Chapter-statistics

Q1.

Compute the median from the following data

Mid value	115	125	135	145	155	165	175	185	195
Frequency	6	25	48	72	116	60	38	22	3

Q2.

If median height of 50 students of a class in the following frequency distribution is 144 cm, find the missing frequencies x and y

Height (in cm)	**125–130**	**130–135**	**135–140**	**140–145**	**145–150**	**150–155**	**155–160**
No. of students	**2**	**4**	***x***	***y***	**8**	**9**	**5**

Q3.

Determine the missing frequency *x*, from the following data, when Mode is 67.

Class	**40–50**	**50–60**	**60–70**	**70–80**	**80–90**
Frequency	**5**	***x***	**15**	**12**	**7**

Q4.

The average score of boys in the examination of a school is 71 and that of the the girls is 73. The average score of the school in the examination is 71.8. Find the ratio of the number of boys to the number of girls who appeared in the examination.

Q5.

In a retail market, fruit vendor were selling mangoes in packing boxes. These boxes contained varying number of mangoes. The following was the distribution:

No. of mangoes	**50–52**	**53–55**	**56–58**	**59–61**	**62–64**
No. of boxes	**15**	**110**	**135**	**115**	**25**

Find the mean and median number of mangoes kept in a packing box.

Q6.

6. If the median of the following frequency distribution is 32.5. Find the values of f_1 and f_2.

Class	Frequency
0–10	f_1
10–20	5
20–30	9
30–40	12
40–50	f_2
50–60	3
60–70	2
Total	40

Q7.

The mean of 'n' observation is $\bar{x}$, if the first term is increased by 1, second by 2 and so on.

What will be the new mean.

Q8.

. The mean of the following frequency distribution is 50. But the frequencies f_1 and f_2 in class 20-40 and 60-80 are missing. Find the missing frequencies.

Class interval	0-20	20-40	40-60	60-80	80-100	Total
Frequency	17	f_1	32	f_2	19	120

Q9.

Marks obtained by 70 students are given below:

Marks	20	70	50	60	75	90	40
No. of Students	8	12	18	6	9	5	12

Find the median

Q10.

Show that the mode of the series obtained by combining the two series S_1 and S_2 given below is different from that of S_1 and S_2 taken separately:

S_1: 3, 5, 8, 8, 9, 12, 13, 9, 9

S_2: 7, 4, 7, 8, 7, 8, 13

Solutions

Here, we are given the mid values. So, we should first find the upper and lower limits of the various classes. The difference between two consecutive values is

$$h = 125 - 115 = 10$$

∴ Lower limit of a class = Midvalue − $h/2$

Upper limit = Midvalue + $h/2$

Calculate of Median

MID-VALUE	CLASS GROUPS	FREQUENCY	CUMULATIVE FREQUENCY
115	110–120	6	6
125	120–130	25	31
135	130–140	48	79
145	140–150	72	151
155	150–160	116	267
165	160–170	60	327
175	170–180	38	365
185	180–190	22	387
195	190–200	3	390

$$N = \sum f_i = 390$$

We have,

$$N = 390$$

∴ $N/2 = 390/2 = 195$

The cumulative frequency first greater than N i.e. 195 is 267 and the corresponding class is 150 – 160, so, 150 – 160 is the median class.
L = 150, f = 116, h = 10, f = 151

Now,

$$\text{Median} = L + \frac{\frac{n}{2} - f}{f} \times h$$

$$\text{Median} = 150 + \frac{195 - 151}{116} \times 10 = 153.8$$

Q1.

Q2.

Solution:

Class Interval	f_i	c.f.
125 – 130	2	2
130 – 135	4	6
135 – 140	x	$6+x$
140 – 145	y	$6+x+y$
145 – 150	8	$14+x+y$
150 – 155	9	$23+x+y$
155 – 160	5	$28+x+y$

A.T.Q.

$28 + x + y = 50 \Rightarrow x + y = 22$ ...(*i*)

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

$144 = 140 + \left(\frac{25 - 6 - x}{y}\right) \times 5$

$4 = \left(\frac{19 - x}{y}\right) \times 5 \Rightarrow 5x + 4y = 95$ ...(*ii*)

On solving equations (*i*) and (*ii*), we get
$x = 7$ and $y = 15$

Q3.

Solution:

Class interval	Frequency
40 – 50	5
50 – 60	$x \rightarrow f_0$
60 – 70	$15 \rightarrow f_1$ ‹ Modal class
70 – 80	$12 \rightarrow f_2$
80 – 90	7

Mode = 67 (given)

∴ Modal class is 60 – 70

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$= 60 + \left(\frac{15 - x}{30 - x - 12}\right) \times 10$$

$$= 60 + \left(\frac{15 - x}{18 - x}\right) \times 10$$

$$67 = 60 + \frac{150 - 10x}{18 - x}$$

$$7 = \frac{150 - 10x}{18 - x}$$

$$126 - 7x = 150 - 10x$$

$$10x - 7x = 150 - 126$$

$$3x = 24$$

$$x = 8$$

Q4.

Solution:

Let number of boys in the school be x

Average score of boys = 71

Total score of boys in the examination of the school = 71xx = 71x

Let number of girls in the school be y

Average score of girls = 73

Total score of girls in the examination of the school = 73 x y = 73y

Now,

average score of the school in examination = 71.8

$$\therefore \quad \frac{\text{Total score of boys} + \text{Total score of girls}}{\text{Total number of boys and girls}} = 71.8$$

$$\frac{71x + 73y}{x + y} = 71.8$$

$$71x + 73y = 71.8x + 71.8y$$

$$73y - 71.8y = 71.8x - 71x$$

$$1.2y = 0.8x$$

$$\frac{1.2}{0.8} = \frac{x}{y}$$

$$\frac{12}{8} = \frac{x}{y} \quad \Rightarrow x : y = 3 : 2$$

Q5.

Solution:

Class interval	Mid value (x_i)	$d_i = \frac{x_i - a}{h}$ (where $a = 57$)	f_i	$f_i d_i$	c.f	
49.5 – 52.5	51	–2	15	–30	15	
52.5 – 55.5	54	–1	110	–110	125	
55.5 – 58.5	57 = a	0	135	0	260	Median class
58.5 – 61.5	60	1	115	115	375	
61.5 – 64.5	63	2	25	50	400	
			$\sum f_i = 400$	$\sum f_i d_i = 25$		

$$\text{Mean} = a + \left(\frac{\sum f_i d_i}{\sum f_i}\right) h = 57 + \frac{25}{400} \times 3 = 57 + \frac{3}{16} = 57 + 0.1875 = 57.18$$

For median: $\text{Median} = l + \left[\frac{\frac{N}{2} - c.f}{f}\right] \times h$

Here $N = 400$ (Even)

$\frac{N}{2} = 200$

Median class is 55.5 – 58.5

$l = 55.5, \quad f = 135, \quad c.f = 125, \quad h = 3$

$$\text{Median} = 55.5 + \left(\frac{200 - 125}{135}\right) \times 3 = 55.5 + \frac{75}{135} \times 3 = 55.5 + \frac{225}{135}$$

$$= 55.5 + 1.666 = 57.16$$

Q6.

s. Median = 32.5

Class	Frequency	Cumulative Frequency
0–10	f_1	f_1
10–20	5	$f_1 + 5$
20–30	9	$f_1 + 14$
30–40	12	$f_1 + 26$
40–50	f_2	$f_1 + f_2 + 26$
50–60	3	$f_1 + f_2 + 29$
60–70	2	$f_1 + f_2 + 31$

Total frequency $= 40$

$\therefore \quad f_1 + f_2 + 31 = 40$

or $f_1 + f_2 = 9$ ...(i)

Also $\frac{n}{2} = \frac{40}{2} = 20$

Median $= 32.5$ (given)

which lies in the class interval (30 – 40)

$\therefore$ Median class = 30 – 40

So, $l = 30, f = 12, C.f. = f_1 + 14, h = 10$

So, $\text{Median} = l + \left[\frac{\frac{n}{2} - C.f.}{f}\right] \times h$

$$32.5 = 30 + \left[\frac{20 - (f_1 + 14)}{12}\right] \times 10$$

$$32.5 = 30 + \left(\frac{6 - f_1}{6}\right) \times 5$$

or $2.5 = \frac{5}{6}(6 - f_1)$

or $\frac{2.5 \times 6}{5} = 6 - f_1$

or $6 - f_1 = 3 \Rightarrow f_1 = 3$

From equation (i), we get

$f_2 = 6$

$\therefore$ $f_1 = 3, \ f_2 = 6$

Q7.

Ans: Let the n observations be $x_1, x_2, x_3 \ldots \ldots x_n$.

New observations are $x_1+1, x_2+2, x_3+3 \ldots \ldots x_n+n$.

New mean $= \frac{(x_1+1)+(x_2+2)+(x_3+3)+\cdots\cdots+(x_n+n)}{n}$

The Mean of the new numbers is $\bar{X} + \frac{\frac{n(n+1)}{2}}{n} = \bar{X} + \frac{(n+1)}{2}$.

Q8.

Class interval	Frequency (f_i)	Class mark (x_i)	f_ix_i
0-20	17	10	170
20-40	f_1	30	$30f_1$
40-60	32	50	1600
60-80	f_2	70	$70f_2$
80-100	19	90	1710

	$\sum f_i = 68+f_1+f_2$		$\sum f_ix_i = 3480+30f_1+70f_2$

Now its given that total frequency is 120.

$\Rightarrow \sum f_i = 120$

$\Rightarrow 68+f_1+f_2 = 120$

$\Rightarrow f_1+f_2 = 120-68$

$\Rightarrow f_1+f_2 = 52$ ---------- (i)

Also mean of the data is 50 (given)

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

$$\Rightarrow 50 = \frac{3480+30f1+70f2}{120}$$

$\Rightarrow 50 \times 120 = 3480+30f_1+70f_2$

$\Rightarrow 6000 - 3480 = 30f_1+70f_2$

$\Rightarrow 2520 = 30f_1+70f_2$

$\Rightarrow 30f_1+70f_2 = 2520$

$\Rightarrow 10(3f_1+7f_2) = 2520$

$\Rightarrow 3f_1+7f_2 = \frac{2520}{10} = 252$ ---------- (ii)

Solving equation (i) and (ii), by elimination method,

Multiplying equation (i) by 3, we get

$$3f_1+3f_2 = 156$$

Eqn (ii) is $3f_1+7f_2 = 252$

Now by subtracting these two equations, we get,

$$-4f_2 = -96$$

$$\Rightarrow f_2 = 24$$

Substitute the value of f_2 in either of the equations (i) or (ii), we get, $f_1 = 28$

Q9.

Marks	No . of students	c.f
20	8	8
40	12	20
50	18	38
60	6	44
70	12	53
75	9	58
90	5	70

N = 70

$\frac{N}{2} = \frac{70}{2} = 35$

The corresponding value of marks for 35 is 50

Q10.

Mode of S_1 series = 9

Mode of S_2 series = 7

After combining S_1 and S_2, the new series will be

= 3, 5, 8, 8, 9, 12, 13, 9, 9, 7, 4, 7, 8, 7, 8, 13.

Mode of combined series = 8 (maximum times)

Mode of (S_1, S_2) is different from mode of S_1 and mode of S_2 separately.

Hence Proved.