Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

AS MATHEMATICS

Unit Statistics 1B

Wednesday 7 June 2017 Morning Time allowed: 1 hour 30 minutes

Materials

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

You may use a graphics calculator.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

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 each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do **not** use the space provided for a different question.
- 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.
- You do not necessarily need to use all the space provided.

Do not write outside the box

Answer **all** questions.

Answer each question in the space provided for that question.

1 A tennis ball was dropped onto a concrete floor from 12 different heights between 25 cm and 300 cm. In each case, the height, x cm, from which the ball was dropped and the height, y cm, above the floor to which the ball bounced were measured.

The results are summarised as follows.

$$S_{xx} = 89375 \qquad S_{xy} = 44725 \qquad \overline{x} = 162.5 \qquad \overline{y} = 83.0$$

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

[3 marks]

(b) (i) Estimate the height to which the tennis ball bounces when it is dropped from a height above the floor of 175 cm.

(ii) Explain why your equation may not be appropriate to estimate the height to which the tennis ball bounces when it is dropped from a height above the floor of 4 metres.

[2 marks]

QUESTION PART REFERENCE	**Answer space for question 1**

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2 The durations, in minutes, of a sample of 10 telephone calls to a helpline were as follows.

$$32 \quad 15 \quad 10 \quad 17 \quad 32 \quad 8 \quad 20 \quad 38 \quad 25 \quad 18$$

The duration of calls to the helpline has a known standard deviation of 7.5 minutes.

(a) Stating **two** necessary assumptions, construct a 95% confidence interval for the mean duration of telephone calls to the helpline.

[7 marks]

(b) Hence comment, with justification, on a claim that the mean duration of telephone calls to the helpline is 25 minutes.

[2 marks]

QUESTION PART REFERENCE	**Answer space for question 2**

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QUESTION PART REFERENCE	**Answer space for question 2**

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3 The heights, in centimetres, of a sample of 80 men were measured. For each man, his height **in excess of 175 cm** was recorded. The results are summarised in the table.

Height (cm)	Number of men
$0 – 2$	5
$2 – 4$	9
$4 – 6$	11
$6 – 8$	21
$8 – 10$	17
$10 – 12$	10
$12 – 14$	7
Total	**80**

(a) Calculate estimates for the mean and the variance of the heights in the table.

[4 marks]

(b) Hence find estimates for the mean and the variance of the actual heights of the 80 men.

[2 marks]

(c) Given that 1 foot is equal to 30.48 cm, find, in **feet**, estimates for the mean and the variance of the actual heights of the 80 men. Give your answers to three significant figures.

[3 marks]

QUESTION PART REFERENCE	**Answer space for question 3**

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QUESTION PART REFERENCE	**Answer space for question 3**

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4 Every week, Hilda buys four apples and three bananas from her local greengrocer. The table shows the total weight, x grams, of the four apples and the corresponding total weight, y grams, of the three bananas for each of a random sample of 13 weeks.

x	562	633	578	621	558	593	607	638	527	623	579	588	524
y	366	320	379	407	422	394	325	369	387	395	446	364	457

(a) Calculate, to three decimal places, the value of the product moment correlation coefficient, r, between x and y.

[3 marks]

(b) Interpret, in context, your value for r.

[2 marks]

(c) Howard, Hilda's husband, claims that each week she buys either big apples and big bananas or small apples and small bananas.

Comment on Howard's claim.

[2 marks]

QUESTION PART REFERENCE

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QUESTION PART REFERENCE	**Answer space for question 4**

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5 The weight, X grams, of a bar of *PureAV* soap may be modelled by a normal distribution with mean 105 grams and standard deviation 4 grams.

(a) Determine the probability that the weight of a randomly selected bar is:

(i) less than 105 grams;

(ii) **not** exactly 100 grams;

(iii) more than 110 grams;

(iv) between 102 grams and 108 grams.

[8 marks]

(b) The weight, Y grams, of a bar of *RichAV* soap may be modelled by a normal distribution with mean 160 grams, unknown standard deviation σ grams and $\mathrm{P}(Y < 150) = 0.05$.

(i) Determine the value of σ. Give your answer to two decimal places.

[3 marks]

(ii) *RichAV* soap is sold in packs of 3 bars. The bars in a pack may be assumed to be a random sample.

Determine the probability that:

(A) the weight of **each** of the 3 bars in a randomly selected pack is more than 150 grams;

(B) the **mean** weight of the 3 bars in a randomly selected pack is more than 162.5 grams.

[5 marks]

QUESTION PART REFERENCE	**Answer space for question 5**

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6 When a patient takes the painkilling drug *PD1*, the patient may have no side effects (event A), slight side effects (event B) or severe side effects (event C).

It has been established that $\mathrm{P}(A) = 0.85$, $\mathrm{P}(B) = 0.10$ and $\mathrm{P}(C) = 0.05$.

(a) A doctor prescribes *PD1* to three unrelated patients.

Calculate the probability that:

(i) all three patients have no side effects;

(ii) two patients have no side effects and one patient has slight side effects;

(iii) one patient has no side effects, one patient has slight side effects and one patient has severe side effects.

[7 marks]

(b) Other painkilling drugs are available.

Of patients taking *PD1*, none of those who suffer no side effects will change to another drug, 25 per cent of those who suffer slight side effects will change to another drug, and 90 per cent of those who suffer severe side effects will change to another drug.

A second doctor prescribes *PD1* to a patient.

Calculate the probability that:

(i) the patient does not change to another drug;

(ii) the patient changes to another drug, given that the patient experienced side effects from taking *PD1*.

[6 marks]

QUESTION PART REFERENCE	**Answer space for question 6**

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7 In a certain country, 25 per cent of the adult population have blond hair.

(a) A random sample of 30 adults is selected.

Determine the probability that the number of adults with blond hair in the sample is:

(i) exactly 5;

[2 marks]

(ii) fewer than 10;

[1 mark]

(iii) at least 6 but at most 12;

[3 marks]

(iv) more than the mean of the distribution $\mathrm{B}(30, 0.25)$.

[3 marks]

(b) The random variable Y has a binomial distribution with parameters n and p.

(i) Given that Y has a mean of 16 and a standard deviation of 2.4, find values for n and p.

[5 marks]

(ii) Hence determine $\mathrm{P}(Y = 20)$.

[2 marks]

QUESTION PART REFERENCE	**Answer space for question 7**

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END OF QUESTIONS

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