General Certificate of Education
January 2004
Advanced Level Examination

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

MATHEMATICS (SPECIFICATION A)   MAS2/W
Unit Statistics 2

Friday 23 January 2004   Morning Session

In addition to this paper you will require:
  • an 8-page answer book;
  • the AQA booklet of formulae and statistical tables.
You may use a graphics calculator.

Time allowed: 1 hour 20 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 MAS2/W.
• Answer **all** questions.
• All necessary working should be shown; 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.
• Tie loosely any additional sheets you have used to the back of your answer book before handing it to the invigilator.

Information
• The maximum mark for this paper is 60.
• Mark allocations are shown in brackets.

Advice
• Unless stated otherwise, formulae may be quoted, without proof, from the booklet.

MAS2/W

Answer **all** questions.

1 The probability that Joanne will have to stand on any single bus journey to work is 0.09.

Calculate:

(a) the probability that she will first have to stand on her tenth bus journey to work;

(3 marks)

(b) the number of her bus journeys, on average, until she first has to stand. *(2 marks)*

2 A company which manufactures computer disks has a good reputation for the reliability of the disks that it produces. It is known that only 1 per cent of the disks which are manufactured by this company are faulty.

The disks are packed in boxes of 500.

(a) (i) Write down the probability distribution for *X*, the number of faulty disks in a box of 500 disks. *(1 mark)*

(ii) Calculate the probability that there is exactly one faulty disk in a randomly selected box of 500 disks. *(2 marks)*

(b) Find values for the mean and variance of *X*. *(2 marks)*

(c) Using a distributional approximation, calculate the probability that there are more than 10 faulty disks in a box of 500 disks. *(3 marks)*

3 The time, *T* hours, taken by any member of a group of friends to complete a run for charity can be modelled by the following probability density function.

$$\text{f}(t) = \begin{cases} \dfrac{1}{90}t^2 & 3 \leqslant t \leqslant 6 \\ 2 - \dfrac{4}{15}t & 6 \leqslant t \leqslant 7.5 \\ 0 & \text{otherwise} \end{cases}$$

(a) (i) Show that the probability that a member of the group selected at random takes at least 6 hours to complete the run is 0.3. *(2 marks)*

(ii) Evaluate the median time taken to complete the run. *(6 marks)*

(b) Calculate the mean time taken to complete the run. *(5 marks)*

4 At a hospital, the number of patients who fail to turn up for appointments on any particular day can be modelled by a Poisson distribution with mean 7.0.

(a) The manager introduces new procedures in an attempt to improve the attendance for appointments at the hospital. On a day chosen at random following the introduction of the new procedures, it was found that only 3 patients did not turn up for their appointments.

Stating null and alternative hypotheses, test, at the 5% level of significance, the manager's claim that the new procedures have resulted in a decrease in the mean number of patients not turning up for their hospital appointments. *(5 marks)*

(b) During the annual inspection of the hospital, the number of patients failing to turn up for their appointments was monitored over a 14-day period. It was found that 74 patients failed to turn up for their appointments.

Use a distributional approximation to test, at the 1% level of significance, whether this indicates a decrease in the mean number of patients not turning up for their hospital appointments. *(9 marks)*

5 Baljeet's parents want to choose a school for her to attend in order to pursue her sixth form studies. They have a choice of sending her to one of two schools, X or Y. To help them make an informed choice, they decide to look at the numbers of A, B, C and D grades achieved last year by each school. These are tabulated below.

	Examination Grades				
	A	**B**	**C**	**D**	**Total**
School X	52	34	16	18	120
School Y	114	58	62	46	280
Total	166	92	78	64	400

Stating the null hypothesis, carry out a χ^2 test at the 5% level of significance to determine whether there is an association between the schools and the numbers of A, B, C and D grades achieved. *(9 marks)*

TURN OVER FOR THE NEXT QUESTION

6 Rectangular cardboard boxes are made to hold three cylindrical cans of drink, as shown below.

View from above
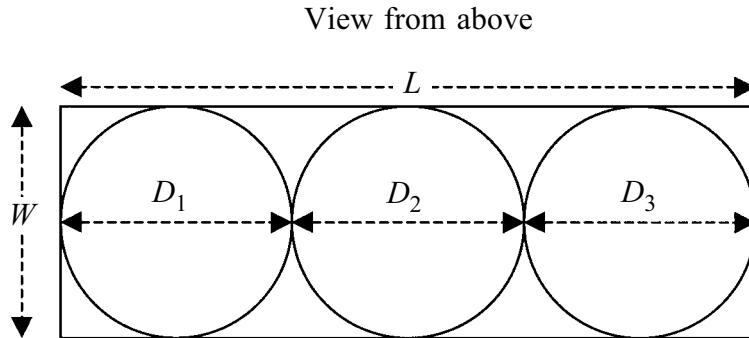
The length, L cm, of the boxes is a normal random variable with mean 27 and variance 1.21. The width, W cm, of the boxes is a normal random variable with mean 9 and variance 0.20. The diameter, D cm, of each of the cylindrical cans is a normal random variable with mean 8 and variance 0.16.

It can be assumed that L, W and D are independent normal random variables.

(a) (i) Write down the distribution for $X = W - D_1$. *(2 marks)*

    (ii) Calculate the value of $P(X > 0)$. *(3 marks)*

(b) (i) Write down the distribution for $Y = L - (D_1 + D_2 + D_3)$. *(2 marks)*

    (ii) Calculate the value of $P(0 < Y < 1)$. *(4 marks)*

END OF QUESTIONS