



GCE AS/A level

983/01

MATHEMATICS S1

Statistics

P.M. WEDNESDAY, 27 January 2010

1½ hours

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- a 12 page answer book;
- a Formula Booklet;
- a calculator;
- statistical tables (Murdoch and Barnes or RND/WJEC Publications)

INSTRUCTIONS TO CANDIDATES

Answer **all** questions.

Sufficient working must be shown to demonstrate the **mathematical** method employed.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

1. A bag contains 10 sweets, of which 1 is red, 2 are blue, 3 are yellow and 4 are green. Sharon chooses 2 sweets at random from the bag, without replacement. Calculate the probability that

- (a) both sweets are yellow, [2]
 (b) both sweets are of the same colour, [4]
 (c) neither of the sweets is green. [2]

2. Events A and B are such that

$$P(A) = 0.2, \quad P(B) = 0.4, \quad P(A \cup B) = 0.52.$$

- (a) Show that A and B are independent. [5]
 (b) Calculate the probability of exactly one of the two events occurring. [2]
 (c) Given that exactly one of the two events occurs, calculate the probability that A occurs. [3]

3. (a) The random variable X has the binomial distribution $B(n, p)$.
 Given that the mean and standard deviation of X are 10 and 3 respectively, find the values of n and p . [5]
 (b) The random variable Y has the binomial distribution $B(380, 0.016)$.
 Use a Poisson approximation to find an approximate value for the probability that Y is less than 3. [4]

4. The probability distribution of the discrete random variable X is given in the following table, where λ is a constant.

x	2	3	4	5	6
$P(X = x)$	0.1	0.2	0.3	λ	$0.4 - \lambda$

- (a) Find the range of possible values of λ . [2]
 (b) Given that $E(X) = 4.25$,
 (i) find the value of λ ,
 (ii) evaluate $\text{Var}(X)$. [6]

5. When seeds of a certain variety of flower are planted, the probability of each seed germinating is 0.8, independently of all other seeds.
- (a) David plants 20 of these seeds. Find the probability that
- exactly 15 seeds germinate,
 - at least 15 seeds germinate. [6]
- (b) Beti plants n of these seeds and she correctly calculates that the probability that they all germinate is 0.10737, correct to five decimal places. Find the value of n . [3]
6. A bag contains three balls numbered 1, 2 and 3 respectively. Jim selects one of these balls at random and he notes the number on the selected ball. He then tosses that number of fair coins.
- (a) Calculate the probability that no head is obtained. [5]
- (b) Given that no head was obtained, find the probability that he tossed 2 coins. [3]
7. The number of letters delivered to Bill's house on a weekday may be assumed to have a Poisson distribution with mean 1.2.
- (a) Find the probability that, on a particular weekday,
- at least 3 letters are delivered,
 - no letters are delivered. [4]
- (b) Given that the postman made a letter delivery to Bill's house on a particular weekday, find the probability that at least 3 letters were delivered. [3]
- (c) In a particular week starting on a Monday, find the probability that the first letter delivery occurs on the Wednesday. [2]
8. The continuous random variable X has cumulative distribution function F given by
- $$F(x) = 0 \quad \text{for } x < 1,$$
- $$F(x) = \frac{1}{10}(x^2 + x - 2) \quad \text{for } 1 \leq x \leq 3,$$
- $$F(x) = 1 \quad \text{for } x > 3.$$
- (a) (i) Evaluate $P(2 \leq X \leq 2.5)$.
- (ii) Find the median of X . [7]
- (b) (i) Obtain an expression for $f(x)$, valid for $1 \leq x \leq 3$, where f denotes the probability density function of X .
- (ii) Write down the value of $f(4)$.
- (iii) Calculate $E(X)$. [7]