**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. $\overline{x}$

2. 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 $\sum\left(f_ix_i - \overline{x}\right)$ is equal to **(1)**

   a. 2
   b. 0
   c. -1
   d. 1

5. 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)**

7. 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 |

8. A data has 25 observations arranged in a descending order. Which observation represents the median? **(1)**

9. Consider the following distribution : **(1)**

| **Marks Obtained** | 0 or more | 10 or more | 20 or more | 30 or more | 40 or more | 50 or 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 - 25

10. Convert the following data to a less than type distribution. **(1)**

| **C.I.** | 50 - 55 | 55 - 60 | 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 | Less than 20 | Less than 30 | Less than 40 | Less than 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 | p | 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 | p | 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 heart beats / 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.

**CBSE Test Paper 03**

**Chapter 14 Statistics**

**Solution**

1. c. $\overline{x} + \frac{n+1}{2}$

   **Explanation:** Let terms be $x_1, x_2, x_3, \ldots\ldots\ldots\ldots, x_n$.

   $\therefore$ Mean $(\overline{x})$

   = $\frac{x_1+x_2+x_3+\ldots\ldots\ldots\ldots+x_n}{n}$

   $\Rightarrow x_1 + x_2 + x_3 + \ldots\ldots\ldots\ldots + x_n = n.\overline{x}$

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

   $\therefore$ New Mean = $\frac{x_1+1+x_2+2+x_3+3+\ldots\ldots\ldots\ldots+x_n+n}{n}$

   = $\frac{n.\overline{x}+\frac{n(n+1)}{2}}{n}$

   = $\overline{x} + \frac{n+1}{2}$

2. c. 70

   **Explanation:** Mean of 40 values = 65

   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 = 2800

   Now, 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.

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

   = $\left(\frac{9+1}{2}\right)^{th}$ term

   = $\left(\frac{10}{2}\right)^{th}$ term

   = 5th term

   = 35

6. Number of teachers of age less than 31 years $= 11 + 32 + 51 = 94$

7. Table:

| **Width(in mm)** | 20 -30 | 30 - 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 $13^{\text{th}}$ 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 |

So, frequency of the class 30 - 40 is 3.

ii. $\text{Class mark } = \frac{(\text{upper limit } + \text{ lower limit})}{2}$

$\text{Class mark of the class } : 10 - 25 = \frac{10+25}{2}$

$= \frac{35}{2}$

$= 17.5$

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 | $\Sigma fx = 630$ |

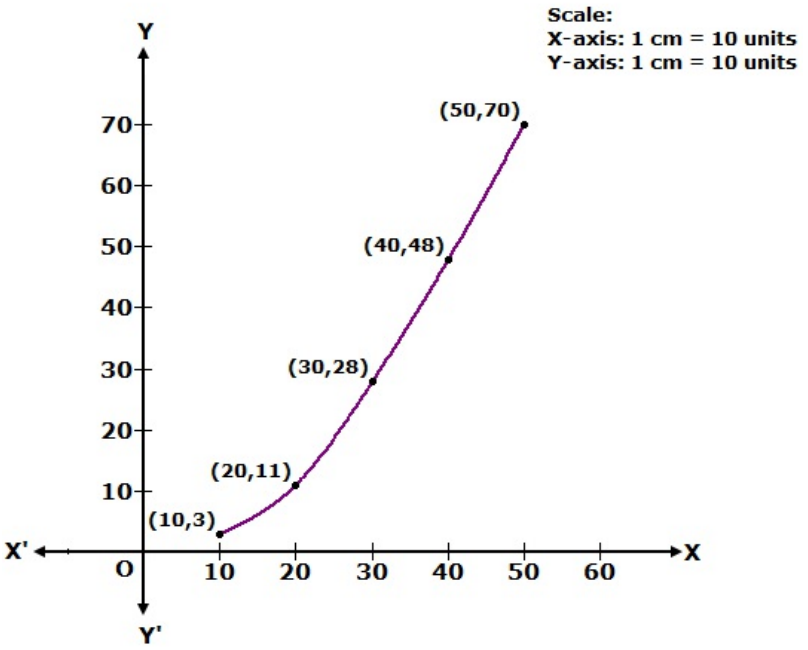
$\Sigma fx = 630, \Sigma f = 40$

Mean = $\frac{\Sigma fx}{\Sigma f}$

$= \frac{630}{40}$

$= 15.75$

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** | **Mid value $x_i$** | **Frequency $f_i$** | **$f_ix_i$** |
|---|---|---|---|
| 0 – 10 | 5 | 8 | 40 |
| 10 – 20 | 15 | P | 152 |
| 20 – 30 | 25 | 12 | 300 |
| 30 – 40 | 35 | 13 | 455 |
| 40 – 50 | 45 | 10 | 450 |
| | | **N = 43 + P** | **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** | $x_i$ | $f_i$ | $x_if_i$ |
|---|---|---|---|
| | | | |

| | | | |
|---|---|---|---|
| $0-6$ | 3 | 10 | 30 |
| $6-12$ | 9 | p | 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, $\overline{x} = \frac{\Sigma x_i f_i}{\Sigma f_i}$
$\Rightarrow \quad 14.7 = \frac{408+9p+27q}{40}$
$\Rightarrow 588 = 408+9p+27q$
$\Rightarrow 588-408 = 9p+27q$
$\Rightarrow 180 = 9p+27q$
$\Rightarrow p+3q = 20.$.....(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.

| **Class Interval** | **Frequency($f_i$)** | **Mid value $x_i$** | **Deviation** | **($f_i \times d_i$)** |
|---|---|---|---|---|

| | | | $d_i = (x_i - 25)$ | |
|---|---|---|---|---|
| 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 |
| | $\Sigma f_i = 100$ | | | $\Sigma\left(f_i \times d_i\right) = 300$ |

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

From table, $\Sigma f_i = 100$ and $\Sigma\left(f_i \times d_i\right)$= 300

$= \left(25 + \frac{300}{100}\right)$

$= 25 + 3 = 28$

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 $x_i$ of each class interval would be same either class interval is continuous or not continuous.

So , we solve it without making it continuous.

Also, $x_i$'s are larger , so we apply step-deviation method.

Here, class width $(h) = 5$.

Table for the given data is:

Now , we have ,$a = 72,\ h = 5, \sum f_i = 40, \sum f_i u_i = 22$

$\therefore$ By step- deviation method,

Mean($\overline{x}$)= $a + \frac{\sum f_i u_i}{\sum f_i} \times h$

$= 72 + \frac{22}{40} \times 5$

$= 72 + \frac{22}{8}$

$= 72 + 2.75$

$= 74.75$

Mean of given data is 74.75.

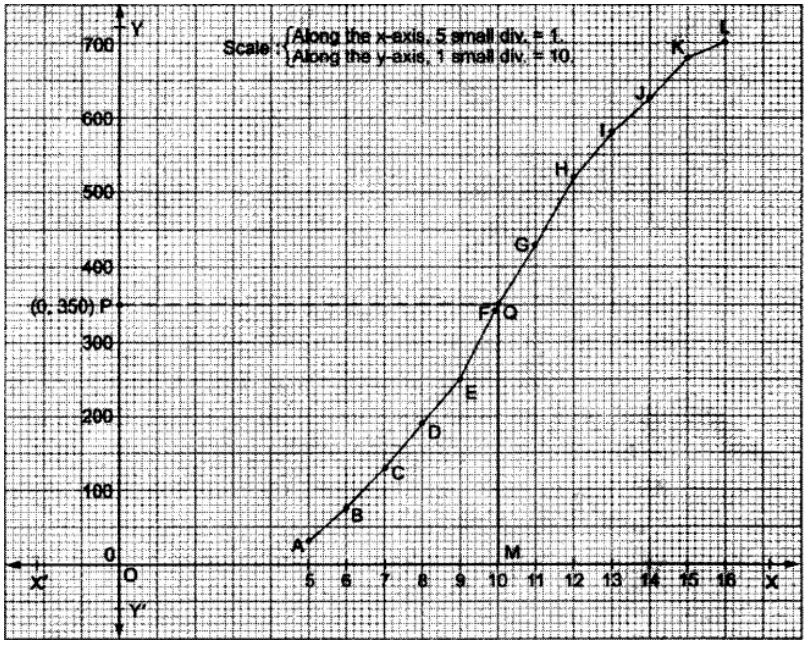
18. 'less than' type :

| 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 $f_i$** | **$f_ix_i$** |
|---|---|---|---|
| 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.