



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
 $P(A) = 0.4$, $P(B) = 0.2$ 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]