs
- b. 341hrs
- c. 340hrs
- d. 347hrs



Swotters

Assertion Reason Questions-

1. **Directions:** In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true and R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) Both A and R is false.

Assertion: median = $\left(\frac{n+1}{2}\right)^{\text{th}}$ value if n is odd

Reason: If the number of runs scored by 11 players of a cricket team of India are 5, 19, 42, 11, 50, 30, 21, 0, 52, 36, 27 then median is 30

2. **Directions:** In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true and R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) Both A and R is false.

Assertion: if the value of mode and mean is 60 and 66 then the value of median is 64.

Reason: median = (mode + 2mean)

Answer Key-

Multiple Choice questions-

1. (b) ogive
2. (b) mode = 3 median – 2 mean
3. (d) Remains the same as that of the original set.
4. (b) 14k
5. (c) 82
6. (b) median
7. (b) centred at the classmarks of the classes
8. (c) 50

9. (c) centred at the classmarks of the classes

10. (a) Mean

Very Short Answer :

1. New median = $21 + 5 = 26$

2.

| Cost of living index | No. of weeks (f) | c.f. |
|----------------------|------------------|------|
| 1400-1550 | 8 | 8 |
| 1550-1700 | 15 | 23 |
| 1700-1850 | 21 | 44 |
| 1850-2000 | 8 | 52 |
| | 52 | |

Here, $n = 52$; $\frac{n}{2} = \frac{52}{2} = 26$

∴ Median class 1700 – 1850.

3.

| Marks obtained | No. of students (c.f.) | Class Interval | f |
|----------------|------------------------|----------------|-----------|
| 0 or more | 63 | 0-10 | 5 |
| 10 or more | 58 | 10-20 | 3 |
| 20 or more | 55 | 20-30 | 4 |
| 30 or more | 51 | 30-40 | 3 |
| 40 or more | 48 | 40-50 | 6 |
| 50 or more | 42 | 50-60 | 42 |
| | | | 63 |

∴ Frequency of class 30 – 40 = 3

4. Maximum no. of pairs sold = 25 (size 5)

∴ Modal size of shoes = 5

5. Maximum frequency = 48

∴ Modal class = 9,000 – 12,000

Upper limit of the modal class = 12,000

6.

$$\text{Class mark} = \frac{\text{Upper limit} + \text{Lower limit}}{2} = \frac{10 + 25}{2} = \frac{35}{2} = 17.5$$

7.

$$\text{Mean} = \frac{x_1 + x_2 + x_3 + x_4 + x_5}{5} = \frac{1 + 2 + 3 + 4 + 5}{5} = \frac{15}{5} = 3$$

8. Total no. of observations = 13, which is odd

$$\therefore \text{The median will be } \left(\frac{n+1}{2}\right)^{\text{th}} \text{ term} = \left(\frac{13+1}{2}\right)^{\text{th}} = \left(\frac{14}{2}\right)^{\text{th}} = 7^{\text{th}}$$

i.e., 7th term will be the median.

9. Mode = 8; Mean = 8; Median = ?

Relation among mean, median and mode is

$$3 \text{ median} = \text{mode} + 2 \text{ mean}$$

$$3 \times \text{median} = 8 + 2 \times 8$$

$$\text{Median} = \frac{8+16}{3} = \frac{24}{3} = 8$$

10. No. of terms = 2n which are even

$$\therefore \text{The median term will be } \frac{\left[\left(\frac{n}{2}\right)^{\text{th}} + \left(\frac{n}{2} + 1\right)^{\text{th}}\right]}{2}$$

$$\text{Put } n = 2n$$

$$= \frac{\left[\left(\frac{2n}{2}\right)^{\text{th}} + \left(\frac{2n}{2} + 1\right)^{\text{th}}\right]}{2} = \frac{\left[n^{\text{th}} + (n + 1)^{\text{th}}\right]}{2}$$

i.e., the mean of nth and (n + 1)th term will be the median.

Short Answer :

1.

We know mean $(\bar{x}) = \frac{\sum f_i x_i}{\sum f_i}$

$$\therefore \sum f_i x_i = \bar{x} \sum f_i \quad \dots(i)$$

Now the value of $\sum f_i (x_i - \bar{x}) = \sum f_i x_i - \sum f_i \bar{x}$
 $= \sum f_i \bar{x} - \sum f_i \bar{x} = 0$. [Using (i)]

2. Classes are not continuous, hence make them continuous by adding 0.5 to the upper limits and subtracting 0.5 from the lower limits.

| C.I. | Frequency | Cumulative Frequency |
|-----------|---------------|----------------------|
| 0-5.5 | 13 | 13 |
| 5.5-11.5 | 10 | 23 |
| 11.5-17.5 | 15 | 38 |
| 17.5-23.5 | 08 | 46 |
| 23.5-29.5 | 11 | 57 |
| Total | $\sum f = 57$ | |

Class interval can't be negative hence the first CI is starting from 0.

Now to find median class we calculate $\frac{\sum f}{2} = \frac{57}{2} = 28.5$

\therefore Median class = 11.5 – 17.5.

So, the upper limit is 17.5

3. First we find the cumulative frequency

| Classes | Frequency | Cumulative Frequency |
|--------------|-----------|----------------------|
| 0-10 | 4 | 4 |
| 10-20 | 4 | 8 |
| 20-30 | 8 | 16 |
| 30-40 | 10 | 26 |
| 40-50 | 12 | 38 |
| 50-60 | 8 | 46 |
| 60-70 | 4 | 50 |
| Total | 50 | |

Here, $\frac{n}{2} = \frac{50}{2}$

∴ Median class = 30 – 40.

4.

$$\text{Class marks} = \frac{\text{upper limit} + \text{lower limit}}{2}$$

$$\text{Class marks of } 15.5 - 18.5 = \frac{18.5 + 15.5}{2} = \frac{34}{2} = 17$$

$$\text{Class marks of } 50 - 75 = \frac{75 + 50}{2} = \frac{125}{2} = 62.5.$$

5. Calculation of mean

| x_i | f_i | $f_i x_i$ |
|--------------|-------------------|----------------------------|
| 2 | 3 | 6 |
| 4 | 2 | 8 |
| 6 | 3 | 18 |
| 10 | 1 | 10 |
| $p + 5$ | 2 | $2p + 10$ |
| Total | $\Sigma f_i = 11$ | $\Sigma f_i x_i = 2p + 52$ |

We have, $\Sigma f_i = 11$, $\Sigma f_i x_i = 2p + 52$, $\bar{X} = 6$

$$\therefore \text{Mean } (\bar{X}) = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

$$\Rightarrow 6 = \frac{2p + 52}{11} \Rightarrow 66 = 2p + 52$$

$$\Rightarrow 2p = 14 \Rightarrow p = 7$$

6. Calculation of arithmetic mean

| x_i | f_i | $f_i x_i$ |
|--------------|-------------------|------------------------|
| 4 | 5 | 20 |
| 6 | 10 | 60 |
| 9 | 10 | 90 |
| 10 | 7 | 70 |
| 15 | 8 | 120 |
| Total | $\Sigma f_i = 40$ | $\Sigma f_i x_i = 360$ |

$$\therefore \text{Mean } (\bar{X}) = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{360}{40} = 9$$

7. Here, the maximum class frequency is 61 and the class corresponding to this frequency is 60 – 80.

So, the modal class is 60 – 80.

Here, $l = 60, h = 20, f_1 = 61, f_0 = 52, f_2 = 38$

$$\begin{aligned} \therefore \text{Mode} &= l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 60 + \frac{61 - 52}{2 \times 61 - 52 - 38} \times 20 = 60 + \frac{9}{122 - 90} \times 20 \\ &= 60 + \frac{9}{32} \times 20 = 60 + \frac{45}{8} = 60 + 5.625 = 65.625 \end{aligned}$$

Hence, modal lifetime of the components is 65.625 hours.

8. Calculation of median

| Weight (in kg) | Number of students (f) | Cumulative frequency (cf) |
|----------------|------------------------|---------------------------|
| 40-45 | 2 | 2 |
| 45-50 | 3 | 5 |
| 50-55 | 8 | 13 |
| 55-60 | 6 | 19 |
| 60-65 | 6 | 25 |
| 65-70 | 3 | 28 |
| 70-75 | 2 | 30 |
| Total | $\Sigma f_i = 30$ | |

The cumulative frequency just greater than $\frac{n}{2} = 15$ is 19, and the corresponding class is 55 – 60.

\therefore 55 – 60 is the median class.

$$\begin{aligned} \therefore \text{Median} &= l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h \\ &= 55 + \left(\frac{15 - 13}{6} \right) \times 5 = 55 + \frac{2}{6} \times 5 = 55 + 1.67 = 56.67 \end{aligned}$$

Hence, median weight is 56.67 kg.

Long Answer :

1. Here, we use step deviation method to find mean.

Let assumed mean $A = 70$ and class size $h = 10$

$$\text{So, } u_i = \frac{x_i - 70}{10}$$

Now, we have

| Literacy rate (in %) | Frequency | Class mark | $u_i = \frac{x_i - 70}{10}$ | $f_i u_i$ |
|----------------------|-------------------|------------|-----------------------------|-----------------------|
| 45-55 | 3 | 50 | -2 | -6 |
| 55-65 | 10 | 60 | -1 | -10 |
| 65-75 | 11 | 70 | 0 | 0 |
| 75-85 | 8 | 80 | 1 | 8 |
| 85-95 | 3 | 90 | 2 | 6 |
| Total | $\Sigma f_i = 35$ | | | $\Sigma f_i u_i = -2$ |

$$\therefore \text{Mean } (\bar{X}) = A + h \times \frac{\Sigma f_i u_i}{\Sigma f_i} = 70 + 10 \times \frac{(-2)}{35} = 70 - 0.57 = 69.43\%$$

2. Let the assumed mean A = 16 and class size h = 2, here we apply step deviation method.

$$\text{So, } u_i = \frac{x_i - A}{h} = \frac{x_i - 16}{2}$$

Now, we have,

| Class interval | Frequency | Class mark | $u_i = \frac{x_i - 16}{2}$ | $f_i u_i$ |
|----------------|-----------------------|------------|----------------------------|----------------------------|
| 11-13 | 7 | 12 | -2 | -14 |
| 13-15 | 6 | 14 | -1 | -6 |
| 15-17 | 9 | 16 | 0 | 0 |
| 17-19 | 13 | 18 | 1 | 13 |
| 19-21 | f | 20 | 2 | $2f$ |
| 21-23 | 5 | 22 | 3 | 15 |
| 23-25 | 4 | 24 | 4 | 16 |
| Total | $\Sigma f_i = f + 44$ | | | $\Sigma f_i u_i = 2f + 24$ |

We have, Mean $(\bar{X}) = 18, A = 16$ and $h = 2$

$$\therefore \bar{X} = A + h \times \frac{\sum f_i u_i}{\sum f_i}$$

$$18 = 16 + 2 \times \left(\frac{2f + 24}{f + 44} \right) \Rightarrow 2 = 2 \times \left(\frac{2f + 24}{f + 44} \right)$$

$$\Rightarrow 1 = \frac{2f + 24}{f + 44} \Rightarrow f + 44 = 2f + 24$$

$$\Rightarrow f = 44 - 24$$

$$\Rightarrow f = 20$$

Hence, the missing frequency is 20.

3. We have

| Class interval | Frequency (f_i) | Class mark (x_i) | $f_i x_i$ |
|----------------|---------------------|----------------------|-----------------------------|
| 0-20 | 5 | 10 | 50 |
| 20-40 | 8 | 30 | 240 |
| 40-60 | x | 50 | $50x$ |
| 60-80 | 12 | 70 | 840 |
| 80-100 | 7 | 90 | 630 |
| 100-120 | 8 | 110 | 880 |
| Total | $\sum f_i = 40 + x$ | | $\sum f_i x_i = 2640 + 50x$ |

Here, $\sum f_i x_i = 2640 + 50x, \sum f_i = 40 + x, \bar{X} = 62.8$

$$\therefore \text{Mean } (\bar{X}) = \frac{\sum f_i x_i}{\sum f_i}$$

$$\Rightarrow 62.8 = \frac{2640 + 50x}{40 + x}$$

$$\Rightarrow 2512 + 62.8x = 2640 + 50x$$

$$\Rightarrow 62.8x - 50x = 2640 - 2512$$

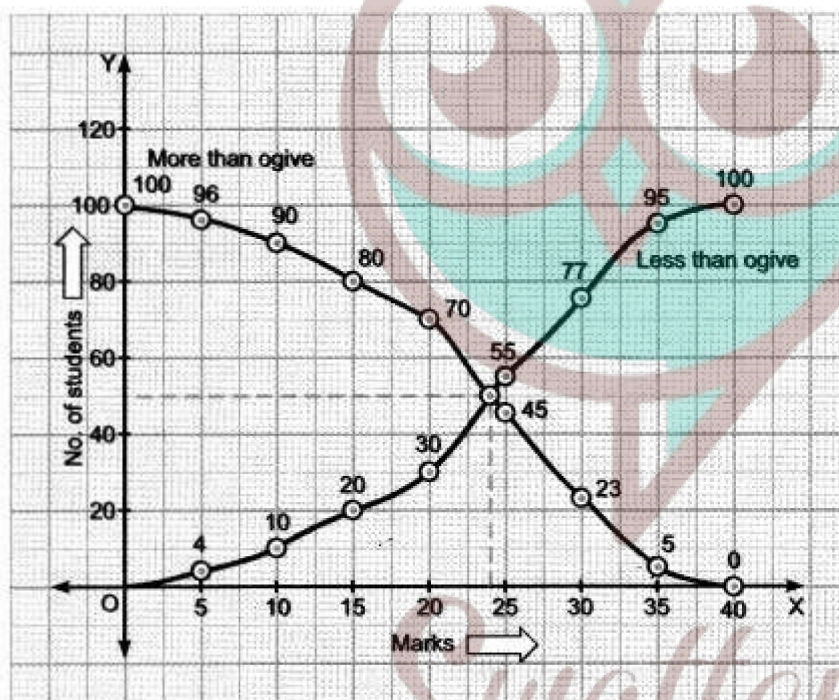
$$\Rightarrow 12.8x = 128$$

$$\therefore x = \frac{128}{12.8} = 10$$

Hence, the missing frequency is 10.

4.

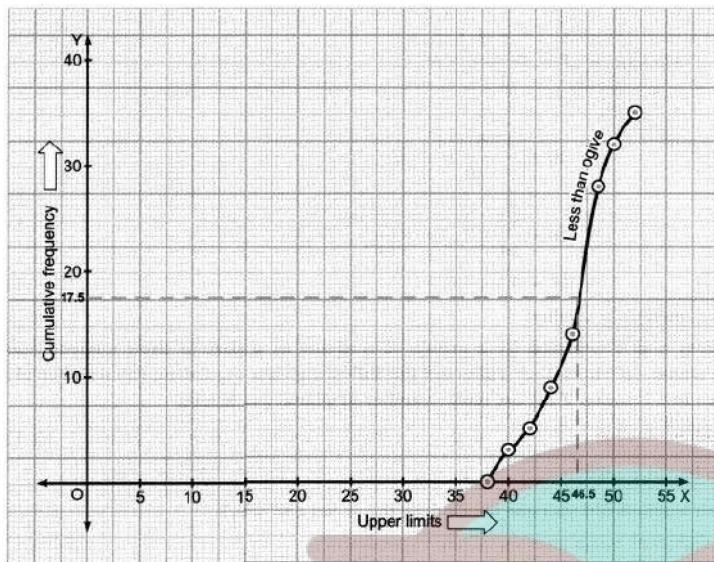
| Marks | Cumulative Frequency | Marks | Cumulative Frequency |
|--------------|----------------------|--------------|----------------------|
| Less than 5 | 4 | More than 0 | 100 |
| Less than 10 | 10 | More than 5 | 96 |
| Less than 15 | 20 | More than 10 | 90 |
| Less than 20 | 30 | More than 15 | 80 |
| Less than 25 | 55 | More than 20 | 70 |
| Less than 30 | 77 | More than 25 | 45 |
| Less than 35 | 95 | More than 30 | 23 |
| Less than 40 | 100 | More than 35 | 5 |



Hence, median marks = 24

5. To represent the data in the table graphically, we mark the upper limits of the class interval on x-axis and their corresponding cumulative frequency on y-axis choosing a convenient scale. Now, let us plot the points corresponding to the ordered pair given by (38,0), (40,3), (42,5), (44, 9), (46, 14), (48, 28), (50, 32) and (52, 35) on a graph paper and join them by a freehand smooth curve.

Thus, the curve obtained is the less than type ogive.



Now, locate $\frac{n}{2} = \frac{35}{2} = 17.5$ on the y-axis,

We draw a line from this point parallel to x-axis cutting the curve at a point. From this point, draw a perpendicular line to the x-axis. The point of intersection of this perpendicular with the x-axis gives the median of the data. Here it is 46.5.

Let us make the following table in order to find median by using formula.

| Weight (in kg) | No. of Students (frequency) (f_i) | Cumulative frequency (cf) |
|----------------|---------------------------------------|-------------------------------|
| 36-38 | 0 | 0 |
| 38-40 | 3 | 3 |
| 40-42 | 2 | 5 |
| 42-44 | 4 | 9 |
| 44-46 | 5 | 14 |
| 46-48 | 14 | 28 |
| 48-50 | 4 | 32 |
| 50-52 | 3 | 35 |
| Total | $\Sigma f_i = 35$ | |

Here, $n = 35$, $\frac{n}{2} = \frac{35}{2} = 17.5$, cumulative frequency greater than $\frac{n}{2} = 17.5$ is 28 and corresponding class is 46 – 48. So median class is 46 – 48.

Now, we have $l = 46$, $\frac{n}{2} = 17.5$, $cf = 14$, $f = 14$, $h = 2$

$$\begin{aligned}
 \therefore \text{Median} &= l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h \\
 &= 46 + \left(\frac{17.5 - 14}{14} \right) \times 2 \\
 &= 46 + \frac{3.5}{14} \times 2 = 46 + \frac{7}{14} \\
 &= 46 + 0.5 = 46.5
 \end{aligned}$$

Hence, median is verified.

Case Study Answer-

1. Answer:

- i. (a) If x_i and f_i are sufficiently large, then direct method is appropriate choice for calculating mean.

Solution:

If f_i and x_i are very small, then direct method is appropriate method for calculating mean.

- ii. (a) 8.15 litres

Solution:

The frequency distribution table from the given data can be drawn as:

| Class | Class mark (x_i) | Frequency(f_i) | $f_i x_i$ |
|--------------|----------------------|--------------------|-----------|
| 3-5 | 4 | 5 | 20 |
| 5-7 | 6 | 10 | 60 |
| 7-9 | 8 | 10 | 80 |
| 9-11 | 10 | 7 | 70 |
| 11-13 | 12 | 8 | 96 |
| Total | | 40 | 326 |

$$\therefore \text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{326}{40} = 8.15 \text{ litres}$$

- iii. (b) 16300 litres

Solution:

If 2000 vehicles comes daily and average quantity of diesel required for a vehicle is 8.15 liters, then total quantity of diesel required,

$$= 2000 \times 8.15 = 16300 \text{ liters}$$

iv. (c) 16

Solution:

Here, $N = 40$ and $\frac{N}{2} = 20$

c.f. for the distribution are 5, 15, 25, 32, 40

Now, cf just greater than 20 is 25 which is corresponding to the class interval 7 - 9.

So median class is 7 - 9.

\therefore Required sum of upper limit and lower limit = $7 + 9 = 16$

v. (b) 7.7 litres

Solution:

We know, Mode = 3 Median - 2 Mean

= $3(8) - 2(8.15) = 24 - 16.3 = 7.7$

2. **Answer:**

i. (d) $2m - b$

Solution:

We know that,

$$\text{Class mark} = \frac{\text{Lower limit} + \text{Upper limit}}{2}$$

$$\Rightarrow m = \frac{\text{Lower limit} + b}{2} \Rightarrow \text{Lower limit} = 2m - b$$

ii. (a) 341hrs

Solution:

| Lifetime (in hours) | Class mark (x_i) | (f_i) | $d_i = x_i - A$ | $f_i d_i$ |
|---------------------|----------------------|-----------|-----------------|-----------|
| 150-200 | 175 | 14 | -150 | -2100 |
| 200-250 | 225 | 56 | -100 | -5600 |
| 250-300 | 275 | 60 | -50 | -3000 |
| 300-350 | 325 = A | 86 | 0 | 0 |
| 350-400 | 375 | 74 | 50 | 3700 |
| 400-450 | 425 | 62 | 100 | 6200 |
| 450-500 | 475 | 48 | 150 | 7200 |
| Total | | 50 | | 6400 |

\therefore Average lifetime of a packet

$$= A + \frac{\sum f_i d_i}{\sum f_i} = 325 + \frac{6400}{400} = 341\text{hrs}$$

iii. (b) 340hrs

Solution:

$$\text{Here, } N = 400 \Rightarrow \frac{N}{2} = 200$$

Also, cumulative frequency for the given distribution are 14, 70, 130, 216, 290, 352, 400
 \therefore c.f just greater than 200 is 216, which is corresponding to the interval 300-350.

$$l = 300, f = 86, \text{ c.f.} = 130, h = 50$$

$$\begin{aligned} \therefore \text{median} &= l + \left(\frac{\frac{N}{2} - \text{c.f.}}{f} \right) \times h = 300 + \left(\frac{200 - 130}{86} \right) \times 50 \\ &= 300 + 40.697 \approx 340.697 \approx 340\text{hrs (approx.)} \end{aligned}$$

iv. (a) 340hrs

Solution:

We know that Mode = 3 Median - 2 Mean

$$\begin{aligned} &= 3(340.697) - 2(341) \\ &= 1022.091 - 682 = 340.091 \approx 340\text{hrs} \end{aligned}$$

v. (c) 340hrs

Solution:

Since, minimum of mean, median and mode is approximately 340hrs. So, manufacturer should claim that lifetime of a packet is 340hrs.

Assertion Reason Answer-

(c) A is true but R is false.

(c) A is true but R is false.



Swotters