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Chapter-14 Statistics

Short Question

Q. 1. Given below is the distribution of weekly pocket money received by students of a class. Calculate the pocket money that is received by most of the students.

Pocket money (in ₹)	0-20	20-40	40-60	60-80	80-100	100-120	120-140
No. of Students	2	2	3	12	18	5	2

[CBSE 2015]

Sol. Here, maximum frequency = 18

Modal class = 80 - 100

So, $l = 80$, $f_1 = 18$, $f_0 = 12$, $f_2 = 5$, $h = 20$

$$\therefore \text{Mode} = l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h$$

$$\text{Mode} = 80 + \left(\frac{18 - 12}{2 \times 18 - 12 - 5} \right) \times 20$$

$$= 80 + \frac{120}{19} = 80 + 6.32 = 86.32$$

Hence, the required pocket money received by most of the students is ₹ 86.32.

Q. 9. Find the difference between the upper limit of the median class and the lower limit of the modal class in the data given ahead

Class	65-85	85-105	105-125	125-145	145-165	165-185
Frequency	4	5	13	20	14	12

[CBSE 2012]

Sol.

Class	Frequency (f_i)	Cumulative frequency
65-85	4	4
85-105	5	9
105-125	13	22
125-145	20	42
145-165	14	56
165-185	12	68
Total	$\Sigma f_i = 68$	

Here, $n = \Sigma f_i = 68$

$$\therefore \frac{n}{2} = \frac{68}{2} = 34$$

which lies in 125-145. Thus, 125-145 is the median class.

Also, maximum frequency = 20

\therefore modal class = 125-145

Now, difference = 145 - 125 = 20

Q. 3. Find the value of λ , if the mode of the following data is 20.

15, 20, 25, 18, 13, 15, 25, 15, 18, 17, 20, 25, 20, λ , 18.

Sol. Writing the data as discrete frequency distribution, we get

x_i	f_i
13	1
15	3
17	1
18	3
20	3
λ	1
25	3

For 20 to be mode of the frequency distribution
 $\lambda = 20$

Q. 5. Find the arithmetic mean of the following frequency distribution

x_i	3	4	5	7	10
f_i	3	4	8	5	10

[CBSE 2015]

Sol. Table for calculate the mean

x_i	f_i	$f_i x_i$
3	3	9
4	4	16
5	8	40
7	5	35
10	10	100
Total	$\Sigma f_i = 30$	$\Sigma f_i x_i = 200$

$$\text{Mean, } \bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{200}{30} = 6.67$$

Hence, the mean is 6.67.

Q. 6. Using the formula connecting mean median and mode, find the median, when mode = 43 and mean = 34. [CBSE 2014]

Sol. Given, Mode = 43 and mean = 34

$$\begin{aligned} \text{Now, Median} &= \frac{1}{3} \text{Mode} + \frac{2}{3} \text{mean} \\ &= \frac{1}{3} \times 43 + \frac{2}{3} \times 34 \\ &= \frac{43}{3} + \frac{68}{3} = \frac{43 + 68}{3} = \frac{111}{3} = 37 \end{aligned}$$

Hence, the median is 37.

Q. 10. Calculate the median from the following data

Marks	0-10	10-20	20-30	30-40	40-50
No. of students	5	15	30	8	2

(CBSE 2012)

Sol.

Marks	No. of students	c.f.
0-10	5	5
10-20	15	20
20-30	30	50
30-40	8	58
40-50	2	60
Total	n = 60	

$$\text{Herc, } \frac{n}{2} = \frac{60}{2} = 30$$

So, median class = 20 - 30

$$l = 20, f = 30, c.f. = 20, h = 10$$

$$\text{Median} = l + \left(\frac{\frac{n}{2} - c.f.}{f} \right) \times h$$

$$= 20 + \left(\frac{30 - 20}{30} \right) \times 10$$

$$= 20 + \frac{100}{30} = 20 + \frac{10}{3}$$

$$= 20 + 3.33 = 23.33$$

Hence, the median is 23.33.

Q.20. Find the median of the following data.

Height (in cm)	Less than 120	Less than 140	Less than 160	Less than 180	Less than 200
No. of Students	12	26	34	40	50

(CBSE 2015)

Sol.

Height (in cm)	Frequency	c.f.
100-120	12	12
120-140	14	26
140-160	8	34
160-180	6	40
180-200	10	50
Total	n = 50	

Here, $n = 50$

$$\therefore \frac{n}{2} = \frac{50}{2} = 25$$

So, Median Class = 120 - 140

$l = 120, c.f. = 12, f = 14, h = 20$

$$\text{Median} = l + \left(\frac{\frac{n}{2} - c.f.}{f} \right) \times h$$

$$= 120 + \left(\frac{25 - 12}{14} \right) \times 20$$

$$= 120 + \frac{260}{14} = 120 + 18.57 = 138.57$$

Hence, the median is 138.57.

Q.18. The mean of the following distribution is 48 and sum of all the frequencies is 50. Find the missing frequencies x and y.

Class	20-30	30-40	40-50	50-60	60-70
Frequency	8	6	x	11	y

[CBSE 2015]

Sol.

x_i	f_i	$x_i f_i$
25	8	200
35	6	210
45	x	45x
55	11	605
65	y	65y
Total	$n = 25 + x + y$	$\sum x_i f_i = 1015 + 45x + 65y$

$$\text{Given, } n = \sum f_i = 50,$$

$$\Rightarrow 25 + x + y = 50$$

$$\Rightarrow x + y = 25 \quad \dots(1)$$

$$\therefore \text{Mean, } \bar{x} = \frac{\sum x_i f_i}{\sum f_i}$$

$$\Rightarrow 48 = \frac{1015 + 45x + 65y}{50}$$

$$\Rightarrow 2400 = 1015 + 45x + 65y$$

$$\Rightarrow 1385 = 45x + 65y$$

$$\Rightarrow 9x + 13y = 277 \quad \dots(2)$$

Multiplying eq. (1) by 9 and subtracting from eq (2), we get

$$9x + 13y = 277$$

$$9x + 9y = 225$$

$$- - -$$

$$4y = 52$$

$$\Rightarrow y = 13$$

Putting the value of y in eq. (1), we get

$$x + y = 25$$

$$\Rightarrow x + 13 = 24$$

$$x = 12$$

Hence, the missing frequencies is 12 and 13.

Q.22. The mean of the following data is 21, find the value of p.

Class	7.5 - 12.5	12.5 - 17.5	17.5 - 22.5	22.5 - 27.5	27.5 - 32.5	32.5 - 37.5
f	6	10	p	10	2	8

[CBSE 2014]

Sol. Consider the frequency distribution.

Class	f_i	Class marks (x_i)	$f_i x_i$
7.5-12.5	6	10	60
12.5-17.5	10	15	150
17.5-22.5	p	20	20p
22.5-27.5	10	25	250
27.5-32.5	2	30	60
32.5-37.5	8	35	280
	$\sum f_i = 36 + p$		$\sum f_i x_i = 800 + 20p$

$$\therefore \text{Mean} = \frac{\sum f_i x_i}{\sum f_i}$$

$$21 = \frac{800 + 20p}{36 + p}$$

$$\Rightarrow 756 + 21p = 800 + 20p$$

$$\Rightarrow 21p - 20p = 800 - 756$$

$$\Rightarrow p = 44$$

Hence, the value of p is 44.

Statistics and Probability

Exercise 13.1 Multiple Choice Questions (MCQs)

Question 1:

In the formula $\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$, for finding the mean of grouped data d_i 's

are deviation from a of

Solution:

(c) We know that, $d_i = x_i - a$

i.e., d_i 's are the deviation from a of mid-points of the classes.

Question 2:

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

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

Solution:

(b) In computing the mean of grouped data, the frequencies are centred at the class marks of the classes.

Question 3:

If x_i 's are the mid-points of the class intervals of grouped data, f_i 's are the corresponding frequencies and \bar{x} is the mean, then $\Sigma(f_i x_i - \bar{x})$ is equal to

Solution:

(a) \therefore

$$\bar{x} = \frac{\sum f_i x_i}{n}$$

•

$$\begin{aligned}\Sigma (f_i x_i - \bar{x}) &= \Sigma f_i x_i - \Sigma \bar{x} \\ &= n\bar{x} - n\bar{x} \\ &\equiv 0\end{aligned}$$

Question 4:

In the formula $\bar{x} = a + h \left(\frac{\sum f_i u_i}{\sum f_i} \right)$, for finding the mean of grouped frequency distribution u_i is equal to

- (a) $\frac{x_i + a}{h}$ (b) $h(x_i - a)$ (c) $\frac{x_i - a}{h}$ (d) $\frac{a - x_i}{h}$

Solution:

(c) Given, $\bar{x} = a + h \left(\frac{\sum f_i u_i}{\sum f_i} \right)$

Above formula is a step deviation formula.

$$u_i = \frac{x_i - a}{h}$$

Question 5:

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 of these

Solution:

(b) Since, the intersection point of less than ogive and more than ogive gives the median on the abscissa.

Question 6:

For the following distribution,

Class	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25
Frequency	10	15	12	20	9

the sum of lower limits of the median class and modal class is

- (a) 15 (b) 25 (c) 30 (d) 35

Solution:

(b) Here,

Class	Frequency	Cumulative frequency
0-5	10	10
5-10	15	25
10-15	12	37
15-20	20	57
20-25	9	66

Now, $\frac{N}{2} = \frac{66}{2} = 33$, which lies in the interval 10-15. Therefore, lower limit of the median class is 10.

The highest frequency is 20, which lies in the interval 15-20. Therefore, lower limit of modal class is 15. Hence, required sum is $10 + 15 = 25$.

Question 7:

Consider the following frequency distribution

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

The upper limit of the median class is

Solution:

(b)

Class	Frequency	Cumulative frequency
-0.5-5.5	13	13
5.5-11.5	10	23
11.5-17.5	15	38
17.5-23.5	8	46
23.5-29.5	11	57

Question 8:

For the following distribution,

Marks	Number of students
Below 10	3
Below 20	12
Below 30	27
Below 40	57
Below 50	75
Below 60	80

the modal class is

Solution:

Marks	Number of students	Cumulative frequency
Below 10	$3 = 3$	3
10-20	$(12 - 3) = 9$	12
20-30	$(27 - 12) = 15$	27
30-40	$(57 - 27) = 30$	57
40-50	$(75 - 57) = 18$	75
50-60	$(80 - 75) = 5$	80

Here, we see that the highest frequency is 30, which lies in the interval 30-40.

Question 9:

consider the data.

Class	65-85	85-105	105-125	125-145	145-165	165-185	185-205
Frequency	4	5	13	20	14	7	4

The difference of the upper limit of the median class and the lower limit of the modal class is

Solution:

(c)

Class	Frequency	Cumulative frequency
65-85	4	4
85-105	5	9
105-125	13	22
125-145	20	42
145-165	14	56
165-185	7	63
185-205	4	67

Here, $\frac{N}{2} = \frac{67}{2} = 33.5$ which lies in the interval 125 -145.

Hence, upper limit of median class is 145.

Here, we see that the highest frequency is 20 which lies in 125-145. Hence, the lower limit of modal class is 125.

Required difference = Upper limit of median class – Lower limit of modal class
 $= 145 - 125 = 20$

Question 10:

The times (in seconds) taken by 150 athletes to run a 110 m hurdle race are tabulated below

Class	13.8-14	14-14.2	14.2-14.4	14.4-14.6	14.6-14.8	14.8-15
Frequency	2	4	5	71	48	20

The number of atheletes who completed the race in less than 14.6 s is

Solution:

- (c)** The number of atheletes who completed the race in less than 14.6
 $= 2 + 4 + 5 + 71 = 82$

Question 11:

Consider the following distribution

Marks obtained	Number of students
More than or equal to 0	63
More than or equal to 10	58
More than or equal to 20	55
More than or equal to 30	51
More than or equal to 40	48
More than or equal to 50	42

the frequency of the class 30-40 is

Solution:

(a)

Marks obtained	Number of students
0-10	$(63 - 58) = 5$
10-20	$(58 - 55) = 3$
20-30	$(55 - 51) = 4$
30-40	$(51 - 48) = 3$
40-50	$(48 - 42) = 6$
50...	$42 = 42$

Hence, frequency in the class interval 30-40 is 3