Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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6	
7	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
June 2010

Mathematics MS/SS1B

Unit Statistics 1B

Statistics

Unit Statistics 1B

Thursday 27 May 2010 9.00 am to 10.30 am

For this paper you must have:
- the blue AQA booklet of formulae and statistical tables.

You may use a graphics calculator.

Time allowed
- 1 hour 30 minutes

Instructions
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
- You must answer the questions in the spaces provided. Do not write outside the box around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- The **final** answer to questions requiring the use of tables or calculators should normally be given to three significant figures.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.
- Unit Statistics 1B has a **written paper only**.

Advice
- Unless stated otherwise, you may quote formulae, without proof, from the booklet.

Answer **all** questions in the spaces provided.

1 The weight, x kg, and the engine power, y bhp, of each car in a random sample of 10 hatchback cars are shown in the table.

x	1196	1062	1335	1429	1012	1355	1145	1417	1275	1284
y	123	88	150	158	69	120	94	143	107	128

(a) Calculate the value of the product moment correlation coefficient between x and y. *(3 marks)*

(b) Interpret your value in the context of the question. *(2 marks)*

QUESTION PART REFERENCE

QUESTION PART REFERENCE

2 Before leaving for a tour of the UK during the summer of 2008, Eduardo was told that the UK price of a 1.5-litre bottle of spring water was about 50p.

Whilst on his tour, Eduardo noted the prices, x pence, which he paid for 1.5-litre bottles of spring water from 12 retail outlets.

He then subtracted 50p from each price and his resulting differences, in pence, were

$$-18 \quad -11 \quad 1 \quad 15 \quad 7 \quad -1 \quad 17 \quad -16 \quad 18 \quad -3 \quad 0 \quad 9$$

(a) (i) Calculate the mean and the standard deviation of these differences. *(2 marks)*

(ii) Hence calculate the mean and the standard deviation of the prices, x pence, paid by Eduardo. *(2 marks)*

(b) Based on an exchange rate of €1.22 to £1, calculate, in euros, the mean and the standard deviation of the prices paid by Eduardo. *(3 marks)*

QUESTION PART REFERENCE

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3 Each day, Margot completes the crossword in her local morning newspaper. Her completion times, X minutes, can be modelled by a normal random variable with a mean of 65 and a standard deviation of 20.

(a) Determine:

(i) $P(X < 90)$;

(ii) $P(X > 60)$. *(5 marks)*

(b) Given that Margot's completion times are independent from day to day, determine the probability that, during a particular period of 6 days:

(i) she completes one of the six crosswords in exactly 60 minutes; *(1 mark)*

(ii) she completes each crossword in less than 60 minutes; *(3 marks)*

(iii) her mean completion time is less than 60 minutes. *(4 marks)*

QUESTION PART REFERENCE

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4 In a certain country, 15 per cent of the male population is left-handed.

(a) Determine the probability that, in a random sample of 50 males from this country:

(i) at most 10 are left-handed; *(2 marks)*

(ii) at least 5 are left-handed; *(2 marks)*

(iii) more than 6 but fewer than 12 are left-handed. *(3 marks)*

(b) In the same country, 11 per cent of the female population is left-handed.

Calculate the probability that, in a random sample of 35 females from this country, exactly 4 are left-handed. *(3 marks)*

(c) A sample of 2000 people is selected at random from the population of the country. The proportion of males in the sample is 52 per cent.

How many people in the sample would you expect to be left-handed? *(4 marks)*

QUESTION PART REFERENCE

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5 Hugh owns a small farm.

(a) He has two sows, Josie and Rosie, which he feeds at a trough in their field at 8.00 am each day.

The probability that Josie is waiting at the trough at 8.00 am on any given day is 0.90. The probability that Rosie is waiting at the trough at 8.00 am on any given day is 0.70 when Josie is waiting at the trough, but is only 0.20 when Josie is not waiting at the trough.

Calculate the probability that, at 8.00 am on a given day:

(i) both sows are waiting at the trough; *(2 marks)*

(ii) neither sow is waiting at the trough; *(2 marks)*

(iii) at least one sow is waiting at the trough. *(1 mark)*

(b) Hugh also has two cows, Daisy and Maisy. Each day at 4.00 pm, he collects them from the gate to their field and takes them to be milked.

The probability, $P(D)$, that Daisy is waiting at the gate at 4.00 pm on any given day is 0.75.
The probability, $P(M)$, that Maisy is waiting at the gate at 4.00 pm on any given day is 0.60.
The probability that both Daisy and Maisy are waiting at the gate at 4.00 pm on any given day is 0.40.

(i) In the table of probabilities, D' and M' denote the events 'not D' and 'not M' respectively.

	M	M'	**Total**
D	0.40		0.75
D'			
Total	0.60		1.00

Complete the copy of this table which is printed on page 13. *(2 marks)*

(ii) Hence, or otherwise, find the probability that, at 4.00 pm on a given day:

(A) neither cow is waiting at the gate; *(1 mark)*

(B) only Daisy is waiting at the gate; *(1 mark)*

(C) exactly one cow is waiting at the gate. *(2 marks)*

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(b)(i)

	M	M'	**Total**
D	0.40		0.75
D'			
Total	0.60		1.00

6 During a study of reaction times, each of a random sample of 12 people, aged between 40 and 80 years, was asked to react as quickly as possible to a stimulus displayed on a computer screen.

Their ages, x years, and reaction times, y milliseconds, are shown in the table.

Person	Age (x years)	Reaction time (y ms)
A	41	520
B	54	750
C	66	650
D	72	920
E	71	280
F	57	620
G	60	740
H	47	950
I	77	970
J	65	780
K	51	550
L	59	730

(a) Calculate the equation of the least squares regression line of y on x. *(4 marks)*

(b) (i) Draw your regression line on the scatter diagram on page 16. *(2 marks)*

(ii) Comment on what this reveals. *(2 marks)*

(c) It was later discovered that the reaction times for persons E and H had been recorded incorrectly. The values should have been 820 and 590 respectively.

After making these corrections, computations gave

$$S_{xx} = 1272 \qquad S_{xy} = 14\,760 \qquad \bar{x} = 60 \qquad \bar{y} = 720$$

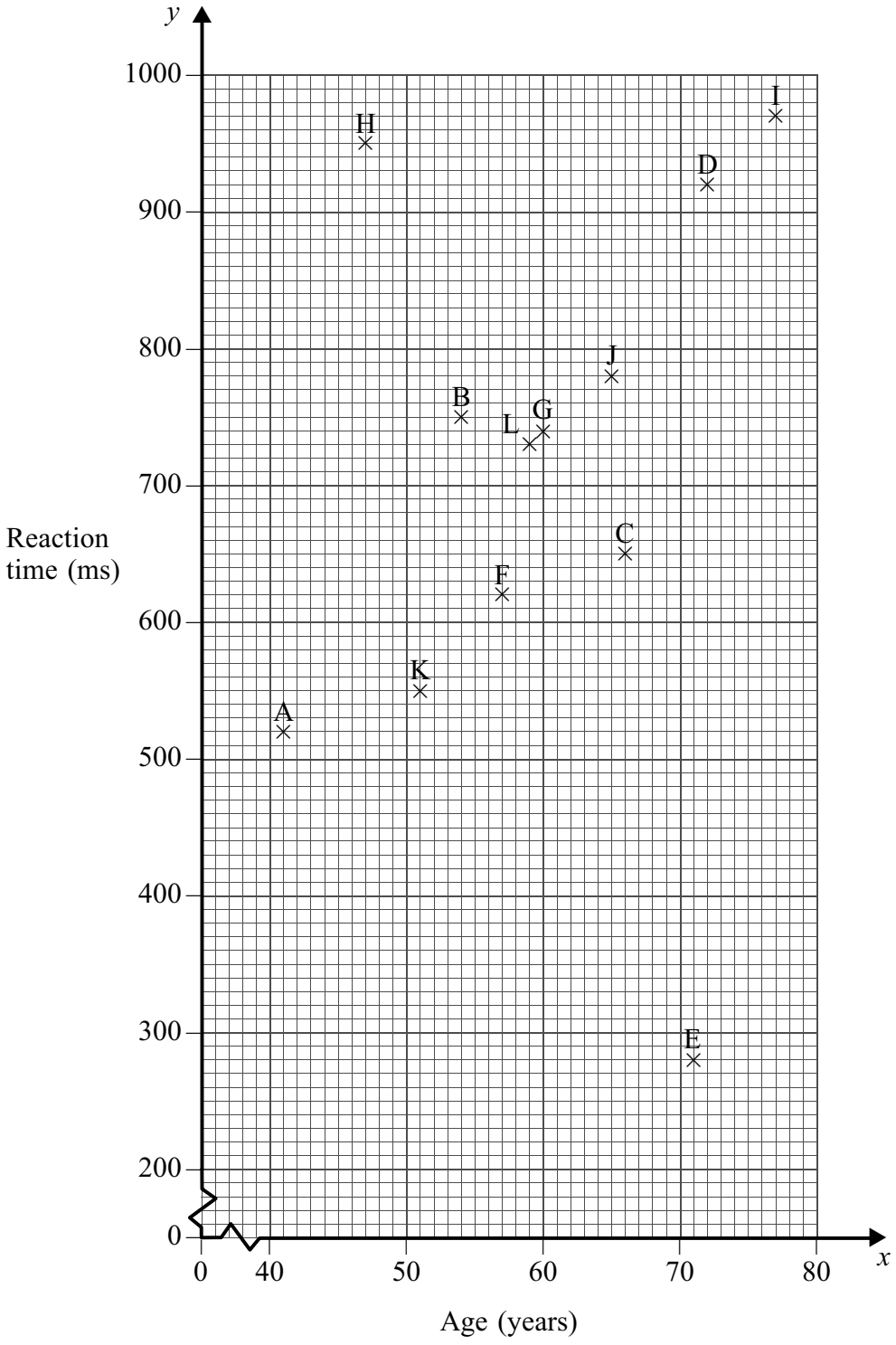
(i) Using the symbol $\odot$, plot the correct values for persons E and H on the scatter diagram on page 16. *(1 mark)*

(ii) Recalculate the equation of the least squares regression line of y on x, and draw this regression line on the scatter diagram on page 16. *(3 marks)*

(iii) Hence revise as necessary your comments in part **(b)(ii)**. *(2 marks)*

QUESTION PART REFERENCE

Reaction Times



QUESTION PART REFERENCE

7 An ambulance control centre responds to emergency calls in a rural area. The response time, T minutes, is defined as the time between the answering of an emergency call at the centre and the arrival of an ambulance at the given location of the emergency.

Response times have an unknown mean μ_T and an unknown variance.

Anita, the centre's manager, asked Peng, a student on supervised work experience, to record and summarise the values of T obtained from a random sample of 80 emergency calls.

Peng's summarised results were

Mean, $\bar{t} = 6.31$ Variance (unbiased estimate), $s^2 = 19.3$

Only 1 of the 80 values of T exceeded 20

(a) Anita then asked Peng to determine a confidence interval for μ_T. Peng replied that, from his summarised results, T was **not** normally distributed and so a valid confidence interval for μ_T could **not** be constructed.

(i) Explain, using the value of $\bar{t} - 2s$, why Peng's conclusion that T was not normally distributed was likely to be **correct**. *(2 marks)*

(ii) Explain why Peng's conclusion that a valid confidence interval for μ_T could not be constructed was **incorrect**. *(2 marks)*

(b) Construct a 98% confidence interval for μ_T. *(4 marks)*

(c) Anita had two targets for T. These were that $\mu_T < 8$ and that $\mathrm{P}(T \leqslant 20) > 95\%$.

Indicate, with justification, whether **each** of these two targets was likely to have been met. *(3 marks)*

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END OF QUESTIONS