

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

**Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education**

MATHEMATICS

2641

Probability & Statistics 1

Thursday

9 JUNE 2005

Morning

1 hour 20 minutes

Additional materials:

- Answer booklet
- Graph paper
- List of Formulae (MF8)

TIME 1 hour 20 minutes

INSTRUCTIONS TO CANDIDATES

- Write your Name, Centre Number and Candidate Number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.
- You are permitted to use a graphic calculator in this paper.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is 60.
- Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.
- **You are reminded of the need for clear presentation in your answers.**

This question paper consists of 4 printed pages.

- 1 The times, x seconds, for 80 athletes to run 100 metres were coded using the relation $y = x - 11$. The values of y are summarised by $\Sigma y = 35.2$ and $\Sigma y^2 = 175.08$. Find

(i) the mean and variance of y , [3]

(ii) the mean and variance of x . [2]

- 2 The letters CCEGGGGEE give the first nine notes of a certain tune.

(i) Find how many different ‘tunes’ can be formed using all of the nine letters. [2]

(ii) Find how many of these tunes will have the four Gs in positions 2, 4, 6 and 8. [2]

(iii) Find the probability that a tune formed randomly using all of the nine letters will have the four Gs in positions 2, 4, 6 and 8. [1]

- 3 The stem-and-leaf diagram shows the prices, to the nearest 10p, of 40 similar items in two stores.

Store A		Store B
9 8 0	1	3 4 6 7
9 8 8 7 7 6 5 5 2 1	2	0 1 2 3 5 7 8 8 8 9 9
9 9 8 5 5 4 4 4 2 2 0	3	1 1 2 2 2 3 3 4 4 5 7 8 8 9 9
9 9 8 8 7 6 6 5 5 5 3 2 1	4	0 0 1 1 2 3 4 4 6 7
3 2 1	5	

Key: 1 | 4 | 0 means Store A’s price is £4.10 and Store B’s price is £4.00.

(i) Find the values of the lower quartile, median and upper quartile for Store A’s prices. [3]

(ii) Draw, on graph paper, a box-and-whisker plot of Store A’s prices. [3]

(iii) Briefly compare

(a) the variability of the prices in the two stores, [1]

(b) the shapes of the distributions. [1]

- 4 A ‘turn’ in a game begins by throwing two unbiased dice. If at least one of the dice shows a six then the turn ends. If neither dice shows a six then one of the dice is thrown again and the turn ends. The number of sixes obtained at the end of a turn is denoted by S . The following table gives the probability distribution of S .

s	0	1	2
$P(S = s)$	a	b	$\frac{1}{36}$

(i) Find the value of a and show that $b = \frac{85}{216}$. [3]

(ii) Find $E(S)$. [2]

(iii) Find the probability that, out of 5 turns, exactly 3 turns result in $S = 0$. [3]

- 5 The following table gives the heights, in cm, of nine pairs of identical twins measured on their first birthday.

Pair	A	B	C	D	E	F	G	H	I
Height of first born (cm)	53.5	55.0	57.5	60.0	63.5	64.0	67.0	68.5	71.0
Height of second born (cm)	50.5	56.5	53.5	58.0	63.0	65.0	68.5	63.5	69.5

- (i) On graph paper draw a scatter diagram to illustrate the data, labelling the points A, B, C, \dots, I . [3]
- (ii) Explain how you can tell from the diagram that Spearman's rank correlation coefficient is not equal to 1. [1]
- (iii) Calculate the value of Spearman's rank correlation coefficient. [4]
- (iv) State what the value of the coefficient indicates about the heights. [1]
- (v) If the heights were given in inches rather than centimetres, which (if any) of your answers to parts (ii), (iii) and (iv) would change? [1]
- 6 A set of kitchen scales was tested by weighing 8 objects whose exact weights were known. The results of the weighings, correct to the nearest gram, are given in the following table.

Known weight (x grams)	10	20	30	40	50	60	70	80
Measured weight (y grams)	9	19	28	41	52	62	73	83

$$[n = 8, \Sigma x = 360, \Sigma x^2 = 20\,400, \Sigma y = 367, \Sigma y^2 = 21\,673, \Sigma xy = 21\,020.]$$

- (i) Calculate the product moment correlation coefficient for the data, giving your answer correct to 4 decimal places. [3]
- (ii) State, giving a reason, which of x and y is the dependent variable. [1]
- (iii) Calculate the equation of a suitable regression line for the data. [4]
- (iv) Using the regression equation, estimate the true weights of objects whose measured weights are
- (a) 56 grams,
- (b) 100 grams. [2]
- (v) Comment on the reliability of each of your two estimates. [2]

[Question 7 is printed overleaf.]

7 Wall tiles of a certain make are packed in boxes of 20. Production procedures lead to imperfections in 3% of these tiles, on average. A box of tiles is classified as 'unsatisfactory' if it contains more than one imperfect tile.

(i) What must be assumed for the number of imperfect tiles in a box to have a binomial distribution? [2]

(ii) Calculate the probability that a randomly chosen box is unsatisfactory. [4]

Each day randomly chosen boxes are checked. The number of boxes checked, up to and including the first unsatisfactory box, is denoted by U .

(iii) Calculate $E(U)$. [2]

(iv) If $U \geq 2 + E(U)$ then production is 'under control'. Calculate the probability that production is under control. [4]