Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2010

Mathematics

Assessment Unit S1

assessing

Module S1: Statistics 1

[AMS11]

AMS11

WEDNESDAY 27 JANUARY, AFTERNOON

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number on the Answer Booklet provided.
Answer **all seven** questions.
Show clearly the full development of your answers.
Answers should be given to three significant figures unless otherwise stated.
You are permitted to use a graphic or scientific calculator in this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A copy of the **Mathematical Formulae and Tables booklet** is provided.
Throughout the paper the logarithmic notation used is $\ln z$ where it is noted that $\ln z \equiv \log_e z$

Answer all seven questions.

Show clearly the full development of your answers.

Answers should be given to three significant figures unless otherwise stated.

1 Adele is planning to collect data concerning distances between trees in a forest for a geography project.
She decides to take data from a sample of trees.

(i) Give **one** advantage and **one** disadvantage of using a sample. [2]

When summarising her data she decides to use a grouped frequency table.

(ii) Give **one** advantage and **one** disadvantage of using a grouped frequency table. [2]

Adele's data is given in **Table 1** below.

Table 1

Distance apart (metres)	0 –	5 –	10 –	15 –	20 –	25 –
Number of pairs of trees	17	23	10	4	2	0

(iii) Calculate the mean and variance of Adele's sample. [5]

2 The probability distribution of a random variable X is shown in **Table 2** below.

Table 2

x	–2	–1	0	1	2
$P(X = x)$	0.16	k	0.25	k	0.31

(i) Find the value of k. [2]

(ii) Find $E(X)$ and $Var(X)$. [6]

A random variable, Y, is related to X by the formula $Y = 1 - 4X$

(iii) Find $E(Y)$ and $Var(Y)$. [3]

3 Vehicles on a motorway pass under a bridge at a constant average rate of 8 per minute.
Using a Poisson model, find the probability that:

(i) exactly 6 vehicles pass under the bridge in a one minute period; [2]

(ii) at least 2 vehicles pass under the bridge in a fifteen second period. [5]

(iii) Give **one** assumption that has been made regarding the vehicles passing under the bridge. [1]

4 A biased die is such that the probability of scoring six is 0.25
It is thrown eight times and the scores noted.
Find the probability that:

(i) the score is six on exactly three occasions; [3]

(ii) the score is six on at least three occasions. [5]

(iii) If the score is six on at least three occasions, find the probability that it occurs exactly five times. [4]

5 The masses of bags of potatoes are known to be Normally distributed.
The standard deviation of the masses is known to be 40 grams.
The heaviest 2.5% weigh greater than 2678.4 grams.

(i) Find the mean mass of the bags. [5]

A bag of potatoes is chosen at random.

(ii) Find the probability that it has mass between 2540 and 2610 grams. [6]

6 A shopping centre has an overflow car park which opens for a six-hour period at peak times. The times, in hours, that vehicles spend in the car park can be modelled by the continuous random variable X with probability density function $f(x)$ defined by

$$f(x) = \frac{1}{108}(6x^2 - x^3) \qquad 0 \leqslant x \leqslant 6$$

(i) Find the mean time spent in the car park. [4]

Find the probability that a vehicle chosen at random spent:

(ii) less than two hours in the car park; [3]

(iii) between two and four hours in the car park. [2]

The charges for the car park are shown in **Table 3** below.

Table 3

Time	Less than two hours	between two and four hours	longer than four hours
Charge	£2.50	£3.50	£4.50

(iv) Find the expected charge for parking in the car park. [5]

7 A bowl contains six chocolates: three milk chocolates and three plain chocolates.
A second bowl contains two milk chocolates and one plain chocolate.
Two chocolates are chosen at random from the first bowl and transferred to the second bowl.
A chocolate is then chosen at random from the second bowl.

(i) Find the probability of transferring one chocolate of each type to the second bowl. [3]

(ii) Find the probability that the chocolate chosen from the second bowl is a plain chocolate. [7]

THIS IS THE END OF THE QUESTION PAPER