Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

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

General Certificate of Education
Advanced Subsidiary Examination
June 2011

Mathematics MS/SS1A/W
Unit Statistics 1A

Statistics
Unit Statistics 1A

Friday 20 May 2011 1.30 pm to 2.45 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 15 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 60.
- Unit Statistics 1A has a **written paper and coursework**.

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

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

1 The number of matches in each of a sample of 85 boxes is summarised in the table.

Number of matches	Number of boxes
Less than 239	1
239–243	1
244–246	2
247	3
248	4
249	6
250	10
251	13
252	16
253	20
254	5
255–259	3
More than 259	1
Total	**85**

(a) For these data:

(i) state the modal value; *(1 mark)*

(ii) determine values for the median and the interquartile range. *(3 marks)*

(b) Given that, on investigation, the 2 extreme values in the above table are 227 and 271 , calculate estimates of the mean and the standard deviation. *(4 marks)*

(c) For the numbers of matches in the 85 boxes, suggest, with a reason, the most appropriate measure of spread. *(2 marks)*

QUESTION PART REFERENCE

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QUESTION PART REFERENCE

2 A machine produces ice hockey pucks whose weights may be modelled by a normal distribution with a mean of 165 grams and a standard deviation of σ grams.

(a) Given that $\sigma = 2.5$, determine the probability that the weight of a randomly selected puck is:

(i) less than 167 grams; *(3 marks)*

(ii) more than 162 grams. *(2 marks)*

(b) An ice hockey club purchases a box of 12 pucks produced by the machine.

Assuming that the pucks in any box represent a random sample, calculate the probability that all 12 pucks weigh less than 167 grams. *(2 marks)*

(c) An ice hockey confederation requires that at most 1 per cent of pucks have weights outside the range 160 grams to 170 grams.

Assuming that the value of the mean remains unchanged at 165 grams, calculate, to two decimal places, the maximum value of σ which meets this requirement. *(4 marks)*

QUESTION PART REFERENCE

QUESTION PART REFERENCE

3 Rice that can be cooked in microwave ovens is sold in packets which the manufacturer claims contain a mean weight of more than 250 grams of rice.

The weight of rice in a packet may be modelled by a normal distribution.

A consumer organisation's researcher weighed the contents, x grams, of each of a random sample of 50 packets. Her summarised results are:

$$\overline{x} = 251.1 \quad \text{and} \quad s = 1.94$$

(a) (i) Construct a 96% confidence interval for the mean weight of rice in a packet, giving the limits to one decimal place. *(4 marks)*

(ii) Hence comment on the manufacturer's claim. *(2 marks)*

(b) (i) Construct an interval within which approximately 96% of the weights of rice in individual packets will lie. *(2 marks)*

(ii) The statement '250 grams' is printed on each packet.

Comment on what your interval in part **(b)(i)** reveals about this statement. *(1 mark)*

QUESTION PART REFERENCE

QUESTION PART REFERENCE

4 Emma visits her local supermarket every Thursday to do her weekly shopping.

The event that she buys orange juice is denoted by J, and the event that she buys bottled water is denoted by W. At each visit, Emma may buy neither, or one, or both of these items.

(a) Complete the table of probabilities, printed below, for these events, where J' and W' denote the events 'not J' and 'not W' respectively. *(3 marks)*

(b) Hence, or otherwise, find the probability that, on any given Thursday, Emma buys either orange juice or bottled water but not both. *(2 marks)*

(c) Show that:

(i) the events J and W are **not** mutually exclusive;

(ii) the events J and W are **not** independent. *(3 marks)*

QUESTION PART REFERENCE

(a)

	J	J'	**Total**
W			0.65
W'	0.15		
Total		0.30	1.00

QUESTION PART REFERENCE

5 An amateur tennis club purchases tennis balls that have been used previously in professional tournaments.

The probability that each such ball fails a standard bounce test is 0.15.

The club purchases boxes each containing 10 of these tennis balls. Assume that the 10 balls in any box represent a random sample.

(a) Determine the probability that the number of balls in a box which fail the bounce test is:

(i) at most 2; *(1 mark)*

(ii) at least 2; *(2 marks)*

(iii) more than 1 but fewer than 5. *(3 marks)*

(b) Determine the probability that, in **5 boxes**, the total number of balls which fail the bounce test is:

(i) more than 5; *(2 marks)*

(ii) at least 5 but at most 10. *(3 marks)*

(c) Calculate the mean and the variance for the total number of balls in **50 boxes** which fail the bounce test. *(2 marks)*

QUESTION PART REFERENCE	

QUESTION PART REFERENCE

6 (a) Three airport management trainees, Ryan, Sunil and Tim, were each instructed to select a random sample of 12 suitcases from those waiting to be loaded onto aircraft.

Each trainee also had to measure the volume, x, and the weight, y, of each of the 12 suitcases in his sample, and then calculate the value of the product moment correlation coefficient, r, between x and y.

- Ryan obtained a value of -0.843.
- Sunil obtained a value of $+0.007$.

Explain why neither of these two values is likely to be correct. *(2 marks)*

(b) Peggy, a supervisor with many years' experience, measured the volume, x cubic feet, and the weight, y pounds, of each suitcase in a random sample of 6 suitcases, and then obtained a value of 0.612 for r.

- Ryan and Sunil each claimed that Peggy's value was different from their values because she had measured the volumes in cubic feet and the weights in pounds, whereas they had measured the volumes in cubic metres and the weights in kilograms.
- Tim claimed that Peggy's value was almost exactly half his calculated value because she had used a sample of size 6 whereas he had used one of size 12.

Explain why neither of these two claims is valid. *(2 marks)*

(c) Quentin, a manager, recorded the volumes, v, and the weights, w, of a random sample of 8 suitcases as follows.

v	28.1	19.7	46.4	23.6	31.1	17.5	35.8	13.8
w	14.9	12.1	21.1	18.0	19.8	19.2	16.2	14.7

(i) Calculate the value of r between v and w. *(3 marks)*

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

QUESTION PART REFERENCE

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QUESTION PART REFERENCE

END OF QUESTIONS

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