Class 10 Mathematics · Chapter 13: Statistics

Answer key and marking scheme · 20 marks · about 40 minutes · based on NCERT

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1. For a distribution with class size 10, the modal class is 40-50 with frequency 20; the class before it has frequency 12 and the class after it has frequency 8. The mode is [1]

(a) 46 (b) 44
(c) 42 (d) 48

Answer: (b) Mode = $l + ((f_1 - f_0) \div (2f_1 - f_0 - f_2)) \times h = 40 + (8 \div 20) \times 10 = 44$. 46 uses $f_1 - f_2$ on top; 42 leaves f_0 and f_2 out of the denominator.

2. For a distribution with class size 20, the step deviation method gives $a = 150$, $\Sigma f_i = 40$ and $\Sigma f_i u_i = 12$. The mean is [1]

(a) 144 (b) 150.3
(c) 162 (d) 156

Answer: (d) $\bar{x} = a + (\Sigma f_i u_i \div \Sigma f_i) \times h = 150 + (12 \div 40) \times 20 = 150 + 6 = 156$. 150.3 forgets to multiply by h.

3. Using the assumed mean method with $a = 45$, a student finds $\Sigma f_i = 50$ and $\Sigma f_i d_i = -150$. The mean is [1]

(a) −3 (b) 48
(c) 45 (d) 42

Answer: (d) $\bar{x} = a + \Sigma f_i d_i \div \Sigma f_i = 45 + (-150 \div 50) = 45 - 3 = 42$. 48 adds the deviation with the wrong sign; −3 forgets to add a.

4. Asha finds the mean of a grouped distribution of 50 observations by the direct method and gets 41.6. Ravi uses the step deviation method on the same data with $a = 45$ and $h = 10$. His $\Sigma f_i u_i$ must be [1]

(a) −3.4 (b) 17
(c) −17 (d) −34

Answer: (c) The methods give the same mean, so $41.6 = 45 + (\Sigma f_i u_i \div 50) \times 10$. Then $\Sigma f_i u_i \div 5 = -3.4$, so $\Sigma f_i u_i = -17$. −3.4 stops one step short.

5. The class marks of a distribution are 1250, 1350, 1450, 1550 and 1650, and the frequencies run into the hundreds. The way of finding the mean that keeps the arithmetic smallest is [1]

(a) the direct method (b) the step deviation method
(c) adding the class marks and dividing by 5 (d) the mode formula

Answer: (b) With large x_i and f_i, taking $a = 1450$ and dividing every d_i by $h = 100$ leaves $u_i = -2, -1, 0, 1, 2$. The direct method multiplies the large numbers as they stand; adding class marks ignores the frequencies.

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6. The weekly hours spent on homework by 40 students of a school in Pune are given below. Find the mean number of hours by the direct method. [2]

Hours	Number of students
0-4	5
4-8	8
8-12	12
12-16	9
16-20	6

Class marks 2, 6, 10, 14, 18. f_ix_i: 10, 48, 120, 126, 108; $\Sigma f_ix_i = 412$. $\bar{x} = 412 \div 40 = 10.3$ hours.

- class marks and the f_ix_i column, $\Sigma f_ix_i = 412$ (1)
- mean = 412 ÷ 40 = 10.3 hours (1)

7. The table gives the number of runs made by 47 batters in a district cricket camp in Ranchi, grouped as below. Find n/2 and the median class. [2]

Runs	Number of batters
0-10	5
10-20	9
20-30	14
30-40	12
40-50	7

n = 47, so n/2 = 23.5 (the grouped formula halves n whatever its parity). Cumulative frequencies: 5, 14, 28, 40, 47. The first to exceed 23.5 is 28, so the median class is 20-30.

- n/2 = 23.5 and cumulative frequencies 5, 14, 28, … (1)
- median class 20-30 (1)

8. The mean and median of the monthly rents of shops in a market in Indore are ₹52.4 thousand and ₹50 thousand. Estimate the mode, and say what the relationship you used is for. [2]

3 Median = Mode + 2 Mean, so Mode = 3(50) − 2(52.4) = 150 − 104.8 = ₹45.2 thousand. The relationship is empirical: it estimates the third measure when two are known.

- mode = 3 Median − 2 Mean = ₹45.2 thousand (1)
- states it is an empirical estimate from the other two measures (1)

9. The marks of 45 students in a unit test at a school in Jaipur are given below. Find the mode. [3]

Marks	Number of students
1-10	5
11-20	9
21-30	15
31-40	11
41-50	5

The classes have gaps, so make them continuous: 0.5-10.5, 10.5-20.5, 20.5-30.5, 30.5-40.5, 40.5-50.5. Modal class 20.5-30.5; l = 20.5, $f_1 = 15$, $f_0 = 9$, $f_2 = 11$, h = 10. Mode = $20.5 + ((15 - 9) \div (30 - 9 - 11)) \times 10 = 20.5 + 6 = 26.5$.

- classes made continuous, l = 20.5 (1)
- f_1, f_0, f_2, h substituted (1)
- mode = 26.5 (1)

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10. The monthly mobile data (GB) used by the members of a youth club in Bhopal is given below. The mean is 25.75 GB. Find k. [3]

Data used (GB)	Number of members
0-10	5
10-20	8
20-30	k
30-40	9
40-50	6

Class marks 5, 15, 25, 35, 45. $\Sigma f_i = 28 + k$; $\Sigma f_i x_i = 25 + 120 + 25k + 315 + 270 = 730 + 25k$. Then $(730 + 25k) \div (28 + k) = 25.75$, so $730 + 25k = 721 + 25.75k$, giving $0.75k = 9$ and $k = 12$.

- $\Sigma f_i = 28 + k$ and $\Sigma f_i x_i = 730 + 25k$ (1)
- equation $(730 + 25k) = 25.75(28 + k)$ (1)
- $k = 12$ (1)

11. The time taken by 50 students of a school in Lucknow to reach school is given below. Find the median time. [3]

Time (minutes)	Number of students
0-10	7
10-20	12
20-30	15
30-40	10
40-50	6

Cumulative frequencies: 7, 19, 34, 44, 50. $n/2 = 25$; the first cumulative frequency above 25 is 34, so the median class is 20-30. $l = 20$, $cf = 19$, $f = 15$, $h = 10$. Median $= 20 + ((25 - 19) \div 15) \times 10 = 24$ minutes.

- cumulative frequency column (1)
- median class 20-30 with l, cf, f, h (1)
- median = 24 minutes (1)

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