Unit 13 · Statistics

ANSWER KEY · FOR TEACHERS

Full marks 33.5

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. mid-value → **c.** half the sum of a class's lower and upper limits
2. cumulative frequency → **a.** the number of values up to a class's upper limit
3. median → **d.** the middle value of data arranged in order
4. mode → **b.** the value that occurs most often
5. first quartile → **f.** the value with a quarter of the data below it

K · 2.5

Each carries 0.5 mark.

2 Multiple choice

i. **b.** 50 — K · 1

$\frac{40+60}{2} = 50.$

ii. **b.** the $\left(\frac{N}{4}\right)$th — K · 1

For classes, Q_1 is the $\frac{N}{4}$th item; $\frac{N+1}{4}$ is for individual and discrete series.

iii. **c.** 37.5 — U · 1

$\overline{X} = \frac{1500}{40} = 37.5.$

iv. **b.** 20–30 — U · 1

$N = 40$: the median is the 20th item. 12 values are below 20 and 25 below 30, so it is in 20–30.

v. **b.** 47 — A · 1

$\overline{X} = 50 + \frac{-60}{20} = 47.$

3 Very short answers

a. MARKING SCHEME — K · 1

✓ The frequency of the class before the modal class.

b. MARKING SCHEME — U · 1

✓ 6.5.

c. MARKING SCHEME — U · 1

✓ 4.

4 Short answers

a. ANSWER — U · 2

For classes the median is the $\frac{N}{2} = 25$th item, and *cf* is that of the class **before** the median class (15), not the median class's own (30). Her answer, 17, isn't even in the median class.

$M_d = 20 + \frac{25-15}{15} \times 10 = \mathbf{26.67}$.

MARKING SCHEME

✓ Both mistakes named ($\frac{N}{2}$; *cf* of the class before).

✓ 26.67.

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b. MARKING SCHEME U · 2

- ✓ $\Sigma fm = AN + \Sigma fd$.
- ✓ Dividing by N gives the direct formula.

c. MARKING SCHEME A · 2

- ✓ Totals 90 and 64.
- ✓ 26.

5 Problems

a. ANSWER A · 3

With $A = 250$: $d = -200, -100, 0, 100, 200$; $fd = -1000, -1200, 0, 1000, 1000$; $\Sigma fd = -200$, $N = 50$.

$\overline{X} = 250 + \frac{-200}{50} =$ **Rs 246**.

MARKING SCHEME

- ✓ The d and fd columns.
- ✓ $\Sigma fd = -200$, $N = 50$.
- ✓ Rs 246.

b. ANSWER A · 3

cf: 5, 17, 35, 45, 50. The 25th item is in 200–300 (17 below 200).

$M_d = 200 + \frac{25 - 17}{18} \times 100 =$ **Rs 244.44**.

MARKING SCHEME

- ✓ The *cf* column and the median class 200–300.
- ✓ $L = 200$, $cf = 17$, $f = 18$, $h = 100$.
- ✓ Rs 244.44.

c. ANSWER A · 3

Modal class 200–300: $f_1 = 18$, $f_0 = 12$, $f_2 = 10$.

$M_o = 200 + \frac{18 - 12}{36 - 12 - 10} \times 100 = 200 + 42.86 =$ **Rs 242.86**.

MARKING SCHEME

- ✓ The modal class and f_1, f_0, f_2.
- ✓ The formula with the values.
- ✓ Rs 242.86.

d. ANSWER A · 3

cf: 4, 12, 26, 36, 40; $N = 40$.

Q_1, the 10th item, in 20–30: $20 + \frac{10 - 4}{8} \times 10 =$ **27.5**.

Q_3, the 30th item, in 40–50: $40 + \frac{30 - 26}{10} \times 10 =$ **44**.

MARKING SCHEME

- ✓ The *cf* column.
- ✓ $Q_1 = 27.5$.
- ✓ $Q_3 = 44$.

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e. **ANSWER** HA · 3

$N = 27 + x$; the median 22 is in 20–30 with $cf = 5 + x$, $f = 10$.

$22 = 20 + \dfrac{\frac{27+x}{2} - (5+x)}{10} \times 10$, so $\dfrac{27+x}{2} - 5 - x = 2$, $27 + x - 10 - 2x = 4$: $x = \mathbf{13}$.

Check: $N = 40$, the 20th item is 2 into 20–30 after 18: 22 ✓.

MARKING SCHEME

- ✓ $N = 27 + x$ and $cf = 5 + x$.
- ✓ The equation from the formula.
- ✓ $x = 13$.

6 Think

ANSWER HA · 2

The **median**: half the families earn less than Rs 2,50,000. A few families with very large incomes raise the total, and so the mean, but they are only a few values above the middle, so the median hardly moves.

MARKING SCHEME

- ✓ The median, with half the families below it.
- ✓ A few very high incomes pull the mean up.

7 Activity: Letters in names

(not marked)

WHAT STUDENTS SHOULD FIND

In many classes most first names have 4 to 6 letters (Sita, Bikash, Sunita), so the mode and the median often fall in that range and close together. The median is the 10.5th name in order, found from the cumulative frequency column; if the two differ, a few long or short names are pulling one way.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	5.5	8	15	5	**33.5**

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