OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

MATHEMATICS

Probability & Statistics 1

4732

Candidates answer on the Answer Booklet

OCR Supplied Materials:
- 8 page Answer Booklet
- List of Formulae (MF1)

Other Materials Required:
None

Wednesday 27 January 2010
Afternoon

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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 graphical calculator in this paper.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- **You are reminded of the need for clear presentation in your answers.**
- The total number of marks for this paper is **72**.
- This document consists of **8** pages. Any blank pages are indicated.

1 Andy makes repeated attempts to thread a needle. The number of attempts up to and including his first success is denoted by X.

(i) State two conditions necessary for X to have a geometric distribution. **[2]**

(ii) Assuming that X has the distribution Geo(0.3), find

(a) $P(X = 5)$, **[2]**

(b) $P(X > 5)$. **[3]**

(iii) Suggest a reason why one of the conditions you have given in part **(i)** might not be satisfied in this context. **[2]**

2 40 people were asked to guess the length of a certain road. Each person gave their guess, l km, correct to the nearest kilometre. The results are summarised below.

l	10–12	13–15	16–20	21–30
Frequency	1	13	20	6

(i) **(a)** Use appropriate formulae to calculate estimates of the mean and standard deviation of l. **[6]**

(b) Explain why your answers are only estimates. **[1]**

(ii) A histogram is to be drawn to illustrate the data. Calculate the frequency density of the block for the 16–20 class. **[2]**

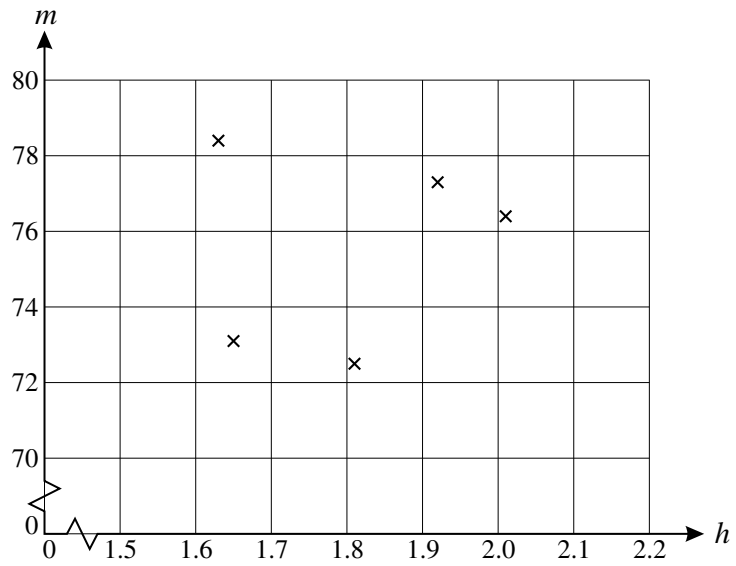
(iii) Explain which class contains the median value of l. **[2]**

(iv) Later, the person whose guess was between 10 km and 12 km changed his guess to between 13 km and 15 km. Without calculation state whether the following will increase, decrease or remain the same:

(a) the mean of l, **[1]**

(b) the standard deviation of l. **[1]**

3 The heights, h m, and weights, m kg, of five men were measured. The results are plotted on the diagram.



The results are summarised as follows.

$$n = 5 \quad \Sigma h = 9.02 \quad \Sigma m = 377.7 \quad \Sigma h^2 = 16.382 \quad \Sigma m^2 = 28\,558.67 \quad \Sigma hm = 681.612$$

(i) Use the summarised data to calculate the value of the product moment correlation coefficient, r. **[3]**

(ii) Comment on your value of r in relation to the diagram. **[2]**

(iii) It was decided to re-calculate the value of r after converting the heights to feet and the masses to pounds. State what effect, if any, this will have on the value of r. **[1]**

(iv) One of the men had height 1.63 m and mass 78.4 kg. The data for this man were removed and the value of r was re-calculated using the original data for the remaining four men. State in general terms what effect, if any, this will have on the value of r. **[1]**

4 A certain four-sided die is biased. The score, X, on each throw is a random variable with probability distribution as shown in the table. Throws of the die are independent.

x	0	1	2	3
$P(X = x)$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{8}$

(i) Calculate $E(X)$ and $Var(X)$. **[5]**

The die is thrown 10 times.

(ii) Find the probability that there are not more than 4 throws on which the score is 1. **[2]**

(iii) Find the probability that there are exactly 4 throws on which the score is 2. **[3]**

5 A washing-up bowl contains 6 spoons, 5 forks and 3 knives. Three of these 14 items are removed at random, without replacement. Find the probability that

(i) all three items are of different kinds, **[3]**

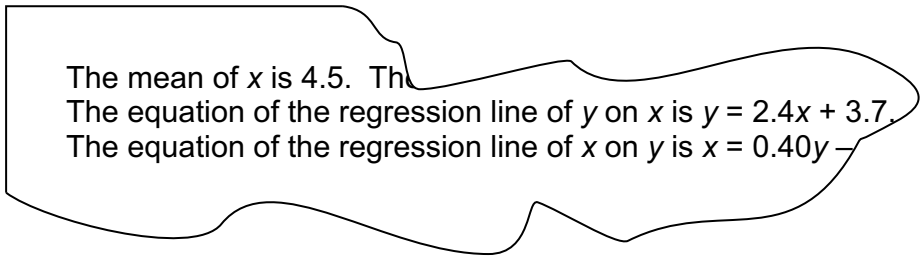
(ii) all three items are of the same kind. **[3]**

6 **(a)** A student calculated the values of the product moment correlation coefficient, r, and Spearman's rank correlation coefficient, r_s, for two sets of bivariate data, A and B. His results are given below.

$$A: \quad r = 0.9 \text{ and } r_s = 1$$
$$B: \quad r = 1 \quad \text{and } r_s = 0.9$$

With the aid of a diagram where appropriate, explain why the student's results for A could both be correct but his results for B cannot both be correct. **[3]**

(b) An old research paper has been partially destroyed. The surviving part of the paper contains the following incomplete information about some bivariate data from an experiment.



Calculate the missing constant at the end of the equation of the second regression line. **[4]**

7 The table shows the numbers of male and female members of a vintage car club who own either a Jaguar or a Bentley. No member owns both makes of car.

	Male	Female
Jaguar	25	15
Bentley	12	8

One member is chosen at random from these 60 members.

(i) Given that this member is male, find the probability that he owns a Jaguar. **[2]**

Now two members are chosen at random from the 60 members. They are chosen one at a time, without replacement.

(ii) Given that the first one of these members is female, find the probability that both own Jaguars. **[4]**

8 The five letters of the word NEVER are arranged in random order in a straight line.

(i) How many different orders of the letters are possible? **[2]**

(ii) In how many of the possible orders are the two Es next to each other? **[2]**

(iii) Find the probability that the first two letters in the order include exactly one letter E. **[3]**

9 R and S are independent random variables each having the distribution Geo(p).

(i) Find P($R = 1$ and $S = 1$) in terms of p. **[1]**

(ii) Show that P($R = 3$ and $S = 3$) $= p^2q^4$, where $q = 1 - p$. **[1]**

(iii) Use the formula for the sum to infinity of a geometric series to show that

$$\mathrm{P}(R = S) = \frac{p}{2 - p}.$$ **[5]**

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