GCSE Higher Mathematics
Practice Test 2: Statistics

Instructions:
Answer all questions. Show your working clearly.
Calculators may be used unless stated otherwise.
Time allowed: 90 minutes

Section A: Advanced Averages and Spread

1. The table shows the distribution of daily temperatures:

Temperature (°C)	Frequency
5-9	4
10-14	7
15-19	12
20-24	19
25-29	16
30-34	11
35-39	6
40-44	2

   Calculate:

   (a) The total number of days recorded
   (b) An estimate of the mean temperature
   (c) The modal class
   (d) An estimate of the median temperature
   (e) An estimate of the range

2. For the data set: 8, 11, 14, 17, 19, 23, 26, 29, 32, 38

   (a) Calculate the mean
   (b) Find the median and quartiles (Q1 and Q3)
   (c) Calculate the interquartile range
   (d) Calculate the standard deviation
   (e) Identify any outliers using the $1.5 \times$ IQR rule

3. Two data sets have the following properties:

   - Set X: mean = 38, standard deviation = 6, n = 25
   - Set Y: mean = 44, standard deviation = 9, n = 35

   (a) Calculate the combined mean

(b) Calculate the combined standard deviation

(c) Which set is more consistent? Explain.

(d) Calculate the coefficient of variation for each set

4. The heights (in cm) of 40 students are summarized:

$$\sum x = 6800, \sum x^2 = 1162400$$

(a) Calculate the mean height

(b) Calculate the variance

(c) Calculate the standard deviation

(d) If each student grows 3 cm, find the new mean and standard deviation

Section B: Histograms and Frequency Density

5. The histogram shows the distribution of waiting times:

[Imagine a histogram with: 0-5 min (density 3.2), 5-10 min (density 4.8), 10-15 min (density 2.4), 15-25 min (density 1.6), 25-40 min (density 0.6)]

(a) Complete the frequency table

(b) Calculate the total number of customers

(c) Estimate the mean waiting time

(d) Find the modal class

(e) What percentage of customers wait more than 15 minutes?

6. Draw a histogram for this data about car ages:

Age (years)	Frequency
0-2	24
2-4	32
4-5	15
5-8	27
8-12	16
12-20	12

(a) Calculate the frequency density for each class

(b) Draw the histogram

(c) Estimate the median car age

(d) What fraction of cars are more than 5 years old?

7. A histogram shows data with unequal class widths. The class 15-18 has frequency density 8 and the class 18-24 has frequency 36.

(a) Find the frequency for the 15-18 class

(b) Find the frequency density for the 18-24 class

(c) If the total frequency is 150, suggest frequencies for other classes

Section C: Cumulative Frequency and Box Plots

8. The table shows the cumulative frequency of quiz scores:

Score	Cumulative Frequency
≤ 15	6
≤ 25	16
≤ 35	32
≤ 45	54
≤ 55	71
≤ 65	83
≤ 75	92
≤ 85	96

   (a) Draw the cumulative frequency curve

   (b) Find the median

   (c) Find the quartiles Q1 and Q3

   (d) Calculate the interquartile range

   (e) Draw a box plot

   (f) Estimate the 90th percentile

9. Two box plots show the distribution of ages for employees at two companies:

   [Imagine box plots: Company A (min 22, Q1 28, median 35, Q3 42, max 58), Company B (min 24, Q1 31, median 38, Q3 46, max 62)]

   Compare the distributions by commenting on:

   (a) Central tendency (medians)

   (b) Spread (ranges and IQRs)

   (c) Shape and outliers

   (d) Which company has more variable ages?

10. The cumulative frequency curve for delivery times (in minutes) passes through these points: (15, 0), (20, 8), (25, 22), (30, 38), (35, 51), (40, 61), (45, 65)

    (a) Find the median delivery time

    (b) Find the quartiles

    (c) What percentage have delivery times between 22 minutes and 37 minutes?

    (d) Draw the corresponding box plot

Section D: Scatter Graphs and Correlation

11. The table shows data for 10 cars:

Engine size (L)	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8
Fuel consumption (L/100km)	5.2	5.8	6.4	6.9	7.5	8.0	8.6	9.1	9.7	10.2

    (a) Plot a scatter graph

    (b) Describe the correlation

    (c) Calculate the equation of the line of best fit

    (d) Use your line to predict fuel consumption for a 2.1L engine

(e) Estimate the engine size for 7.8L/100km consumption

(f) Calculate the correlation coefficient

12. The equation of a regression line is $y = 2.3x + 8$.

(a) Interpret the gradient

(b) Interpret the y-intercept

(c) If $x = 18$, predict y

(d) If $y = 62$, estimate x

(e) State assumptions made when using this model

13. Classify these correlation coefficients and describe the relationships:

(a) $r = 0.89$

(b) $r = -0.76$

(c) $r = 0.23$

(d) $r = -0.94$

(e) $r = 0.58$

Section E: Advanced Probability

14. A box contains 6 yellow balls, 4 purple balls, and 3 orange balls. Two balls are drawn without replacement.

(a) Draw a tree diagram

(b) Find P(both yellow)

(c) Find P(both same color)

(d) Find P(at least one purple)

(e) Find P(different colors)

15. The probability that a machine breaks down on any day is 0.15, independently of other days.

(a) Find the probability it breaks down on exactly 1 out of 4 days

(b) Find the probability it breaks down on at least 2 out of 4 days

(c) Find the expected number of breakdowns in a week

(d) In a 20-day period, find P(more than 5 breakdowns)

16. A quiz has 12 true/false questions. A student guesses randomly.

(a) Find P(correct answer on one question)

(b) Find P(exactly 8 correct answers)

(c) Find P(at least 9 correct answers)

(d) Find the expected number of correct answers

(e) Find the most likely number of correct answers

17. Events C and D are such that P(C) = 0.45, P(D) = 0.35, and P(C D) = 0.18.

(a) Find P(C D)

(b) Find P(C')

(c) Find P(C — D)

(d) Find P(D — C)

(e) Are C and D independent? Justify your answer

Section F: Conditional Probability and Independence

18. A survey of 180 people about streaming services gives:

    - 105 subscribe to Netflix
    - 75 subscribe to Amazon Prime
    - 42 subscribe to both services

    (a) Draw a Venn diagram
    (b) Find P(subscribes to Netflix — subscribes to Amazon Prime)
    (c) Find P(subscribes to Amazon Prime — subscribes to Netflix)
    (d) Find P(subscribes to exactly one service)
    (e) Are the subscriptions independent? Explain

19. In a workshop, 60% of products are made by Worker X and 40% by Worker Y. Worker X produces 3% defective items, Worker Y produces 7% defective items.

    (a) Draw a tree diagram
    (b) Find the probability a product is defective
    (c) If a product is defective, find the probability it was made by Worker X
    (d) If a product is not defective, find the probability it was made by Worker Y

20. A deck contains 10 black cards numbered 1-10 and 8 white cards numbered 1-8. A card is drawn at random.

    (a) Find P(black and odd number)
    (b) Find P(white — even number)
    (c) Find P(number ¿ 6)
    (d) Are color and number parity independent?

21. A screening test is 92% accurate for positive cases and 96% accurate for negative cases. 3% of the population has the condition.

    (a) Find the probability of testing positive
    (b) If someone tests positive, find the probability they have the condition
    (c) If someone tests negative, find the probability they don't have the condition
    (d) Comment on the effectiveness of the test

Section G: Hypothesis Testing and Sampling

22. A die is suspected of being biased towards sixes. It's rolled 30 times and shows six 8 times.

    (a) State the null and alternative hypotheses
    (b) Calculate the probability of getting 8 or more sixes if the die is fair
    (c) At the 5% significance level, is there evidence the die is biased?
    (d) What would be a Type I error in this context?

23. A sample of 60 batteries has mean lifetime 720 hours and standard deviation 85 hours.

    (a) Calculate a 95% confidence interval for the population mean
    (b) Interpret your confidence interval
    (c) What assumptions are made?

(d) How would the interval change with a smaller sample size?

24. A bakery claims 98% of cakes meet quality standards. In a sample of 80 cakes, 76 meet standards.

(a) Test at 5% level whether the claim is justified

(b) Calculate the critical value

(c) State your conclusion

(d) What is the p-value for this test?

Section H: Problem Solving and Integration

25. A restaurant records customer waiting times over 120 visits. The data shows:

- Mean = 18 minutes
- Standard deviation = 4.5 minutes
- Distribution is approximately normal

(a) Find P(waiting time ¿ 25 minutes)

(b) Find the waiting time exceeded by only 5% of customers

(c) What percentage of customers wait within two standard deviations of the mean?

(d) If the restaurant serves 300 customers per week, estimate weekly complaints (assuming complaints when wait ¿ 20 minutes)

26. A production line samples 15 items every 2 hours. Over 6 sampling periods, the number of defective items found was: 1, 3, 0, 2, 1, 4.

(a) Calculate the mean and standard deviation

(b) Test whether the defect rate exceeds 8%

(c) Create a control chart with warning limits

(d) Comment on process stability

27. Compare these three portfolio options over 3 years:

- Portfolio P: Mean return 12%, standard deviation 15%
- Portfolio Q: Mean return 9%, standard deviation 10%
- Portfolio R: Mean return 15%, standard deviation 22%

(a) Calculate the coefficient of variation for each

(b) Which offers the best risk-adjusted return?

(c) Using normal distribution, find P(return ¡ 0%) for each

(d) Recommend an option for a conservative investor

28. A college tracks the relationship between study hours and exam grades. The correlation is 0.68.

(a) What does this correlation suggest?

(b) If study hours have mean 25 and standard deviation 8, and grades have mean 72 and standard deviation 14, find the regression equation

(c) Predict the grade for a student studying 30 hours

(d) Calculate the coefficient of determination and interpret it

29. Design a statistical investigation to compare the effectiveness of two training programs:

(a) State hypotheses

(b) Describe the sampling method

(c) Identify variables and potential confounding factors

(d) Outline the analysis plan

(e) Discuss limitations and assumptions

Answer Space

Use this space for your working and answers.

END OF TEST

Total marks: 100

For more resources and practice materials, visit:
stepupmaths.co.uk