Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

General Certificate of Education
Advanced Subsidiary Examination
June 2014

Mathematics MS1A/W

Unit Statistics 1A

Friday 6 June 2014 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 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.

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Answer **all** questions.

Answer each question in the space provided for that question.

1 Henrietta lives on a small farm where she keeps some hens.

For a period of 35 weeks during the hens' first laying season, she records, **each week**, the total number of eggs laid by the hens.

Her records are shown in the table.

Total number of eggs laid in a week (x)	Number of weeks (f)
66	1
67	2
68	3
69	5
70	7
71	8
72	4
73	2
74	2
75	1
Total	**35**

(a) For these data, calculate values for the mean and the standard deviation.

[4 marks]

(b) Each week, for the 35 weeks, Henrietta sells 60 eggs to a local shop, keeping the remainder for her own use.

State values for the mean and the standard deviation of the number of eggs that she keeps.

[2 marks]

QUESTION PART REFERENCE

Answer space for question 1

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QUESTION PART REFERENCE

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2 The volume of *Fizzer* lemonade in a can, X millilitres, may be modelled by a normal distribution with a mean of 340 and a standard deviation of 3.2.

(a) Determine:

(i) $\mathrm{P}(X > 345)$;

(ii) $\mathrm{P}(X < 333)$;

(iii) $\mathrm{P}(333 < X < 345)$;

(iv) $\mathrm{P}(X = 340)$.

[8 marks]

(b) The volume of *Fizzer* cola in a can, Y millilitres, may be modelled by a normal distribution with mean μ and standard deviation σ.

It is required that $\mathrm{P}(Y > 330) = 0.975$ and $\mathrm{P}(Y < 345) = 0.975$.

(i) State why $\mu = 337.5$.

[1 mark]

(ii) Determine the value of σ.

[3 marks]

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3 The table shows the colour of hair and the colour of eyes of a sample of 750 people from a particular population.

		Colour of hair					
		Black	**Dark**	**Medium**	**Fair**	**Auburn**	**Total**
Colour of eyes	**Blue**	6	51	68	66	24	215
	Brown	14	92	97	90	47	340
	Green	0	37	55	64	39	195
	Total	20	180	220	220	110	750

(a) Calculate, **to three decimal places**, the probability that a person, selected at random from this sample, has:

(i) fair hair;

(ii) auburn hair and blue eyes;

(iii) either auburn hair or blue eyes but not both;

(iv) green eyes, given that the person has fair hair.

[6 marks]

(b) Three people are selected at random from the sample.

Calculate, **to three significant figures**, the probability that two of them have dark hair and brown eyes and the other has medium hair and green eyes.

[4 marks]

QUESTION PART REFERENCE

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4 Every year, usually during early June, the Isle of Man hosts motorbike races. Each race consists of three consecutive laps of the island's course. To compete in a race, a rider must first complete at least one qualifying lap.

The data refer to the lightweight motorbike class in 2012 and show, for each of a random sample of 10 riders, values of

$$u = x - 100 \quad \text{and} \quad v = y - 100$$

where

x denotes the average speed, in mph, for the rider's fastest qualifying lap
and
y denotes the average speed, in mph, for the rider's three laps of the race.

	Rider									
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
u	7.88	13.02	4.29	2.88	6.26	7.03	3.60	11.78	13.15	11.69
v	6.63	10.16	3.63	0.47	5.70	8.01	3.30	7.31	13.08	11.82

(a) (i) Calculate the value of r_{uv}, the product moment correlation coefficient between u and v.

[3 marks]

(ii) Hence state the value of r_{xy}, giving a reason for your answer.

[2 marks]

(b) Interpret your value of r_{xy} in the context of this question.

[2 marks]

QUESTION PART REFERENCE

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QUESTION PART REFERENCE

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5 An analysis of the number of vehicles registered by each household within a city resulted in the following information.

Number of vehicles registered	0	1	2	$\geqslant 3$
Percentage of households	18	47	25	10

(a) A random sample of 30 households within the city is selected.

Use a binomial distribution with $n = 30$, together with relevant information from the table in each case, to find the probability that the sample contains:

(i) exactly 3 households with **no** registered vehicles;

[3 marks]

(ii) at most 5 households with **three or more** registered vehicles;

[2 marks]

(iii) more than 10 households with **at least two** registered vehicles;

[3 marks]

(iv) more than 5 households but fewer than 10 households with **exactly two** registered vehicles.

[3 marks]

(b) (i) If a random sample of **20** households within the city were to be selected, estimate the mean and the variance for the number of households in the sample that would have **exactly one** registered vehicle.

[2 marks]

(ii) Six female students each selected 20 households within the city. Each student then visited the 20 households that she had selected and counted the number of households in her sample that had exactly one registered vehicle.

A subsequent analysis of their six counts resulted in a mean of 6 and a variance of 21.2.

Comment on a claim that the students did not select random samples. Justify your answer.

[2 marks]

QUESTION PART REFERENCE

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6 The volume of water, V, used by a guest in an en suite shower room at a small guest house may be modelled by a random variable with mean μ litres and standard deviation 65 litres.

A random sample of 80 guests using this shower room showed a mean usage of 118 litres of water.

(a) (i) Give a numerical justification as to why V is unlikely to be normally distributed.

[2 marks]

(ii) Explain why $\overline{V}$, the mean of a random sample of 80 observations of V, may be assumed to be approximately normally distributed.

[2 marks]

(b) (i) Construct a 98% confidence interval for μ.

[4 marks]

(ii) Hence comment on a claim that μ is 140.

[2 marks]

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END OF QUESTIONS

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