CBSE Test Paper 03 Chapter 14 Statistics

- **1.** The mean of 'n' observations is \overline{x} . If the first item is increased by 1, second by 2 and so on, then the new mean is **(1)**
 - a. $\overline{x} \frac{n-1}{2}$ b. $\overline{x} - \frac{n+1}{2}$ c. $\overline{x} + \frac{n+1}{2}$ d. \overline{x}
- The arithmetic mean of a set of 40 values is 65. If each of the 40 values is increased by 5, what will be the mean of the set of new values: (1)
 - a. 65
 - b. 60
 - **c.** 70
 - d. 50
- **3.** The most frequent value in the data is known as **(1)**
 - a. mean
 - b. mode
 - c. all the three
 - d. median
- 4. If $x_i's$ are the midpoints of the class intervals of grouped data, $f_i's$ are the corresponding frequencies and \overline{x} is the mean, then $\sum (f_i x_i \overline{x})$ is equal to (1)
 - a. 2
 - b. 0
 - **c.** -1
 - d. 1
- The marks obtained by 9 students in Mathematics are 59, 46, 30, 23, 27, 40, 52, 35 and
 29. The median of the data is (1)

- a. 29
- b. 35
- **c.** 40
- d. 30
- 6. For a particular year, the following is the distribution of the age (in yrs.) of primary school teachers in H.P:

Age(in years)	Number of teachers
16 - 20	11
21 - 25	32
26 - 30	51
31 - 35	49
36 - 40	27
41 - 45	6
46 - 50	4

Find how many teachers are of age less than 31 years. (1)

 The widths of 50 leaves of a plant were measured in mm and their cumulative frequency distribution is shown in the following table. Make frequency distribution table for this. (1)

Width(in mm)	Cumulative Frequency
Greater than or equal to 20	50
Greater than or equal to 30	44
Greater than or equal to 40	28
Greater than or equal to 50	20
Greater than or equal to 60	15
Greater than or equal to 70	7

Greater than or equal to 80	0
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8. A data has 25 observations arranged in a descending order. Which observation represents the median? (1)

9. Consider the following distribution : (1)

Marks	0 or more	10 or	20 or	30 or	40 or	50 or
Obtained		more	more	more	more	more
Number of students	63	58	55	51	48	42

- i. Calculate the frequency of class 30 -40.
- ii. Calculate the class mark of class $10\mathchar`-25$
- **10.** Convert the following data to a less than type distribution. **(1)**

С.І.	50 - 55	5 <mark>5 - 60</mark>	60 - 65	65 - 70	70 - 75	75 - 80
Frequency	2	8	12	24	38	16

- **11.** The mean of 'n' observations is \overline{x} , if the first term is increased by 1, second by 2 and so on. What will be the new mean? **(2)**
- **12.** Find the mean of the following frequency distribution : **(2)**

Class	0 - 6	6 - 12	12 - 18	18 - 24	24 - 30
Frequency	7	5	10	12	6

13. Following is the distribution of marks of 70 students in a periodical test:

Marks	Less than				
	10	20	30	40	50
Number of students	3	11	28	48	70

Draw a cumulative frequency curve for the above data. (2)

14. If the mean of the following distribution is 27, find the value of p. **(3)**

Class	0-10	10-20	20-30	30-40	40-50
Frequency	8	р	12	13	10

15. If the mean of the following data is 14.7, find the values of p and q. **(3)**

Class	0 - 6	6 - 12	12 -18	18 -24	24 -30	30 - 36	36 - 42	Total
Frequency	10	р	4	7	q	4	1	40

16. Find the mean marks per student, using assumed-mean method: (3)

Marks	0 -10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
Number of students	12	18	27	20	17	6

17. In a health check-up, the number of heart beats of 40 women are recorded in the following table: (3)

Number of he <mark>art b</mark> eats / minute	65-69	70-74	75-79	80-84
Number of women	2	18	16	4

Find the mean of data.

18. Following is the age distribution of a group of students. Draw the cumulative frequency curve of 'less than' type and hence obtain the median value. (4)

Age(in years)	Frequency
4 - 5	36
5 - 6	42
6 - 7	52
7 - 8	60
8 - 9	68

9 - 10	84
10 - 11	96
11 - 12	82
12 - 13	66
13 - 14	48
14 - 15	50
15 - 16	16

19. For the following distribution, calculate mean using all suitable methods:

Size of item	1-4	4-9	9-16	16-27
Frequency	6	12	26	20

20. The following table gives the height of trees:

Height	No. of trees		
Less than 7	26		
Less than 14	57		
Less than 21	92		
Less than 28	134		
Less than 35	216		
Less than 42	287		
Less than 49	341		
Less than 56	360		

Draw 'less than' ogive and 'more than' ogive.

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Solution

1. c. $\overline{x} + \frac{n+1}{2}$ Explanation: Let terms be $x_1, x_2, x_3, \dots, x_n$. \therefore Mean (\overline{x}) $= \frac{x_1+x_2+x_3+\dots+x_n}{n}$ $\Rightarrow x_1 + x_2 + x_3 + \dots + x_n = n.\overline{x}$ New observations, are $x_1 + 1, x_2 + 2, x_3 + 3, \dots, x_n + n$. \therefore New Mean $= \frac{x_1+1+x_2+2+x_3+3+\dots+x_n+n}{n}$ $= \frac{n.\overline{x} + \frac{n(n+1)}{2}}{n}$ $= \overline{x} + \frac{n+1}{2}$ 2. c. 70 Explanation: Mean of 40 values = 65

Explanation: Mean of 40 values = 65 Total of 40 values = $65 \times 40 = 2600$ When each value is increased by 5, then total of 40 values will be $40 \times 5 = 200$ more than 2600 \therefore New total of 40 values = 2600 + 200 = 2800Now, New mean of 40 values = $\frac{2800}{40} = 70$

3. b. mode

Explanation: The most frequent value in the data is known as the Mode. e.g let us consider the following data set: 3,5,7,5,9,5,8,4 the mode is 5 , since it occurs most often in data set.

4. b. 0

Explanation: If $x_i's$ are the midpoints of the class intervals of grouped data, $f_i's$ are the corresponding frequencies and \overline{x} is the mean, then $\sum (f_i x_i - \overline{x})$ is equal to 0. i.e the difference between the sum of product of frequencies and mid values of corresponding class intervals of the grouped data and the sum of

their mean value is equal to zero.

5. b. 35

Explanation: Arranging the given data in ascending order, we get 23, 27, 29, 30, 35, 40, 46, 52, 59

Here, n = 9, which is odd.

$$\therefore \text{Median} = \left(\frac{n+1}{2}\right)^{th} \text{term}$$
$$= \left(\frac{9+1}{2}\right)^{th} \text{term}$$
$$= \left(\frac{10}{2}\right)^{th} \text{term}$$
$$= 5\text{th term}$$
$$= 35$$

- 6. Number of teachers of age less than 31 years =11+32+51=94
- 7. Table:

Width(in mm)	20 - 30	<mark>30 -</mark> 40	40 - 50	50 - 60	60 -70	70 -80
Frequency	6	16	8	5	8	7

8. Number of observations = 25

Hence, median = Value of $\left(\frac{n+1}{2}\right)^{th}$ Observation = Value of $\left(\frac{25+1}{2}\right)^{th}$ Observations

= Value of 13th Observation

9. i.

Class Interval	c.f.	f
0-10	63	63 - 58 = 5
10-20	58	58 - 55 = 3
20-30	55	55 - 51 = 4
30-40	51	51 - 48 = 3
40-50	48	48 - 42 = 6

	50-60			42			42	
ii.	So, frequency of the class 30 - 40 is 3. ii. Class mark $= \frac{(\text{upper limit} + \text{lower limit})}{2}$ Class mark of the class : $10 - 25 = \frac{10+25}{2}$ $= \frac{35}{2}$ = 17.5							
		= 0		(0)				00

10.

Less than	50	55	60	65	70	75	80
Frequency	0	2	10	22	46	84	100

11. Mean of the series = \overline{x}

According to the question, terms of new series-

I term + 1

II term + 2

- III term + 3
- n terms + n

The mean of the new numbers is $\overline{x} + \frac{\frac{n(n+1)}{2}}{n} = \overline{x} + \frac{(n+1)}{2}$

12.

Class	0 - 6	6 - 12	12 - 18	18 - 24	24 - 30	
x	3	9	15	21	27	
f	7	5	10	12	6	$\Sigma f = 40$
fx	21	45	150	252	162	$\Sigma fx = 630$

$$\Sigma f x = 630, \Sigma f = 40$$

Mean = $rac{\Sigma f x}{\Sigma f}$
= $rac{630}{40}$
= 15.75

13. We plot the points (10, 3), (20, 11), (30, 28), (40, 48) and (50, 70) to get the cumulative frequency curve as follows:



14.

Class interval	Mic	l value	x _i		Free	quency f _i		f _i x _i
0 - 10		5				8		40
10 – 20	15		15			Р		152
20 - 30		25				12		300
30 - 40	35		35			13		455
40 – 50		45			10			450
						N = 43 +	Р	Sum = 1245 + 15p

Given mean =27

$$Mean = \frac{sum}{N}$$
$$\frac{1245+15p}{43+p} = 27$$
$$1245 + 15p = 1161 + 27p$$
$$12p = 84$$
$$P = 7$$

15.

Class	x_i	f_i	$x_i f_i$

0 - 6	3	10	30
6 - 12	9	р	9p
12 - 18	15	4	60
18 - 24	21	7	147
24 - 30	27	q	27q
30 - 36	33	4	132
36 - 42	39	1	39
Total	Total	$\Sigma f_i=26+p+q=40$	$\Sigma x_i f_i = 408 + 9p + 27q$

Given,
$$\Sigma f_i = 40$$
,
 $\Rightarrow 26 + p + q = 40$.
 $\Rightarrow p + q = 40 - 26$
 $\Rightarrow p + q = 14...(i)$
 \therefore Mean, $\overline{x} = \frac{\Sigma x_i f_i}{\Sigma f_i}$
 $\Rightarrow 14.7 = \frac{408 + 9p + 27q}{40}$
 $\Rightarrow 588 = 408 + 9p + 27q$
 $\Rightarrow 588 - 408 = 9p + 27q$
 $\Rightarrow 180 = 9p + 27q$
 $\Rightarrow p + 3q = 20......(ii)$
Subtracting eq(i) from eq (ii),
 $2q = 6$
 $\Rightarrow q = 3$
Putting this value of q in eq(i),
 $p = 14 - q$
 $p = 14 - 3$
 $p = 11$
Hence, $p = 11, q = 3$

16. the assumed mean is 25.



			$d_i = (x_i - 25)$	
0 - 10	12	5	-20	-240
10 - 20	18	15	-10	-180
20 - 30	27	25 = A	0	0
30 - 40	20	35	10	200
40 - 50	17	45	20	340
50 - 60	6	55	30	180
	$\Sigma f_i = 100$			$\Sigma\left(f_i imes d_i ight)=300$

we know that, mean =
$$A + rac{\sum (f_i imes x_i)}{\sum f_i}$$

From table, $\Sigma f_i = 100$ and $\Sigma (f_i imes d_i)$ = 300
= $\left(25 + rac{300}{100}
ight)$
= $25 + 3 = 28$

17.

Number of heart beats/minute	Class marks(x _i)	Number of women (f _{i)}	$u_{i=\frac{x_i-72}{5}}$	$f_i u_i$
65-69	67	2	-1	-2
70-74	72=a	18	0	0
75-79	77	16	1	16
80-84	82	4	2	8
Total		$\sum f_i = 40$		$\sum f_i u_i = 22$

Here, class intervals are not continuous . But mid - value \boldsymbol{x}_i of each class interval

would be same either class interval is continuous or not continuous.

So, we solve it without making it continuous.

Also, $\boldsymbol{x}_i{}'\boldsymbol{s}$ are larger , so we apply step-deviation method.

Here, class width (h) = 5.

Table for the given data is:

Now, we have a = 72, h = 5, $\sum f_i = = 22$ $\therefore 40$, $\sum f_i u_i$ By step- deviation method, Mean $(\overline{x}) = a + \frac{\sum f_i u_i}{\sum f_i} \times h$ $= 72 + \frac{22}{40} \times 5$ $= 72 + \frac{22}{8}$ = 72 + 2.75 = 74.75Mean of given data is 74.75.

18. 'less than' type :

Age(in years)	cf
Less than 5	36
Less than 6	78
Less than 7	130
Less than 8	190
Less than 9	258
Less than 10	342
Less than 11	438
Less than 12	520
Less than 13	586
Less than 14	634
Less than 15	684
Less than 16	700

And, plot the points A(5, 36), B(6, 78), C(7, 130), D(8, 190), E(9,258), F(10,342), G(11, 438), H(12,520), I(13,586), J(14,634), K(15,684) and L(16,700).

We join freehand these points to get the cumulative frequency curve.

On a graph paper, we take the scale.



Scale:

Along x - axis, 5 small divisions = 1

Along the y - axis, 1 small division = 10

Here, N = 700 $\Rightarrow \frac{N}{2} = 350$

Take a point P(0, 350) on the y-axis and draw PQ || x-axis, meeting the curve at Q.

Draw QM \perp x-axis, intersecting the x-axis at M whose coordinates are (10,0).

Hence, median = 10 years.

19. By direct method

Class interval	Mid value x _i	Frequency f _i	f _i x _i
1 - 4	2.5	6	15
4 - 9	6.5	12	18
9 - 16	12.5	26	325
16 – 27	21.5	20	430
		N = 64	Sum = 848

 $Mean = \frac{sum}{N} = \frac{848}{64}$

= 13.25

By assuming mean method

Let the assumed mean (A) = 6.5

Class interval	Mid value x _i	u _i = (x _i - A) =x _i - 65	Frequency f _i	f _i u _i
1 - 4	2.5	-4	6	-25
4 - 9	6.5	0	12	0
9 - 16	12.5	6	26	196
16 - 27	21.5	15	20	300
			N = 64	Sum = 432

Mean = $A + \frac{sum}{N}$ = 6.5+432/64 = 6.5 + 6.75 = 13.25

20. By less than method:

Height	Frequency	Height less than	C.F.
0-7	26	7	26
7-14	31	14	57
14-21	35	21	92
21-28	42	28	134
28-35	82	35	216
35-42	71	42	287
42-49	54	49	341
49-56	19	56	360

Plot the points (7,26), (14,57), (21,92), (28,134), (35,216), (42,287), (49,341), (56,360) by taking upper class limit over the x-axis and cumulative frequency over the y-axis. By more than method:

Height	Frequency	Height more than	C.F.
0-7	26	0	360
7-14	31	7	334
14-21	35	14	303
21-28	42	21	268
28-35	82	28	226
35-42	71	35	144
42-49	54	42	73
49-56	19	49	19

plot (0,360) , (7,334) , (14,303) , (21,268) (28,226) , (35,144) , (42,73) , (49,19) by taking lower class limit over the x-axis and cumulative frequency over the y-axis.

