Statistics topic test 3

10 questions | 40 marks | 65 minutes

A progressive original paper on investigation design, numerical summaries and evidence-based interpretation.

Equivalent correct methods earn the corresponding marks.

1. A researcher asks “Do students prefer online learning?” [4 marks]

(a) Improve the question. [2 marks]

Define population, period and response.

Answer: For example: What proportion of this school’s current Year 11 students prefer online to face-to-face revision this term?

(b) Why is it statistical? [2 marks]

A proportion or distribution needs several observations.

Answer: Preferences can differ between students.

2. Five classes are randomly selected, then every member is surveyed. [4 marks]

(a) Name the method. [2 marks]

Groups are selected before their members are measured.

Answer: Cluster sampling.

(b) State a limitation. [2 marks]

The design needs adequate cluster coverage.

Answer: Class members may be similar, and only a few clusters may not represent the cohort.

3. An exercise-time column labelled minutes contains 45, 60, 75, blank, 0, 1.5. [4 marks]

(a) Which entries need clarification? [2 marks]

Check original responses before altering them.

Answer: Blank is missing; 1.5 may mean hours; 0 might be genuine or a missing-code error.

(b) Why distinguish missing from zero? [2 marks]

Treating missing as zero distorts the meaning and averages.

Answer: Zero measures none; missing means no usable value.

4. Data are 2, 3, 4, 4, 7, 10. [4 marks]

(a) Find mean, median, range. [2 marks]

Total 30 divided by count 6; middle pair 4, 4; $10-2=8$.

Answer: 5, 4, 8.

(b) Find Q_1, Q_3, IQR using halves. [2 marks]

Lower half 2, 3, 4; upper half 4, 7, 10.

Answer: 3, 7, 4.

5. Category counts are A 8, B 12, C4, D6. [4 marks]

Category	A	B	C	D
Frequency	8	12	4	6

(a) Find relative frequency of B. [2 marks]

Total 30; $\frac{12}{30}=0.4$.

Answer: 0.4 or 40%.

(b) Choose a display and explain why not a histogram. [2 marks]

A histogram implies a numerical interval structure.

Answer: Bar chart; A-D are categories, not numerical intervals.

6. The full population is 3, 3, 7, 7. [4 marks]

(a) Find mean and population SD. [2 marks]

Squared deviations total 16; $\sqrt{\frac{16}{4}} = 2$.

Answer: 5 and 2.

(b) Add 5 to every value. Give new mean and SD. [2 marks]

Translation changes centre but not spread.

Answer: Mean 10; SD 2.

7. $Q_1 = 9$, $Q_3 = 15$, and 25 is recorded. [4 marks]

(a) Find fences and decide whether 25 is flagged. [2 marks]

IQR 6; subtract/add 9.

Answer: 0 and 24; 25 is flagged.

(b) Give a legitimate action if 25 is genuine and relevant. [2 marks]

The flag is not a deletion instruction.

Answer: Retain it and use suitable summaries; a transparent sensitivity analysis may help.

8. Scores: A median 40, IQR 12, range 30; B median 43, IQR 6, range 35. [4 marks]

(a) Compare centre and central spread. [2 marks]

Compare matching measures.

Answer: B median is 3 points higher; its IQR is 6 points smaller.

(b) How can B have smaller IQR but larger range? [2 marks]

IQR and range use different parts of the distribution.

Answer: The middle half can be tighter while extremes extend farther.

9. Sales rise from 98 to 102 units; a bar-chart axis starts at 97. [4 marks]

(a) Find the percentage increase. [2 marks]

$\frac{4}{98} \times 100 \approx 4.08\%$.

Answer: About 4.08%.

(b) Explain the graphical concern. [2 marks]

Use an honest zero baseline or a more appropriate clearly labelled display.

Answer: Truncated bars can exaggerate a modest increase.

10. Calculator owners have higher average marks in a survey. [4 marks]

(a) Why is ownership not established as the cause? [2 marks]

The design is observational.

Answer: Course choice, prior attainment and habits may differ.

(b) Give a cautious statement and next step. [2 marks]

Further analysis should address plausible alternative explanations.

Answer: Ownership was associated with marks; compare similar course/prior-achievement groups.