# Chapter 22. Statistics

## Ex 22.1

### Answer 1.

Primary data is that which is collected by investigator himself through personal observations with a definite plan or design in mind.

Secondary data is that which has been collected previously by someone other

Than the investigator but is used by the investigator for some specific

purpose.

### Answer 2.

(i) Variate : A particular value of a variable is called a variate.

(ii) Class Mark: The class mark of a class interval is half the sum of the class boundaries of that class.

(iii) True Class limits: When we group a number of variates together then the lowest value of the variate and the highest value of the variate form the class limits.
Let the class intervals for some grouped data be 10-20, 20-30, 30-40 etc. This is an exclusive frequency distribution. For the class 20-30, 20 is the lower limit, while 30 is the upper limit. Here the limits are actual and are called true class limits.

(iv) Frequency : The number which tells us the number of times the variate appears in a given data is called frequency of the variate.

**Answer 3.**

| CLASS | TALLY MARKS | FREQUENCY |
|---|---|---|
| 11-15 | 𝍸 | 5 |
| 16-20 | 𝍸 II | 7 |
| 21-25 | 𝍸 III | 8 |
| 26-30 | 𝍸 IIII | 9 |
| 31-35 | 𝍸 II | 7 |
| 36-40 | 𝍸 I | 6 |
| 41-45 | III | 3 |
| 46-50 | 𝍸 | 5 |
| | **Total** | 50 |

(i) The highest score is 49.

(ii) The lowest score is 12.

(iii) Range = 49 – 12 = 37

(iv) Given, pass marks is 20
So, all the students in the class 11-15 and 16-20 must have failed except for the students with score 20.
∴ Number of such students = 5 + 7 – 2 = 10

(v) Number of students scoring above 40 is the sum total of students in the classes 41-45 and 46-50
i.e 3 + 5 = 8
Number of students scoring exactly 40 = 2
∴ Number of students scoring 40 or more marks = 8+2 = 10

**Answer 4.**

$$ar(\Delta APD) = \frac{\sqrt{3}s^2}{4}$$

$$ar(\Delta APD) = \frac{\sqrt{3} \times 8^2}{4}$$

$$ar(\Delta APD) = \frac{\sqrt{3} \times 64}{4}$$

$$ar(\Delta APD) = \sqrt{3} \times 16 = 16\sqrt{3} cm^2$$

$ar(\Delta APD) = \frac{1}{2}$ x ar(parallelogram ABCD)

(The area of a triangle is half that of a parallelogram on the same base and between the same parallels)

$\Rightarrow$ ar(parallelogram ABCD) = 2 x ar( $\Delta$ APD)

$\Rightarrow$ ar(parallelogram ABCD) = 2 x 16 $\sqrt{3}$ $cm^2$

$\Rightarrow$ ar(parallelogram ABCD) = 32 $\sqrt{3}$ $cm^2$

**Answer 5.**

For the class 55- 59,

The actual lower limit = 55 – 0.5 = 54.5
The actual upper limit = 59 + 0.5 = 59.5
∴ The class boundaries are 54.5 and 59.5
∴ The class mark = $\frac{1}{2}(54.5 + 59.5) = 57$

Similarly calculating for the other classes we get the following table:

| Class | Class Boundaries | Class Mark |
|---|---|---|
| 55-59 | 54.5 – 59.5 | 57 |
| 60-64 | 59.5 – 64.5 | 62 |
| 65-69 | 64.5 – 69.5 | 67 |
| 70-74 | 69.5 – 74.5 | 72 |
| 75-79 | 74.5 – 79.5 | 77 |
| 80-84 | 79.5 – 84.5 | 82 |
| 85-89 | 84.5 – 89.5 | 87 |
| 90-94 | 89.5 – 94.5 | 92 |
| 95-99 | 94.5 – 99.5 | 97 |

**Answer 8.**

The discrete frequency distribution table is as below:

| No. Of goals | Tally Marks | Frequency |
|---|---|---|
| 0 | II | 2 |
| 1 | 𝍸 II | 7 |
| 2 | 𝍸 II | 7 |
| 3 | 𝍸 I | 6 |
| 4 | 𝍸 III | 8 |
| 5 | IIII | 4 |
| 6 | II | 2 |

(i) Maximum goals scored = 6
Minimum goals scored = 0
∴ Range of the goals scored = 6 – 0 = 6
(ii) No. Of times AFC scored 3 or more goals = 6 + 8 + 4 + 2= 20
(iii) The variate which has highest frequency is 4

**Answer 9.**

(i) Here, the lower limit is 21 and the upper limit is 28.

The actual lower limit = 21 – 0.5 = 20.5
The actual upper limit = 28 + 0.5 = 28.5
∴ The class boundaries are 20.5 and 28.5

(ii) For the class 45-52,
The actual class limits are 45-0.5 = 44.5 and 52+0.5 = 52.5
∴ The class size of this class = 52.5 – 44.5 = 8
∴ The class mark of this class = $\frac{1}{2}(44.5+52.5) = 48.5$

(iii) As the classes are exclusive, so the true class limits are the same as the class limits.

| Class | True class limits |
|---|---|
| 5-12 | 4.5-12.5 |
| 13-20 | 12.5-20.5 |
| 21-28 | 20.5-28.5 |
| 29-36 | 28.5-36.5 |
| 37-44 | 36.5-44.5 |
| 45-52 | 44.5-52.5 |
| 53-60 | 52.5-60.5 |

**Answer 10.**

The class marks are uniformly spread.

∴ The class size is the difference between any two consecutive class marks.

Class size = 25 – 15 = 10

The lower limit of the first class = $15 - \frac{10}{2} = 15 - 5 = 10$

The upper limit of the first class = $15 + \frac{10}{2} = 15 + 5 = 20$

Thus, the first class interval is 10-20

Similarly, we can find the class limits of all the class marks given.

| Class Marks | Class limits |
|---|---|
| 15 | 10-20 |
| 25 | 20-30 |
| 35 | 30-40 |
| 45 | 40-50 |
| 55 | 50-60 |
| 65 | 60-70 |
| 75 | 70-80 |

**Answer 11.**

The class marks are uniformly spread.

∴ The class size is the difference between any two consecutive class marks.

Class size = 32 – 27 = 5

The lower limit of the first class = $27 - \frac{5}{2} = 27 - 2.5 = 24.5$

The upper limit of the first class = $27 + \frac{5}{2} = 27 + 2.5 = 29.5$

Thus, the first class interval is 24.5-29.5

Similarly, we can find the class limits of all the class marks given.

| Class Marks | Class limits |
|---|---|
| 27 | 24.5-29.5 |
| 32 | 29.5-34.5 |
| 37 | 34.5-39.5 |
| 42 | 39.5-44.5 |
| 47 | 44.5-49.5 |
| 52 | 49.5-54.5 |
| 57 | 54.5-59.5 |
| 62 | 59.5-64.5 |
| 67 | 64.5-69.5 |
| 72 | 69.5-74.5 |
| 77 | 74.5-79.5 |

**Answer 12.**

Minimum value of variate = 14

Maximum value of variate = 55

$\therefore$ Range = 55 – 14 = 41

Class size = 7

$\therefore$ No. Of class intervals = $\frac{41}{7} \approx 6$

| Class | Tally Marks | Frequency |
|---|---|---|
| 14-21 | 𝍸 IIII | 9 |
| 21-28 | 𝍸 II | 7 |
| 28-35 | 𝍸 𝍸 I | 11 |
| 35-42 | 𝍸 III | 8 |
| 42-49 | 𝍸 𝍸 III | 13 |
| 49-56 | 𝍸 𝍸 II | 12 |
| | Total | 60 |

## Ex 22.2

### Answer 1.

| Marks | No. of students | Cum. frequency |
|---|---|---|
| 0-10 | 4 | 4 |
| 10-20 | 15 | 19 |
| 20-30 | 21 | 40 |
| 30-40 | 12 | 52 |
| 40-50 | 8 | 60 |

### Answer 2.

| Age | No. of patients | Cum. Frequency |
|---|---|---|
| 10-20 | 90 | 90 |
| 20-30 | 50 | 140 |
| 30-40 | 60 | 200 |
| 40-50 | 80 | 280 |
| 50-60 | 50 | 330 |
| 60-70 | 30 | 360 |

### Answer 3.

| Class | Tally Marks | Frequency | Cum Frequency |
|---|---|---|---|
| 150-300 | 𝍸 II | 7 | 7 |
| 300-450 | 𝍸 𝍸 I | 11 | 18 |
| 450-600 | 𝍸 𝍸 III | 13 | 31 |
| 600-750 | 𝍸 II | 7 | 38 |
| 750-900 | 𝍸 II | 7 | 45 |

**Answer 4.**

| Class | c.f. | Frequency |
|---|---|---|
| 0- 10 | 10 | 10 |
| 10- 20 | 18 | 18-10=8 |
| 20- 30 | 32 | 32-18=14 |
| 30- 40 | 45 | 45-32=13 |
| 40- 50 | 50 | 50-45=5 |

## Ex 22.3

### Answer 1.

$$\text{Mean} = \frac{\sum x}{N}$$

(i) $\text{Mean} = \frac{5+7+8+4+6}{5} = \frac{30}{5} = 6$

(ii) $\text{Mean} = \frac{3+0+5+2+6+2}{6} = \frac{18}{6} = 3$

### Answer 2.

| x | f | fx |
|---|---|---|
| 3 | 1 | 3 |
| 4 | 1 | 4 |
| 6 | 3 | 18 |
| 7 | 4 | 28 |
| 8 | 2 | 16 |
| 9 | 2 | 18 |
| 11 | 1 | 11 |
| Total | 14 | 98 |

$\therefore$ $\text{Mean} = \frac{\sum fx}{\sum f}$

Or $= \frac{98}{14} = 7$

### Answer 3.

$$\text{Mean} = \frac{\sum x}{N}$$

$$\text{Mean} = \frac{20+52+56+72+64+13+80}{7} = \frac{351}{7} = 51\text{kg}$$

**Answer 4.**

$$\text{Mean} = \frac{\sum x}{N}$$

Avg. mean marks =

$$\frac{17+15+16+7+10+14+12+19+16+12}{10} = \frac{138}{10} = 13.8$$

**Answer 5.**

$$\text{Mean} = \frac{\sum x}{N}$$

Average score =

$$\frac{10+9+31+45+0+4+8+15+12+0+6}{11} = \frac{140}{11} = 12.7$$

**Answer 7.**

$$\text{Mean} = \frac{\sum x}{N}$$

$$= \frac{2+5+3+8+0+9+x+6+1+8}{10} = \frac{42+x}{10}$$

$$\therefore \quad 5 = \frac{42+x}{10}$$

$$\Rightarrow \quad 50 = 42 + x$$

$$\Rightarrow \quad x = 50 - 42 = 8$$

**Answer 8.**

$$\text{Mean} = \frac{\sum x}{N}$$

$$= \frac{148+162+160+154+170+162+x+152}{8} = \frac{1108+x}{8}$$

$$\therefore \quad 158 = \frac{1108+x}{8}$$

$$\Rightarrow \quad 1264 = 1108 + x$$

$$\Rightarrow \quad x = 156$$

$\therefore$ Mean height = 156 cm.

**Answer 9.**

$$\text{Mean} = \frac{\sum x}{N}$$

$$= \frac{7+16+9+15+16+a+12+8+b+11}{10} = \frac{94+a+b}{10}$$

$\therefore \quad 12 = \frac{94+a+b}{10}$

$\Rightarrow \quad 120 = 94 + a + b$

$\Rightarrow \quad a = 120-94-b = 26-b$

$\therefore \quad a = 26 - b$

**Answer 10.**

(i) Marks scored by the 16 students

$= 25+8+14+20+16+22+10+15+8+7+24+18+19+6+11+17$

$= 240$

$$\text{Mean marks} = \frac{240}{16} = 15$$

(ii) If the marks are entered out of 50, then the given marks shall be doubled.
So, new marks scored will be 2 times the marks scored by the 16 students initially
i.e. $2 \times 240 = 480$

$$\text{Mean marks} = \frac{480}{16} = 30$$

**Answer 11.**

(i) Total marks awarded to 8 students =
$14+16+18+14+16+14+12+1 = 120$

$$\text{Mean marks} = \frac{120}{8} = 15$$

(ii) When extra 2 marks are awarded, new addition to total marks scored $= 2 \times 8 = 16$

$\therefore$ New total marks scored $= 120 + 16 = 136$

$\therefore$ Revised mean marks $= \frac{136}{8} = 17$

**Answer 16.**

(i) 15, 8, 14, 20, 13, 12, 16

Arranging the data in ascending order,

8, 12, 13, 14, 15, 16, 20

Here N = 7

$\therefore$ Median is $\left(\frac{N+1}{2}\right)^{th}$ term

$= \left(\frac{7+1}{2}\right) = 4^{th}$ term

$\therefore$ Median = 14.

(ii) 25, 11, 15, 10, 17, 6, 5, 12

Arranging the data in ascending order,

5, 6, 10, 11, 12, 15, 17, 25

Here N = 8

$\therefore$ $\left(\frac{N}{2}\right)^{th}$ term $= \left(\frac{8}{2}\right) = 4^{th}$ term $= 11$

$\left(\frac{N}{2}+1\right)^{th}$ term $= 4+1 = 5$th term $= 12$

$\therefore$ Median $= \frac{11+12}{2} = \frac{23}{2} = 11.5$

Or Median = 11.5

**Answer 17.**

Arranging these numbers in ascending order,

1, 1, 2, 2, 3, 4, 4, 4, 5, 6, 8, 9, 9, 10

Here N = 14

$\therefore$ $\left(\frac{N}{2}\right)^{th}$ term $= \left(\frac{14}{2}\right) = 7^{th}$ term $= 4$

$\left(\frac{N}{2}+1\right)^{th}$ term $= 7+1 = 8$th term $= 4$

$\therefore$ Median $= \frac{4+4}{2} = \frac{8}{2} = 4$

Or Median = 4.

**Answer 18.**

3, 8, 10, x, 14, 16, 18, 20 is already in ascending order

Here N = 8

$\therefore \quad \left(\frac{N}{2}\right)^{th}$ term $= \left(\frac{8}{2}\right) = 4^{th}$ term $= x$

$\left(\frac{N}{2}+1\right)^{th}$ term $= 4+1 = 5$th term $= 14$

Given, median = 13

$\therefore \quad \frac{x+14}{2} = 13$

$\therefore x+14 = 13\times 2 = 26$

$\Rightarrow x = 26-14 = 12$

**Answer 20.**

(i) Total marks scored by the boy in 11 tests =
$15+17+16+7+10+12+14+16+19+12+16 = 154$

$\therefore \quad$ Mean marks $= \frac{154}{11} = 14$

(ii) Arranging the given marks in ascending order,
7, 10, 12, 12, 14, 15, 16, 16, 16, 17, 19
Here N = 11

$\therefore \quad$ Median is $\left(\frac{N+1}{2}\right)^{th}$ term

$= \left(\frac{11+1}{2}\right) = 6^{th}$ term

$\therefore \quad$ Median marks = 15.