# A Level Statistics
# Practice Test 3: Data Collection

**Instructions:**
Answer all questions. Show your working clearly.
Calculators may be used unless stated otherwise.
Draw diagrams where appropriate to illustrate your solutions.
Time allowed: 3 hours

## Section A: Statistical Diagrams and Interpretation [25 marks]

1. **[8 marks]** Explain the construction and use of different statistical diagrams:
   (a) Define frequency polygons and explain when they are preferred over histograms.
   (b) Explain cumulative frequency curves (ogives) and their applications.
   (c) Describe stem-and-leaf diagrams and their advantages for small datasets.
   (d) Compare dot plots and strip charts for displaying quantitative data.

2. **[10 marks]** Choose the most appropriate diagram for each scenario and justify your choice:
   (a) Displaying the daily temperature readings over a month
   (b) Comparing salary distributions across different job sectors
   (c) Showing the breakdown of a company's annual expenses
   (d) Illustrating the relationship between study time and exam scores
   (e) Displaying the number of defective items produced each day
   (f) Comparing test score distributions between two classes
   (g) Showing quarterly sales figures over three years
   (h) Displaying the median house prices by region
   (i) Illustrating the spread of reaction times in an experiment
   (j) Showing the proportion of votes for different political parties

3. **[7 marks]** A researcher collected data on smartphone battery life (in hours) for 50 devices:

   8.2, 9.1, 7.8, 10.3, 8.9, 9.5, 8.7, 9.2, 8.1, 9.8, 7.9, 8.6, 9.4, 8.3, 9.7,
   8.8, 9.0, 8.4, 9.6, 8.5, 9.3, 8.0, 9.9, 8.7, 9.1, 8.2, 9.4, 8.6, 9.2, 8.9,
   7.7, 8.8, 9.5, 8.1, 9.0, 8.4, 9.7, 8.3, 9.6, 8.7, 9.3, 8.5, 9.8, 8.0, 9.1,
   8.6, 9.4, 8.2, 9.2, 8.8

   (a) Create a stem-and-leaf diagram for this data.
   (b) Identify the median and mode from your diagram.
   (c) Suggest two other appropriate ways to display this data and explain why.

## Section B: Data Analysis and Summary Statistics [30 marks]

4. **[12 marks]** Define and explain measures of central tendency and spread:

(a) Compare mean, median, and mode as measures of central tendency.

(b) Explain when each measure is most appropriate.

(c) Define range, interquartile range, and standard deviation.

(d) Describe how outliers affect different measures of spread.

5. **[18 marks]** The following data shows exam scores (

| Score Range | Frequency |
|---|---|
| 40-50 | 2 |
| 50-60 | 5 |
| 60-70 | 8 |
| 70-80 | 10 |
| 80-90 | 4 |
| 90-100 | 1 |

(a) Calculate the estimated mean score using the midpoint method.

(b) Determine which class contains the median score.

(c) Estimate the median score using linear interpolation.

(d) Calculate the modal class and estimate the mode.

(e) Construct a cumulative frequency table.

(f) Use the cumulative frequency to estimate the first and third quartiles.

(g) Calculate the estimated interquartile range.

(h) Construct a histogram with appropriate frequency densities.

(i) Comment on the shape and skewness of the distribution.

## Section C: Comparative Analysis and Data Interpretation [35 marks]

6. **[15 marks]** Two manufacturing processes produce electronic components. Quality control data shows:

**Process A:** Mean life = 2400 hours, Standard deviation = 300 hours, n = 100 **Process B:** Mean life = 2350 hours, Standard deviation = 200 hours, n = 80

Additional data for Process A: Q1 = 2200 hours, Median = 2380 hours, Q3 = 2580 hours Additional data for Process B: Q1 = 2220 hours, Median = 2340 hours, Q3 = 2480 hours

(a) Calculate the coefficient of variation for each process.

(b) Compare the relative variability of the two processes.

(c) Calculate the interquartile range for each process.

(d) Determine which process has better consistency.

(e) Comment on the skewness of each distribution using the relationship between mean and median.

7. **[20 marks]** A retail chain collected customer satisfaction data from three stores:

| Rating | Store A | Store B | Store C |
|---|---|---|---|
| Very Poor (1) | 5 | 12 | 8 |
| Poor (2) | 15 | 18 | 10 |
| Average (3) | 35 | 25 | 22 |
| Good (4) | 30 | 20 | 35 |
| Excellent (5) | 15 | 25 | 25 |
| Total | 100 | 100 | 100 |

(a) Calculate the mean satisfaction rating for each store.

(b) Determine the modal rating for each store.

(c) Create a comparative bar chart showing the distribution of ratings across stores.

(d) Calculate the percentage of customers rating each store as "Good" or "Excellent".

(e) Construct a grouped frequency table combining all three stores.

(f) Identify which store has the most consistent customer satisfaction.

(g) Calculate the median rating for Store B using interpolation.

(h) Recommend which store performs best overall and justify your answer.

**Answer Space**

Use this space for your working and answers.

**Formulae and Key Concepts**

**Measures of Central Tendency (Grouped Data):**

Mean: $\bar{x} = \frac{\sum f \cdot x}{\sum f}$ (using midpoints)

Modal class: Class with highest frequency

Median: Use interpolation in median class

**Median Interpolation:**

Median $= L + \frac{\frac{n}{2} - CF}{f} \times h$

where L = lower boundary of median class, CF = cumulative frequency before median class

f = frequency of median class, h = class width

**Quartiles (Grouped Data):**

Q1 position $= \frac{n}{4}$, Q3 position $= \frac{3n}{4}$

Use same interpolation formula with appropriate positions

**Measures of Spread:**

Range = Maximum - Minimum
IQR = Q3 - Q1
Coefficient of Variation = $\frac{\text{Standard Deviation}}{\text{Mean}} \times 100\%$

**Frequency Density:**
Frequency Density = $\frac{\text{Frequency}}{\text{Class Width}}$
Area of bar = Frequency Density × Class Width = Frequency

**Skewness Indicators:**
Positive skew: Mean ¿ Median, tail extends right
Negative skew: Mean ¡ Median, tail extends left
Symmetric: Mean  Median

**Comparative Analysis:**
Compare measures of central tendency and spread
Consider context and data type when choosing measures
Use appropriate diagrams for comparison

**Data Quality Assessment:**
Check for outliers and unusual values
Consider sample size and representativeness
Assess reliability and validity of conclusions

**END OF TEST**

Total marks: 90

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