Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2014

Mathematics

Assessment Unit S1

assessing

Module S1: Statistics 1

[AMS11]

AMS11

WEDNESDAY 29 JANUARY, MORNING

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 same 55 students take end of term examinations in Mathematics and Science. **Table 1** below shows a summary of the marks obtained in the Mathematics examination.

Table 1

Marks	1–10	11–20	21–30	31–40	41–50
Frequency	1	15	25	12	2

(i) Find the mean and standard deviation of these marks. [5]

The Mathematics examination was marked out of 50
These marks need to be doubled so that they can be reported as marks out of 100

(ii) Find the mean and standard deviation of these adjusted marks. [2]

The science marks are given as marks out of 100
The mean and standard deviation of the Science marks are 47.2 and 11.2 respectively.

(iii) State 2 differences in the performances of the students in the two examinations. [2]

2 An insurance company is known to receive an average of 2 major claims per day.

(i) State one assumption that would have to be made if a Poisson distribution is to be used to model the number of major claims received in a day. [1]

Assuming that the number of major claims does follow a Poisson distribution, find the probability that on a day the company receives:

(ii) no major claims; [2]

(iii) at least 2 major claims; [4]

(iv) more than 3 major claims, given that at least 2 major claims are received. [5]

3 A discrete random variable X has the probability distribution given in **Table 2** below.

Table 2

x	0	1	2	b	8
$P(X = x)$	0.1	0.2	0.1	a	0.3

where a and b are positive constants.

(i) Find a. [2]

(ii) If $E(X) = 4.9$, find b. [3]

(iii) If instead $E(X^2) = 22.5$, find b. [3]

4 **(i)** State 2 of the conditions necessary for a random variable to be modelled by a binomial distribution. [2]

The probability that a boy chosen at random has a birthday on a Saturday this year is $\frac{1}{7}$

8 boys are chosen at random.

(ii) Find the probability that none of these boys has a birthday on a Saturday this year. [4]

(iii) Find the probability that at most 2 of these boys have a birthday on a Saturday this year. [4]

(iv) Find the mean and variance of the number of boys with a birthday on a Saturday this year. [2]

5 A machine produces metal disks.
The diameters of the disks are Normally distributed with mean 25 cm and standard deviation 0.2 cm.
A disk is rejected if its diameter is more than 25.5 cm or less than 24.7 cm.

(i) Find the percentage of the disks that are accepted. [7]

The machine setting is altered so that larger disks can be made.
The standard deviation does not change but the mean diameter does.

(ii) Find the new mean diameter if 4% of the disks produced are larger than 30 cm in diameter. [4]

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

$$f(x) = \begin{cases} x^2(2-x) & 0 \leqslant x \leqslant 1 \\ 1 & 1 \leqslant x \leqslant k \\ 0 & \text{otherwise} \end{cases}$$

where k is a constant.

(i) Find k. [6]

(ii) Find $E(X)$. [5]

7 A biased die, in the shape of a cube, has the numbers 1, 2, 3, 4, 5 and 6 respectively on its faces.
When the die is thrown:

the probability of getting 3 is equal to the probability of getting 1;

the probability of getting 6 is twice the probability of getting 1;

the probability of getting 5 is twice the probability of getting 6;

the probabilities of getting 2, 4, 6 are equal.

(i) When this die is thrown find the probability of getting 1 [3]

When a biased coin is tossed the probability of getting a head is $\frac{2}{3}$

A trial consists of tossing the coin and throwing the die.

(ii) Find the probability of getting:

(a) a head and a 6; [2]

(b) a tail and a prime number. [4]

(iii) Find the probability, in 4 trials, of getting a head together with a 6 only once. [3]

THIS IS THE END OF THE QUESTION PAPER