Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2011

Mathematics

Assessment Unit S1

assessing

Module S1: Statistics 1

[AMS11]

AMS11

WEDNESDAY 26 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 The probability distribution of a discrete random variable, X, is given in **Table 1** below.

Table 1

x	1	2	3	4	5
$P(X = x)$	0.17		0.17	0.23	0.18

(i) Briefly explain why $P(X = 2)$ must be equal to 0.25 [1]

(ii) Find $E(X)$. [2]

(iii) Find $Var(X)$. [4]

Another discrete random variable, Y, is related to X by the formula $Y = 2X - 3$

(iv) Using the results from **(ii)** and **(iii)** find $E(Y)$ and $Var(Y)$. [3]

2 Paul plants ten snowdrop bulbs.
He knows from experience that the bulbs have a 65% chance of flowering in the spring.

Find the probability that:

(i) exactly 7 snowdrops flower in the spring; [3]

(ii) at least 7 snowdrops flower in the spring; [4]

(iii) at most 7 snowdrops flower in the spring. [3]

3 Tina is involved in a class project for Sociology.
A sample of match-goers at the local football ground were asked their age.
The teacher constructed a histogram summarising the data.
Tina wishes to calculate the mean and standard deviation of the ages.
Table 2 below shows the work that she has done so far.

Table 2

Age (complete years)	Frequency Density	Frequency
0–9	3.2	32
10–14	13.2	66
15–19	13.8	
20–29	12.3	
30–44	10.2	
45–74	1.9	

(i) Find the remaining four frequencies. [3]

(ii) Find the mean and standard deviation for the age of match-goers. [5]

4 The times taken by families to do their weekly shop at a local supermarket are Normally distributed with mean 55 minutes and standard deviation 10 minutes.

Find the probability that a family's weekly shop takes:

(i) less than 60 minutes; [3]

(ii) between 45 minutes and 60 minutes. [4]

A family's time to do their weekly shop is in the upper 15% of shopping times.

(iii) Find the minimum time taken to do the family's weekly shop. [5]

5 Avril's car has developed an oil leak.
The oil drips randomly at an average rate of 16 drips per minute.
While driving the car to the garage Avril stops at traffic lights for 15 seconds.

Find the probability that while stopped at the lights, the oil drips:

(i) exactly twice; [4]

(ii) at least three times. [4]

(iii) If oil dripped at least three times, find the probability that it dripped exactly six times. [4]

6 A continuous random variable X has the probability density function f(x) defined by

$$f(x) = kx^n \qquad 0 \leqslant x \leqslant 1$$

where $n > -1$

(i) Show that $k = n + 1$ [3]

Find an expression, in terms of n, for:

(ii) E(X); [3]

(iii) Var(X). [5]

7 [In this question the convention $\overline{A}$ is used to denote the event 'not A'.]

Consider the following probability tree diagram.

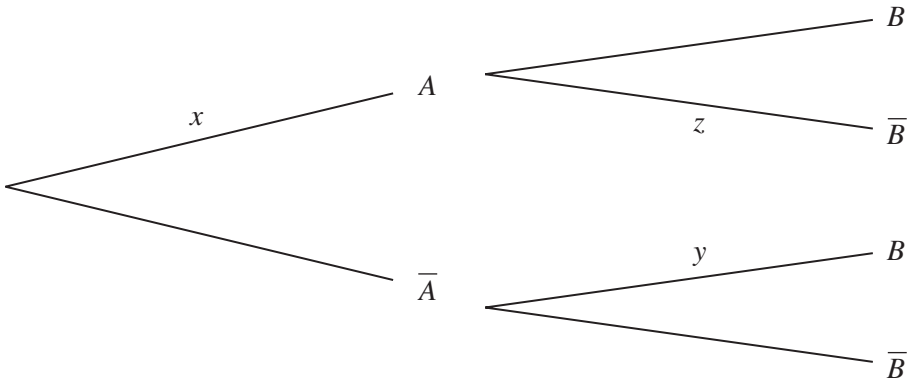

Fig. 1

In **Fig. 1** above x, y and z are the probabilities of three events.

(i) Using **Fig. 1** state the events for which x, y and z are the probabilities. [3]

(ii) Given that $z = 1 - x$ and $y = 2x$ find an expression for $\mathrm{P}(\overline{B})$ in terms of x. [4]

(iii) If $\mathrm{P}(\overline{B}) = 0.25$, find x. [5]

THIS IS THE END OF THE QUESTION PAPER