



**GCE AS/A level**

0983/01

**MATHEMATICS S1**  
**Statistics**

P.M. WEDNESDAY, 25 January 2012

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**

Use black ink or black ball-point pen.

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 class contains 8 girls and 6 boys. A sub-committee of 3 members of the class is to be formed and it is decided to select its members at random from the class. Calculate the probability that the sub-committee will contain
- (a) 3 boys, [2]
- (b) more boys than girls. [4]
2. The random variable  $X$  has a Poisson distribution with mean 5 and the random variable  $Y$  is given by  $Y = 2X + 3$ . Determine the mean and variance of  $Y$ . [5]
3. Alun and Ben are snooker players. When they play a game against each other, Alun wins with probability 0.6 and successive games are independent.
- (a) One evening they play 10 games against each other. Determine the probability that Alun wins
- (i) exactly 7 games,
- (ii) at least 6 games. [5]
- (b) On another evening, find the probability that Alun wins for the first time on the fourth game. [3]
4. The events  $A$  and  $B$  are such that  

$$P(A) = 0.4, P(B) = 0.2 \text{ and } P(A|B) = 0.3.$$
 Calculate
- (a)  $P(A \cap B)$ , [2]
- (b)  $P(A \cup B)$ , [2]
- (c)  $P(B|A)$ . [2]
5. Each of three boxes contains 3 cards. Box A contains 1 red card, Box B contains 2 red cards and Box C contains 3 red cards. One of the boxes is selected at random and a card is chosen at random from that box.
- (a) Find the probability that a red card is chosen. [3]
- (b) Given that a red card is chosen, find the probability that Box A was selected. [3]

6. The number of emergency admissions,  $X$ , into a hospital during each 24-hour period can be modelled by a Poisson distribution with mean 3.6.

(a) **Without the use of tables**, determine

(i)  $P(X = 5)$ ,

(ii)  $P(X < 3)$ . [5]

(b) **Using tables**, determine  $P(3 \leq X \leq 7)$ . [3]

7. The probability distribution of the discrete random variable  $X$  is given by

$x$	1	2	3	4	5
$P(X = x)$	0.1	0.1	0.2	0.2	0.4

(a) Calculate the mean and variance of  $X$ . [5]

(b) Calculate  $E\left(\frac{1}{X^2}\right)$ . [3]

(c) Two independent observations  $X_1, X_2$  are taken from the distribution of  $X$ .

(i) Calculate  $P(X_1 + X_2 = 6)$ . [4]

(ii) Calculate  $P(X_1 = X_2)$ . [3]

8. The random variable  $X$  has the binomial distribution  $B(16, p)$ , where  $p < 0.5$ . Given that the variance of  $X$  is 2.56,

(a) calculate the value of  $p$ , [4]

(b) for this value of  $p$ , calculate  $E(X^2)$ . [3]

**TURN OVER**

9. The continuous random variable  $X$  has cumulative distribution function  $F$  given by

$$\begin{aligned} F(x) &= 0 && \text{for } x < 1, \\ F(x) &= k(x^2 - x) && \text{for } 1 \leq x \leq 3, \\ F(x) &= 1 && \text{for } x > 3, \end{aligned}$$

where  $k$  is a constant.

- (a) (i) Show that  $k = \frac{1}{6}$ .
- (ii) Find the probability that the value of  $X$  is greater than 2.
- (iii) Find the median of  $X$ . [8]
- (b) (i) Find an expression for  $f(x)$ , valid for  $1 \leq x \leq 3$ , where  $f$  denotes the probability density function of  $X$ .
- (ii) Determine  $E(X)$ . [6]