

Class: X
Subject: Math's
Topic: Statistics
No. of Questions: 20

Q.1 Find the mean of the following distribution:

x_i :	10	30	50	70	89
f_i :	7	8	10	15	10

Sol:

x_i :	10	30	50	70	89
f_i :	7	8	10	15	10
$f_i x_i$:	70	240	500	1050	890
$N = \sum f_i = 50$ and $\sum f_i x_i = 2750$					
Mean = $\frac{\sum f_i x_i}{N} = \frac{2750}{50} = 55$					

Q.2 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

Sol:

x_i :	2	4	6	10	p+5
f_i :	3	2	3	1	2
$f_i x_i$:	6	8	18	10	2p+10
$N = \sum f_i = 11$ and $\sum f_i x_i = 2p + 52$					
Mean = $\frac{\sum f_i x_i}{N} = 6 = \frac{2p+52}{11}$					
$66 = 2p + 52$					
$2p = 14$					
$p = 7$					

Q.3 Find the missing frequencies in the following frequency distribution if it is known that the mean of the distribution is 1.46.

Number of accidents(x):	0	1	2	3	4	5	Total
Frequency(f):	46	?	?	25	10	5	200

Sol: Let the missing frequencies be f_1 and f_2 .

x_i :	0	1	2	3	4	5
f_i :	46	f_1	f_2	25	10	5
$f_i x_i$:	0	f_1	$2f_2$	75	40	25

$$N=86 + f_1 + f_2 \text{ and } \sum f_i x_i = 140 + f_1 + 2f_2$$

$$N=200$$

$$200=86 + f_1 + f_2$$

$$f_1 + f_2=114 \dots\dots\dots (1)$$

$$\text{Mean}= 1.46$$

$$1.46= \sum f_i x_i / N$$

$$292= 140 + f_1 + 2f_2$$

$$f_1 + 2f_2=152 \dots\dots\dots (2)$$

On solving (1) and (2)

$$f_1=76 \text{ and } f_2=38$$

Q.4 The following table shows the weights of 12 students:

Weight (in Kg):	67	70	72	73	75
Number of students:	4	3	2	2	1

Find the mean weight by shortcut method.

Sol: Let the assumed mean be $A=72$

x_i =	67	70	72	73	75
f_i =	4	3	2	2	1
$d_i = x_i - A = x_i - 72$:	-5	-2	0	1	3
$f_i d_i$:	-20	-6	2	2	3

$$N = \sum f_i = 12 \quad \sum f_i d_i = -21 \text{ and } A = 72$$

$$\text{Mean} = A + 1/N(\sum f_i d_i) = 72 + (-21)/12 = 72 - 7/4 = 70.25 \text{ Kg.}$$

Q.5 Find the mean wage from the following data:

Wage (in Rs.):	800	820	860	900	920	980	1000
No. Of workers:	7	14	19	25	20	10	5

Sol: Let the assumed mean be $A=900$ and $h=20$

Wage (in Rs.) x_i :	800	820	860	900	920	980	1000
No. Of workers f_i :	7	14	19	25	20	10	5
d_i :	-100	-80	-40	0	20	80	100
u_i :	-5	-4	-2	0	1	4	5
$f_i u_i$:	-35	-56	-38	0	20	40	25

$$N = \sum f_i = 100 \quad \sum f_i u_i = -44 \text{ and } A = 900 \text{ and } h = 20$$

$$\text{Mean} = \bar{X} = A + h(1/N \sum f_i u_i) = 891.2$$

Q.6 The table below gives the distribution of villages under different heights from the sea level in a certain region. Compute the mean height of the region.

Height (in metres):	200	600	1000	1400	1800	2200
No. Of villages:	142	265	560	271	89	16

Sol: Let the assumed mean be $A=1400$ and $h=40$

Height (in metres) x_i :	200	600	1000	1400	1800	2200
No. Of villages f_i :	142	265	560	271	89	16
d_i :	-1200	-800	-400	0	400	800
u_i :	-3	-2	-1	0	1	2
$f_i u_i$:	-426	-530	-560	0	89	32

$$N = \sum f_i = 1343 \quad \sum f_i u_i = -1395 \quad A = 1400 \quad h = 40$$

$$\text{Mean} = A + h \left\{ \frac{1}{N} \sum f_i u_i \right\} = 984.51$$

Q.7 Find the mean of the following frequency distribution:

Class-interval:	0-10	10-20	20-30	30-40	40-50
No. of workers f :	7	10	15	8	10

Sol:

Class-interval:	0-10	10-20	20-30	30-40	40-50
Mid-values (x_i):	5	15	25	35	45
No. of workers f :	7	10	15	8	10
$d_i = x_i - 25$:	-20	-10	0	10	20
u_i :	-2	-1	0	1	2
$f_i u_i$:	-14	-10	0	8	20

$$N = \sum f_i = 50 \quad \sum f_i u_i = 4 \quad A = 25 \quad h = 10$$

$$\text{Mean} = A + h \left\{ \frac{1}{N} \sum f_i u_i \right\} = 25.8$$

Q.8 Find the mean of the following frequency distribution:

(CBSE-2006)

Classes:	0-20	20-40	40-60	60-80	80-100
Frequency:	15	18	21	29	17

Sol:

Classes:	0-20	20-40	40-60	60-80	80-100
Mid-values (x_i):	10	30	50	70	90
Frequency (f_i):	15	18	21	29	17
$d_i = x_i - 50$:	-40	-20	0	20	40
u_i :	-2	-1	0	1	2
$f_i u_i$:	-30	-18	0	29	34

$$N = \sum f_i = 100 \quad \sum f_i u_i = 15 \quad A = 50 \quad h = 20$$

$$\text{Mean} = A + h \left\{ \frac{1}{N} \sum f_i u_i \right\} = 53$$

Q.9 If the mean of the following distributions 54, find the value of p: (CBSE-2006)

Class:	0-20	20-40	40-60	60-80	80-100
Frequency:	7	p	10	9	13

Sol:

Class:	0-20	20-40	40-60	60-80	80-100
Mid-values (x_i):	10	30	50	70	90
Frequency:	7	p	10	9	13
$d_i = x_i - 50$:	-40	-20	0	20	40
u_i :	-2	-1	0	1	2
$f_i u_i$:	-14	-p	0	9	26

$$N = \sum f_i = 39 + p \quad \sum f_i u_i = 21 - p \quad A = 50 \quad h = 20 \quad \text{and} \quad \bar{X} = 54$$

$$\text{Mean} = A + h \left\{ \frac{1}{N} \sum f_i u_i \right\}$$

$$54 = 50 + 20 \left\{ \frac{21 - p}{39 + p} \right\}$$

$$4 = 20 \left\{ \frac{21 - p}{39 + p} \right\}$$

$$39 + p = 105 - 5p$$

$$p = 11$$

Q.10 The mean of the following frequency table is 50. But the frequencies f_1 and f_2 in the class 20-40 and 60-80 are missing. Find the missing frequencies.

(CBSE-2006)

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

Sol: Let the assumed mean be $A = 50$ and $h = 20$

Class:	0-20	20-40	40-60	60-80	80-100
Mid-values (x_i):	10	30	50	70	90
Frequency:	17	f_1	32	f_2	19
u_i :	-2	-1	0	1	2
$f_i u_i$:	-34	$-f_1$	0	f_2	38

$$N = \sum f_i = 68 + f_1 + f_2 \quad \sum f_i u_i = 4 - f_1 + f_2 \quad A = 50 \quad h = 20 \quad \text{and} \quad \bar{X} = 50$$

$$N = \sum f_i = 68 + f_1 + f_2 = 120$$

$$f_1 + f_2 = 52 \dots \dots \dots (1)$$

$$\text{Mean} = A + h \left\{ \frac{1}{N} \sum f_i u_i \right\}$$

$$50 = 50 + 20 \left\{ \frac{4 - f_1 + f_2}{120} \right\}$$

$$f_1 - f_2 = 4 \dots \dots \dots (2)$$

On solving (1) and (2),

$$f_1 = 28 \text{ and } f_2 = 24$$

Q.11 If the median of the distribution given below is 28.5, find the value of x and y.

Class interval:	0-10	10-20	20-30	30-40	40-50	50-60
No. of students:	5	x	20	15	y	5

Sol:

Class interval:	0-10	10-20	20-30	30-40	40-50	50-60
No. of students (f):	5	x	20	15	y	5
Cumulative frequency(cf):	5	5+x	25+x	40+x	40+x+y	45+x+y

$$\text{Median} = 28.5$$

It lies in the class interval 20-30. So 20-30 is the median class.

$$l = 20, h = 10, f = 20, F = 5 + x \text{ and } N = 60$$

$$\text{Median} = l + \frac{(N/2 - F)}{f} \times h$$

$$28.5 = 20 + \frac{30 - (5 + x)}{20} \times 10$$

$$x = 8$$

$$N = 60$$

$$45 + x + y = 60$$

$$x + y = 15$$

Put $x = 8$ in $x + y = 15$, we get $y = 7$

Hence $x = 8$ and $y = 7$

Q.12 The following table shows the age distribution of cases of a certain disease admitted during a year in a particular hospital:

Age(in years):	5-14	15-24	25-34	35-44	45-54	55-64
No. of cases:	6	11	21	23	14	5

Find the average age for which the maximum cases occurred.

Sol: Here class intervals are not in inclusive form. So, we first convert them in inclusive form by subtracting $h/2$ from the lower limit and by adding $h/2$ to upper limit of each class, where h is the difference between the lower limit of a class and upper limit of the preceding class. The given frequency distribution in inclusive form is as follows:

Age(in years):	4.5-14.5	14.5-24.5	24.5-34.5	34.5-44.5	44.5-54.5	54.5-64.5
No. of cases:	6	11	21	23	14	5

We observe that the class 34.5-44.5 has the maximum frequency. So, it will be the modal class.

$$l=34.5, h=10, f=23, f_1=21 \text{ and } f_2=14$$

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

$$= 34.5 + \frac{(23 - 21)}{(46 - 21 - 14)} \times 10$$

$$\text{Mode} = 36.31$$

Q.13 The following data gives the distribution of total household expenditure (in rupees) of manual workers in a city:

Expenditure (in Rs.)	Frequency
1000-1500	24
1500-2000	40
2000-2500	33
2500-3000	28
3000-3500	30
3500-4000	22
4000-4500	16
4500-5000	7

Find the average expenditure which is being done by the maximum number of manual workers.

Sol: We observe that the class 1500-2000 has the maximum frequency 40. So, it is the modal class.
 $l=1500, h=500, f=40, f_1=24 \text{ and } f_2=33$
 $\text{Mode} = l + \frac{(f - f_1)}{(2f - f_1 - f_2)} \times h$
 $= 1500 + \frac{(40 - 24)}{(80 - 24 - 33)} \times 500$
 $\text{Mode} = 1847.826$

Q.14 For the following grouped frequency distribution find the mode:

Class:	3-6	6-9	9-12	12-15	15-18	18-21	21-24
Frequency:	2	5	10	23	21	12	3

Sol: We observe that the class 12-15 has the maximum frequency. So, it is the modal class.
 $l=12, h=3, f=23, f_1=10 \text{ and } f_2=21$
 $\text{Mode} = l + \frac{(f - f_1)}{(2f - f_1 - f_2)} \times h$
 $= 12 + \frac{(23 - 10)}{(46 - 10 - 21)} \times 3$
 $\text{Mode} = 14.6$

Q.15 Compute the mode for the following frequency distribution:

Size of items:	0-4	4-8	8-12	12-16	16-20	20-24	24-28	28-32	32-36	36-40
Frequency:	5	7	9	17	12	10	6	3	1	0

Sol: We observe that the class 12-16 has the maximum frequency 17. So, it is the modal class.
 $l=12, h=4, f=17, f_1=9 \text{ and } f_2=12$
 $\text{Mode} = l + \frac{(f - f_1)}{(2f - f_1 - f_2)} \times h$

$$=12 + (17 - 9)/(34 - 9 - 12) \times 4$$

$$\text{Mode} = 32.66$$

Q.16 Compute the median for the following cumulative frequency distribution:

Class interval:	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of students (f):	4	12	14	16	20	16	10	8

Sol:

Class interval:	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of students (f):	4	12	14	16	20	16	10	8
Cumulative frequency (cf):	4	16	30	46	66	82	92	100

$$N=100 \quad N/2=50$$

Median class is 60-70

$$l=60, h=10, f=20, F=46$$

$$\text{Median} = l + (N/2 - F)/f \times h$$

$$\text{Median} = 60 + \{50 - 46\}/20 \times 10$$

$$\text{Median} = 62$$

Q.17 Find the median of the following distribution:

Weekly wages:	60-69	70-79	80-89	90-99	100-109	110-119
No. of workers:	5	15	20	30	20	8

Sol: Here class intervals are not in inclusive form. So, we first convert them in inclusive form by subtracting $h/2$ from the lower limit and by adding $h/2$ to upper limit of each class, where h is the difference between the lower limit of a class and upper limit of the preceding class. The given frequency distribution in inclusive form is as follows:

Weekly wages:	59.5-69.5	69.5-79.5	79.5-89.5	89.5-99.5	99.5-109.5
No. of workers:	5	15	20	30	20
Cumulative frequency:	5	20	40	70	90

$$N=98 \quad N/2=49$$

Median class is 89.5-99.5

$$l=89.5, h=10, f=30, F=40$$

$$\text{Median} = l + (N/2 - F)/f \times h$$

$$\text{Median} = 89.5 + \frac{49 - 40}{30} \times 10$$

$$\text{Median} = 92.5$$

Q.18 Calculate the median of the following frequency distribution:

Class:	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45
Frequency:	5	6	15	10	5	4	2	2

Sol:

Class:	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45
Frequency:	5	6	15	10	5	4	2	2
Cf:	5	11	26	36	41	45	47	49

$$N = 49 \quad N/2 = 24.5$$

Median class is 15-20

$$l = 15, h = 5, f = 15, F = 11$$

$$\text{Median} = l + \frac{(N/2 - F)}{f} \times h$$

$$\text{Median} = 15 + \frac{24.5 - 11}{15} \times 5$$

$$\text{Median} = 19.5$$

Q.19 The frequency distribution of scores obtained by 230 candidates in a medical entrance exam is as follows:

Scores:	400-450	450-500	500-550	550-600	600-650	650-700	700-750	750-800
	450	500	550	600	650	700	750	800

No. of candidates:	20	35	40	32	24	27	18	24
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Draw the cumulative frequency curve by more than method. Also, draw the cumulative frequency polygon.

Sol:

Scores:	400-450	450-500	500-550	550-600	600-650	650-700	700-750	750-800
	450	500	550	600	650	700	750	800

No. of candidates:	20	35	40	32	24	27	18	24
Scores more than:	400	450	500	550	600	650	700	750
Cf:	230	210	175	135	103	79	61	27

Plot the points (400,230), (450, 210), (500,175), (550,135), (600,103), (650, 79), (700, 61), (750, 27) and (800,0) on the graph.

By joining these points by a free hand smooth curve, we obtain an ogive by more than method.

Q.20 Draw a cumulative frequency curve and cumulative frequency polygon for the following frequency distribution by less than method.

Marks:	0-10	10-20	20-30	30-40	40-50	50-60
No. of students:	7	10	23	51	6	3

Sol:

Marks:	0-10	10-20	20-30	30-40	40-50	50-60
No. of students:	7	10	23	51	6	3
Marks less than:	10	20	30	40	50	60
Cf:	7	17	40	91	97	100

Plot the points (0,0), (10, 7), (20,17), (30,40), (40,91), (50,97) and (60,100) on the graph.
By joining these points by a free hand smooth curve, we obtain an ogive by less than method.

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