Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2014

Mathematics

Assessment Unit S1

assessing

Module S1: Statistics 1

[AMS11]

AMS11

FRIDAY 30 MAY, MORNING

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number on the Answer Booklet provided.
Answer **all eight** 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 eight questions.

Show clearly the full development of your answers.

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

1 **Table 1** below summarises the times, recorded to the nearest minute, that a physiotherapist spent with the same patient.

Table 1

Time	5–9	10–14	15–19	20–24	25–29
Number of sessions	2	6	20	a	8

The physiotherapist has deleted the number of sessions of between 20 and 24 minutes that he spent with the patient.
He had previously calculated from the table that the mean time that he spent with the patient was 19 minutes.

(i) Find a. [3]

(ii) Find the standard deviation of the times that the physiotherapist spent with the patient. [2]

2 A large sack contains onions.
The probability that an onion, picked at random from the sack, is bad is 0.08

A cook picks 10 onions, chosen at random, from the sack.

(i) Find the probability that:

(a) none of the onions is bad; [3]

(b) fewer than 2 of the onions are bad. [3]

The cook picks 10 onions, chosen at random, from the sack on each of 4 days.

(ii) Find the probability that no bad onions are chosen on any of the 4 days. [3]

3 The random variable X follows a Poisson distribution Po(λ), with standard deviation $\sqrt{3}$

(i) Show that $\lambda = 3$ [2]

(ii) Find $P(X > 2)$. [5]

4 A continuous random variable X has the probability density function $f(x)$ denoted by

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

where k is a constant.

(i) Show that $k = 3$ [4]

(ii) Find Var(X). [8]

(iii) Find $P(X > 0.2)$. [3]

5 A and B are two events such that:

$$P(A|B) = \frac{1}{4}$$

$$P(B|A) = \frac{1}{3}$$

$$\text{and} \quad P(B) = \frac{4}{7}$$

(i) Find $P(A \cup B)$. [7]

(ii) State, giving a reason:

(a) whether or not A and B are mutually exclusive; [1]

(b) whether or not A and B are exhaustive; [1]

(c) whether or not A and B are independent. [1]

6 Two fair dice, each in the shape of a tetrahedron, are thrown.
Each die has the numbers 1, 2, 3, 4 respectively on its 4 faces.
Let X be the random variable:
"The sum of the numbers on the two downward facing faces".

(i) Construct the probability distribution table for X. [4]

(ii) **Write down** E(X), giving a reason for being able to do so. [1]

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

7 The continuous random variable X is normally distributed with mean μ and standard deviation σ.

Given that:

$$P(X < 30) = 0.1$$
$$\text{and } P(X > 60) = 0.2$$

find μ and σ. [7]

8 A bag initially contains 2 red and 4 white balls identical in shape and size.

A trial consists of selecting a ball at random:
if the ball is red then it is replaced and an additional red ball is added to the bag;
if the ball is white then it is not replaced.

Three trials are carried out, one after the other.

(i) Find the probability that exactly one white ball is selected. [6]

(ii) Find the probability that at least one white ball is selected. [3]

(iii) Given that all three balls selected are of the same colour, find the probability that they are all red. [4]

THIS IS THE END OF THE QUESTION PAPER