GCSE Higher Mathematics
Practice Test 4: 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 video game completion times:

Time (hours)	Frequency
15-19	6
20-24	11
25-29	17
30-34	23
35-39	19
40-44	13
45-49	9
50-54	5

Calculate:

(a) The total number of players
(b) An estimate of the mean completion time
(c) The modal class
(d) An estimate of the median completion time
(e) An estimate of the range

2. For the data set: 24, 27, 30, 33, 36, 39, 42, 45, 48, 54

(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 M: mean = 48, standard deviation = 9, n = 28
- Set N: mean = 55, standard deviation = 14, n = 32

(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 scores of 48 students in a test are summarized:

$$\sum x = 3360, \sum x^2 = 240480$$

(a) Calculate the mean score

(b) Calculate the variance

(c) Calculate the standard deviation

(d) If 5 marks are added to each score, find the new mean and standard deviation

Section B: Histograms and Frequency Density

5. The histogram shows the distribution of flight delays:

[Imagine a histogram with: 0-15 min (density 4.2), 15-30 min (density 3.6), 30-45 min (density 2.8), 45-75 min (density 1.4), 75-120 min (density 0.8)]

(a) Complete the frequency table

(b) Calculate the total number of flights

(c) Estimate the mean delay time

(d) Find the modal class

(e) What percentage of flights have delays over 45 minutes?

6. Draw a histogram for this data about book prices:

Price (£)	Frequency
5-10	25
10-15	40
15-18	21
18-22	24
22-28	18
28-35	14

(a) Calculate the frequency density for each class

(b) Draw the histogram

(c) Estimate the median book price

(d) What fraction of books cost more than £18?

7. A histogram shows data with unequal class widths. The class 40-45 has frequency density 16 and the class 45-55 has frequency 80.

(a) Find the frequency for the 40-45 class

(b) Find the frequency density for the 45-55 class

(c) If the total frequency is 400, suggest frequencies for other classes

Section C: Cumulative Frequency and Box Plots

8. The table shows the cumulative frequency of swimming lap times:

Time (seconds)	Cumulative Frequency
≤ 45	8
≤ 50	22
≤ 55	38
≤ 60	56
≤ 65	71
≤ 70	83
≤ 75	91
≤ 80	95

   (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 80th percentile

9. Two box plots show the distribution of commute times for two cities:

   [Imagine box plots: City A (min 18, Q1 28, median 36, Q3 44, max 62), City B (min 22, Q1 32, median 40, Q3 48, max 66)]

   Compare the distributions by commenting on:

   (a) Central tendency (medians)

   (b) Spread (ranges and IQRs)

   (c) Shape and outliers

   (d) Which city has more variable commute times?

10. The cumulative frequency curve for download times (in seconds) passes through these points: (10, 0), (15, 14), (20, 32), (25, 48), (30, 61), (35, 72), (40, 78)

    (a) Find the median download time

    (b) Find the quartiles

    (c) What percentage have download times between 18 seconds and 28 seconds?

    (d) Draw the corresponding box plot

Section D: Scatter Graphs and Correlation

11. The table shows data for 10 smartphones:

Storage (GB)	32	64	96	128	160	192	224	256	288	320
Price (£)	280	340	400	460	520	580	640	700	760	820

    (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 the price for 180GB storage

(e) Estimate the storage for a phone priced at £600

(f) Calculate the correlation coefficient

12. The equation of a regression line is $y = 3.2x - 15$.

(a) Interpret the gradient

(b) Interpret the y-intercept

(c) If $x = 25$, predict y

(d) If $y = 118$, estimate x

(e) State assumptions made when using this model

13. Classify these correlation coefficients and describe the relationships:

(a) $r = 0.86$

(b) $r = -0.71$

(c) $r = 0.18$

(d) $r = -0.93$

(e) $r = 0.65$

Section E: Advanced Probability

14. A deck contains 8 hearts, 6 clubs, and 5 spades. Two cards are drawn without replacement.

(a) Draw a tree diagram

(b) Find P(both hearts)

(c) Find P(both same suit)

(d) Find P(at least one club)

(e) Find P(different suits)

15. The probability that a router disconnects on any day is 0.12, independently of other days.

(a) Find the probability it disconnects on exactly 3 out of 7 days

(b) Find the probability it disconnects on at least 4 out of 7 days

(c) Find the expected number of disconnections in 10 days

(d) In a 30-day month, find P(more than 5 disconnections)

16. A driving test has 20 multiple choice questions, each with 3 options. A candidate guesses randomly.

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

(b) Find P(exactly 7 correct answers)

(c) Find P(at least 14 correct answers)

(d) Find the expected number of correct answers

(e) Find the most likely number of correct answers

17. Events G and H are such that P(G) = 0.55, P(H) = 0.65, and P(G H) = 0.33.

(a) Find P(G H)

(b) Find P(G')

(c) Find P(G — H)

(d) Find P(H — G)

(e) Are G and H independent? Justify your answer

Section F: Conditional Probability and Independence

18. A survey of 300 students about course preferences gives:

    - 180 prefer Mathematics
    - 135 prefer Science
    - 75 prefer both subjects

    (a) Draw a Venn diagram
    (b) Find P(prefers Mathematics — prefers Science)
    (c) Find P(prefers Science — prefers Mathematics)
    (d) Find P(prefers exactly one subject)
    (e) Are the subject preferences independent? Explain

19. In a food processing plant, 65% of products are packed by Line 1 and 35% by Line 2. Line 1 produces 2% contaminated products, Line 2 produces 5% contaminated products.

    (a) Draw a tree diagram
    (b) Find the probability a product is contaminated
    (c) If a product is contaminated, find the probability it came from Line 1
    (d) If a product is not contaminated, find the probability it came from Line 2

20. A box contains 14 square tiles numbered 1-14 and 10 circular tiles numbered 1-10. A tile is drawn at random.

    (a) Find P(square and multiple of 3)
    (b) Find P(circular — number less than 6)
    (c) Find P(number ¿ 10)
    (d) Are shape and number size independent?

21. A security scan is 94% accurate for threats and 97% accurate for non-threats. 1.5% of items contain threats.

    (a) Find the probability of a positive scan result
    (b) If an item triggers the scan, find the probability it contains a threat
    (c) If an item passes the scan, find the probability it's safe
    (d) Comment on the effectiveness of the security scan

Section G: Hypothesis Testing and Sampling

22. A lottery scratch card is suspected of having a higher win rate than advertised. Out of 40 cards tested, 12 are winners.

    (a) State the null and alternative hypotheses (advertised rate is 20%)
    (b) Calculate the probability of getting 12 or more winners if the rate is 20%
    (c) At the 5% significance level, is there evidence the win rate is higher?
    (d) What would be a Type I error in this context?

23. A sample of 55 laptop batteries has mean lifespan 840 hours and standard deviation 95 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 90% confidence level?

24. A delivery service claims 96% on-time delivery. In a sample of 200 deliveries, 188 are on time.

(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 coffee shop records customer service times over 180 transactions. The data shows:

- Mean = 4.2 minutes
- Standard deviation = 1.1 minutes
- Distribution is approximately normal

(a) Find P(service time ¿ 6 minutes)

(b) Find the service time exceeded by only 8% of customers

(c) What percentage of transactions take between 3 and 5.5 minutes?

(d) If the shop serves 400 customers daily, estimate complaints (assuming complaints when service ¿ 5.5 minutes)

26. A manufacturing process samples 12 components every 30 minutes. Over 10 sampling periods, the number of defective components found was: 1, 0, 2, 1, 3, 0, 1, 2, 0, 1.

(a) Calculate the mean and standard deviation

(b) Test whether the defect rate exceeds 6%

(c) Create a control chart with warning limits

(d) Comment on process stability

27. Compare these three retirement fund options over 10 years:

- Fund X: Mean return 6%, standard deviation 8%
- Fund Y: Mean return 9%, standard deviation 14%
- Fund Z: Mean return 4%, standard deviation 5%

(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 fund

(d) Recommend an option for a risk-neutral investor

28. A language school studies the relationship between practice hours and test scores. The correlation is 0.79.

(a) What does this correlation suggest?

(b) If practice hours have mean 15 and standard deviation 6, and test scores have mean 78 and standard deviation 18, find the regression equation

(c) Predict the test score for a student practicing 20 hours

(d) Calculate the coefficient of determination and interpret it

29. Design a statistical investigation to determine if online learning is as effective as classroom learning:

    (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