Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2013

Mathematics

Assessment Unit S1

assessing

Module S1: Statistics 1

[AMS11]

AMS11

THURSDAY 13 JUNE, 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 At a local airport planes cannot land if there are severe cross winds.
During the winter months the probability of this happening on a given day is 0.04
Find the probability that in a period of 7 winter days severe winds prevent landings on:

(i) no days; [3]

(ii) 2 or more days. [3]

(iii) State why this distribution would not be suitable to calculate the probability of landing being prevented in all months of the year. [1]

2 The wingspans of a random sample of moths were recorded.
The results are summarised in **Table 1** below.

Table 1

Wingspan, w, mm	**Frequency**
$20 \leqslant w < 40$	10
$40 \leqslant w < 50$	16
$50 \leqslant w < 60$	30
$60 \leqslant w < 70$	36
$70 \leqslant w < 80$	30
$80 \leqslant w < 100$	0
$100 \leqslant w < 120$	1

Calculate an estimate of the:

(i) mean wingspan; [3]

(ii) median wingspan. [4]

3 A shop sells a particular make of multi-fuel burner.
Assuming that the weekly demand for the multi-fuel burner is a Poisson variable with mean 3, find the probability that in a week the shop sells:

(i) exactly three burners; [3]

(ii) at least four burners. [5]

(iii) If there were at least 4 burners sold, find the probability that exactly 7 were sold. [4]

4 The number of roses on a small rose bush is modelled by the discrete random variable X, with the probability distribution given in **Table 2** below.

Table 2

x	1	2	3	4	5
$P(X = x)$	c^2	$4c^2$	$2c^2 + 2c$	$4c$	$3c^2 + 3c$

(i) Show that $c = 0.1$ [4]

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

The number of roses on a large rose bush is modelled by the discrete random variable Y.
Y is related to X by the formula $Y = 12 - X$.

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

5 In a long-jump competition, the distance in excess of 3 m jumped by a competitor is X. X has probability density function:

$$f(x) = \begin{cases} k(16x - x^3) & 0 \leqslant x \leqslant 4 \\ 0 & \text{otherwise} \end{cases}$$

(i) Show that $k = \frac{1}{64}$ [4]

(ii) Find the expected distance in excess of 3 m jumped. [3]

(iii) Find the probability that a competitor jumped in excess of 6 m. [2]

6 Farmer Alcrop's hens produce eggs whose weights are Normally distributed with mean 62 g and standard deviation 5 g.
Eggs are graded as small, medium or large.
Eggs weighing over 68 g are graded as large.

(i) Find the probability that an egg is graded as large. [4]

The lightest 30% of eggs are graded as small.

(ii) Find the upper weight limit of the small grade. [5]

(iii) Hence find the percentage of eggs graded as medium. [2]

7 A mobile phone shop stocks three models of the top selling Sphere Smart phone.
Table 3 below shows the number of Sphere phones of each model sold in one week, together with the length of contract chosen by each customer.

Table 3

	Length of Contract (months)			
	12 month	**18 month**	**24 month**	**Total**
Sphere 220	15	18	17	50
Sphere 300	32	24	14	70
Sphere 350	28	30	22	80
Total	75	72	53	200

Customers are selected at random for a customer satisfaction survey.

A is the event that a customer purchased a Sphere 220 phone.
B is the event that a customer chose an 18 month contract.
C is the event that a customer purchased a Sphere 300 phone.

Find the values of:

(i) $\mathrm{P}(B)$; [1]

(ii) $\mathrm{P}(A \cap B)$; [2]

(iii) $\mathrm{P}(\overline{C} \cup \overline{B})$; [3]

(iv) $\mathrm{P}(A \mid B)$. [2]

(v) Express in terms of the events A, B and C that have been defined, the event that a customer purchased a Sphere 350 [2]

A skin may also be purchased to protect and style the Sphere phones.
Of the customers who purchased the Sphere 220, 14% also purchased a skin,
as did 30% of the customers who purchased the Sphere 300
and 40% of the customers who purchased the Sphere 350

Find the probability that a customer selected at random purchased:

(vi) a skin; [3]

(vii) a Sphere 350, given that they did purchase a skin. [3]

THIS IS THE END OF THE QUESTION PAPER