General Certificate of Education
January 2007
Advanced Level Examination

MATHEMATICS
Unit Statistics 2A

MS2A/W

ASSESSMENT and QUALIFICATIONS ALLIANCE

Friday 12 January 2007 9.00 am to 10.15 am

For this paper you must have:
- an 8-page answer book
- the **blue** AQA booklet of formulae and statistical tables.

You may use a graphics calculator.

Time allowed: 1 hour 15 minutes

Instructions
- Use blue or black ink or ball-point pen. Pencil should only be used for drawing.
- Write the information required on the front of your answer book. The *Examining Body* for this paper is AQA. The *Paper Reference* is MS2A/W.
- Answer **all** questions.
- Show all necessary working; otherwise marks for method may be lost.
- The **final** answer to questions requiring the use of tables or calculators should normally be given to three significant figures.

Information
- The maximum mark for this paper is 60.
- The marks for questions are shown in brackets.
- Unit Statistics 2A has a **written paper and coursework**.

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

Answer **all** questions.

1 The number of accidents, X, occurring during one week at Joanne's place of work can be modelled by a Poisson distribution with a mean of 0.7 .

The number of accidents, Y, occurring during one week at Pete's place of work can be modelled by a Poisson distribution with a mean of 1.3 .

(a) (i) Determine $P(X < 3)$. *(1 mark)*

(ii) Calculate $P(Y = 2)$. *(2 marks)*

(b) Find the probability that, during a particular week, there are at least 4 accidents in total at these two places of work. *(3 marks)*

2 The marks achieved by Pat in her homework assignments may be assumed to be normally distributed with mean μ .

The marks achieved by Pat in a random sample of 8 assignments were recorded as follows:

60 65 62 67 69 71 63 66

Construct a 99% confidence interval for μ . *(5 marks)*

3 The handicap committee of a golf club has indicated that the mean score achieved by the club's members in the past was 85.9 .

A group of members believes that recent changes to the golf course have led to a change in the mean score achieved by the club's members and decides to investigate this belief.

A random sample of the scores, x, of 100 club members was taken and is summarised by

$$\sum x = 8350 \quad \text{and} \quad \sum (x - \overline{x})^2 = 15\,321$$

where $\overline{x}$ denotes the sample mean.

Test, at the 5% level of significance, the group's belief that the mean score of 85.9 has changed. *(8 marks)*

4 The number of mistakes, X, that Holli makes as a learner driver when she drives from Ampthill to Bedford can be modelled by the following discrete probability distribution:

x	$\leqslant 1$	2	3	4	5	6	$\geqslant 7$
$\mathbf{P}(X = x)$	0	0.40	0.25	0.18	0.12	k	0

(a) Find the value of k. *(1 mark)*

(b) Find:

(i) $\mathrm{E}(X)$; *(1 mark)*

(ii) $\mathrm{Var}(X)$. *(3 marks)*

(c) When Holli makes the return journey by the same route, the number of mistakes, Y, that she makes can be approximated by

$$Y = 2X - 3$$

Find:

(i) $\mathrm{E}(Y)$; *(1 mark)*

(ii) the standard deviation of Y. *(3 marks)*

5 Jasmine's French teacher states that a homework assignment should take, on average, 30 minutes to complete.

Jasmine believes that he is understating the mean time that the assignment takes to complete and so decides to investigate. She records the times, in minutes, that it takes for a random sample of 10 students to complete the French assignment, with the following results:

29 33 36 42 30 28 31 34 37 35

(a) Test, at the 1% level of significance, Jasmine's belief that her French teacher has understated the mean time that it should take to complete the homework assignment. *(7 marks)*

(b) State an assumption that you must make in order for the test used in part (a) to be valid. *(1 mark)*

Turn over for the next question

6 The waiting time, T minutes, before being served at a local newsagents can be modelled by a continuous random variable with probability density function

$$f(t) = \begin{cases} \frac{3}{8}t^2 & 0 \leqslant t < 1 \\ \frac{1}{16}(t+5) & 1 \leqslant t \leqslant 3 \\ 0 & \text{otherwise} \end{cases}$$

(a) Sketch the graph of f. *(3 marks)*

(b) For a customer selected at random, calculate $P(T \geqslant 1)$. *(2 marks)*

(c) (i) Show that the cumulative distribution function for $1 \leqslant t \leqslant 3$ is given by

$$F(t) = \frac{1}{32}(t^2 + 10t - 7)$$ *(5 marks)*

(ii) Hence find the median waiting time. *(4 marks)*

7 A statistics unit is required to determine whether or not there is an association between students' performances in mathematics at Key Stage 3 and at GCE.

A survey of the results of 500 students showed the following information:

		GCE Grade				
		A	**B**	**C**	**Below C**	**Total**
Key Stage 3 Level	**8**	60	55	47	43	205
	7	55	32	31	26	144
	6	40	38	35	38	151
	Total	155	125	113	107	500

(a) Use a χ^2 test at the 10% level of significance to determine whether there is an association between students' performances in mathematics at Key Stage 3 and at GCE. *(9 marks)*

(b) Comment on the number of students who gained a grade A at GCE having gained a level 7 at Key Stage 3. *(1 mark)*

END OF QUESTIONS