Centre Number						Candidate Number				
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Other Names										
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For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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TOTAL	

General Certificate of Education
Advanced Level Examination
June 2014

Statistics SS05

Unit Statistics 5

Wednesday 18 June 2014 1.30 pm to 3.00 pm

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 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.

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 A milk processing plant fills cartons with milk using a machine. Alexis, the quality control engineer, selects 12 filled cartons at random and records the volumes, in millilitres, of milk contained in each carton. His results are as follows.

1220 1162 1237 1215 1157 1212 1191 1217 1135 1126 1148 1154

Investigate the claim that the standard deviation of the volume of milk delivered by the filling machine is 30 millilitres. Use the 5% level of significance.

Assume that the volume of milk delivered by the filling machine can be modelled by a normal distribution.

[8 marks]

QUESTION PART REFERENCE

Answer space for question 1

QUESTION PART REFERENCE

Answer space for question 1

2 Jamila, a zoology student, is researching the common toad. She decides to carry out a hypothesis test to investigate whether the mean length of female common toads is more than $1.5\,\text{cm}$ greater than the mean length of male common toads.

(a) State null and alternative hypotheses for her test.

[2 marks]

(b) Jamila collects a sample of 8 female common toads and calculates their mean length to be $8.54\,\text{cm}$. She also collects, independently, a sample of 10 male common toads and calculates their mean length to be $6.28\,\text{cm}$.

Assume that each sample is random and that the lengths of female common toads and male common toads are each normally distributed with a standard deviation of $0.6\,\text{cm}$.

Carry out Jamila's test using the 1% significance level.

[6 marks]

QUESTION PART REFERENCE

Answer space for question 2

QUESTION PART REFERENCE

Answer space for question 2

3 (a) Nicky is to fly abroad on holiday. She weighs her packed suitcase on her bathroom scales. She knows that readings on these scales are accurate to within 0.5 kilograms. Nicky models the error in readings by the rectangular distribution on $[-0.5,\ +0.5]$.

(i) Write down the mean and find the value of the standard deviation of the error in readings made on Nicky's scales.

[3 marks]

(ii) What is the probability that a reading on Nicky's scales will **not** be within 0.3 kilograms of the correct weight?

[2 marks]

(b) The airline that Nicky is to fly with has a maximum baggage allowance of 22 kilograms per suitcase per passenger.

When she weighs her suitcase on her scales, the reading is 21.7 kilograms.

What is the probability that her suitcase weighs more than the airline's maximum baggage allowance?

[2 marks]

QUESTION PART REFERENCE

Answer space for question 3

QUESTION PART REFERENCE

Answer space for question 3

4 Ahmed works on a fruit farm. He packs, by hand, strawberries into punnets.

To monitor Ahmed's packing, his supervisor, Brian, selects at random a sample of 10 punnets that Ahmed has packed. Brian records the weights, in grams, of strawberries contained in these 10 punnets as follows.

505 523 514 530 501 495 518 497 520 512

Assume that the weight of strawberries in a punnet packed by Ahmed can be modelled by a normal distribution.

(a) Construct a 95% confidence interval for the mean weight of strawberries in a punnet packed by Ahmed.

[7 marks]

(b) Construct a 90% confidence interval for the standard deviation of the weight of strawberries in a punnet packed by Ahmed.

[5 marks]

(c) The punnets are expected to hold a weight of strawberries that has a mean of 515 grams and a standard deviation of 5 grams.

With reference to the confidence intervals that you constructed in parts **(a)** and **(b)**, what conclusions should Brian make about Ahmed's packing of strawberries into punnets?

[4 marks]

QUESTION PART REFERENCE

Answer space for question 4

QUESTION PART REFERENCE

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QUESTION PART REFERENCE

Answer space for question 4

5 Kanwar and Ashok are travelling salesmen who drive the same model of car. Kanwar claims that his car travels, on average, more miles per litre than Ashok's car.

To investigate this claim, they agree that each time that one of them buys petrol he will record the number of miles travelled per litre since he last bought petrol.

Their recorded data for one month are given in the table.

Kanwar	9.1	8.7	10.2	10.7	9.9	9.7	10.1		
Ashok	8.8	8.5	9.2	9.6	10.3	8.2	9.1	9.7	8.9

Assume that the number of miles travelled per litre is normally distributed.

(a) Confirm, using the 5% level of significance, that it is reasonable to assume that the samples come from populations with the same variance.

[7 marks]

(b) Investigate Kanwar's claim at the 10% level of significance.

[10 marks]

(c) Ashok claims that the test is unfair because his sales area is greater than that of Kanwar and so he has to drive greater distances.

Is Ashok's claim reasonable? Give a reason for your answer.

[1 mark]

QUESTION PART REFERENCE

Answer space for question 5

QUESTION PART REFERENCE

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Answer space for question 5

QUESTION PART REFERENCE

Answer space for question 5

6 Sandra is often disturbed by emails when working on her office computer. She estimates that during her working day she receives on average 8 emails per hour. Sandra models the number of emails she receives during an interval of one working hour by a Poisson distribution with mean 8.

(a) (i) Using this model, determine the probability that Sandra receives more than 2 emails during an interval of **15 minutes**.

[3 marks]

(ii) Write down **two** assumptions that Sandra must make about the arrivals of her emails for this Poisson model to be valid.

[2 marks]

(b) Sandra also records the **time interval**, X minutes, between successive emails that she receives during a particular week. Her results are shown in the table.

Time interval (x mins)	0–	3–	6–	10–	15–	20–	30–	40–
Number of emails	124	82	51	31	16	11	3	2

Sandra believes that X can be modelled by an exponential distribution with a **mean** of 7.5.

Carry out a χ^2-test, using the 10% level of significance, to investigate Sandra's belief.

[11 marks]

(c) In the light of your conclusion in part **(b)**, comment on the likely validity of your answer to part **(a)(i)**.

[2 marks]

QUESTION PART REFERENCE

Answer space for question 6

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END OF QUESTIONS

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