Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

AS STATISTICS

Unit Statistics 1A

Wednesday 24 May 2017 Morning Time allowed: 1 hour 15 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	
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 60.
- Unit Statistics 1A has a **written paper and coursework**.

Advice
- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- You do not necessarily need to use all the space provided.

Answer **all** questions.

Answer each question in the space provided for that question.

1 The delay times, in minutes, of appointments for a sample of 15 patients at a clinic were recorded. The times, in ascending order, were as follows.

7 9 11 13 18 23 28 31 35 38 42 47 52 58 above 60

(a) For these 15 times, name and find the value of:

(i) a measure of average;

(ii) a measure of spread.

[4 marks]

(b) Subsequently, it was discovered that the time recorded as 'above 60' was, in fact, 83 minutes.

Calculate values for the mean and the standard deviation of the 15 times.

[3 marks]

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

Do not write outside the box

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

7

Turn over ►

2 A common breed of turkey is the *Large White*.

(a) The weight, in kilograms, of a female *Large White* turkey, at 20 weeks old, can be modelled by a normal distribution with a mean of $8.25\ \text{kg}$ and a standard deviation of $1.25\ \text{kg}$.

A 20-week-old female *Large White* turkey is selected at random.

Determine the probability that this turkey weighs:

(i) at most $9.00\ \text{kg}$;

(ii) not exactly $8.25\ \text{kg}$;

(iii) between $8.00\ \text{kg}$ and $10.00\ \text{kg}$.

[5 marks]

(b) The weight, in kilograms, of a male *Large White* turkey, at 24 weeks old, can be modelled by the distribution $\text{N}(\mu, \sigma^2)$.

Given that, for such turkeys, 2.5% weigh less than $10\ \text{kg}$ and 2.5% weigh more than $20\ \text{kg}$, determine values for μ and σ.

[4 marks]

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

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

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

9

3 (a) The events A and B are such that $\mathrm{P}(A) = 0.45$ and $\mathrm{P}(B) = 0.20$

Write down the value of:

(i) $\mathrm{P}(A \cup B)$ if A and B are mutually exclusive;

(ii) $\mathrm{P}(A \cap B)$ if A and B are independent;

(iii) $\mathrm{P}(A \cup B)$ if A and B are independent.

[3 marks]

(b) Every weekday morning, three mechanics, Clare, Dinesh and Elroy, arrive independently at the garage where they all work.

On any weekday morning, the probability that Clare arrives late for work is 0.05, the probability that Dinesh arrives late for work is 0.09, and the probability that Elroy arrives late for work is 0.12

For these three mechanics, determine the probability that, on a particular weekday morning:

(i) none are late for work;

(ii) only Elroy is late for work;

(iii) exactly one is late for work;

(iv) two or more are late for work.

[7 marks]

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

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10

4 A consumer organisation road-tested 12 new cars to measure each car's actual fuel consumption, x mpg, under normal driving conditions.

For each car, the organisation then used the fuel consumption, u mpg, claimed by the car's manufacturer, to calculate the difference, y mpg, between the car's claimed and actual fuel consumptions. This difference, $y = u - x$, is called the car's 'mileage mark-up'.

The results are shown in the table.

Car	A1	B1	C1	D1	E1	F1	A2	B2	C2	D2	E2	F2
x	23.6	31.4	38.3	46.3	52.3	60.1	29.8	38.0	45.2	58.0	61.4	67.6
y	10.1	12.3	10.1	10.3	13.6	13.8	13.8	13.2	12.5	12.3	9.4	7.8

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

[3 marks]

(ii) Assuming that the 12 cars are a random sample, interpret your value in the context of this question.

[2 marks]

(b) In fact, cars A1 and A2 are the same make and model except that A1 has a petrol engine whereas A2 has the equivalent diesel engine. The same is also the case for the other 5 pairs of cars: B1 and B2, ..., F1 and F2.

The summarised data for petrol-engine cars A1 to F1 is as follows.

$$S_{xx} = 916.80 \qquad S_{yy} = 15.46 \qquad S_{xy} = 80.56$$

(i) Calculate the value of the product moment correlation coefficient between x and y for cars A1 to F1.

[2 marks]

(ii) The value of the product moment correlation coefficient between x and y for the diesel-engine cars A2 to F2 is -0.889, correct to three decimal places.

In the light of this information, together with your answer to part **(b)(i)**, comment on the **correlations** between the actual fuel consumption and the mileage mark-up for petrol-engine cars and for diesel-engine cars.

[4 marks]

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

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11

5 (a) A bag contains 20 discs of which 5 are blue.

The variable R denotes the number of blue discs in a random sample of 10 discs selected, **without** replacement, from the bag.

The variable S denotes the number of blue discs in a random sample of 10 discs selected, **with** replacement, from the bag.

The variable T denotes the number of discs randomly selected, **with** replacement, from the bag, until exactly two blue discs have been selected.

For **each** of the variables, R, S and T, state whether or not the variable can be modelled by a binomial distribution, $\mathrm{B}(n, p)$.

If such a model is possible, give values for n and p.

If such a model is **not** possible, give a reason why not.

[5 marks]

(b) In a particular country, 15 per cent of adults have brown hair.

Use binomial distributions to estimate the probability that:

(i) a sample of 18 adults contains exactly 2 with brown hair;

(ii) a sample of 50 adults contains more than 5 but at most 12 with brown hair.

[5 marks]

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

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

10

Turn over ►

6 (a) The weight, X grams, of a *Dubler* chocolate bar is normally distributed with mean μ_X and variance σ_X^2.

Rob weighed a random sample of 50 such bars and obtained the following summarised data.

$$\overline{x} = 59.50 \qquad \text{and} \qquad s_X^2 = 0.2608$$

Construct a 98% confidence interval for μ_X. Give the limits to two decimal places.

[4 marks]

(b) The weight, Y grams, of a *Tiger* chocolate bar is normally distributed with mean μ_Y and variance σ_Y^2.

Pamela weighed a random sample of 36 *Tiger* bars and obtained the following **99%** confidence interval for μ_Y.

$$(56.15,\ 59.85)$$

Determine her values for the sample mean, $\overline{y}$, and the sample standard deviation, s_Y, where s_Y^2 is an unbiased estimate of σ_Y^2. Give your answers to three significant figures.

[5 marks]

(c) Using both the information given and the results of your calculations in parts **(a)** and **(b)**, compare the weights of *Dubler* and *Tiger* chocolate bars. Additional calculations are **not** required.

[4 marks]

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

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END OF QUESTIONS