



**General Certificate of Education  
Advanced Subsidiary/Advanced**

983/01

**MATHEMATICS S1  
Statistics**

P.M. THURSDAY, 17 January 2008  
(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.

**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. The two events  $A, B$  are such that

$$P(A) = 0.3, P(B) = 0.1, P(A \cup B) = 0.35.$$

- (a) Evaluate  $P(A \cap B)$ . [2]
- (b) Determine whether or not  $A$  and  $B$  are independent. [3]
- (c) Evaluate  $P(A | B')$ . [4]

2. A group of 10 children, 6 girls and 4 boys, is on a school visit to the theatre. The teacher is asked to select 3 of these children to meet members of the cast after the show and she decides to do the selection at random.

- (a) Calculate the probability that she selects
- (i) 3 girls, [2]
- (ii) more boys than girls. [4]
- (b) Ann is one of the children on the visit. Calculate the probability that she is one of the selected children. [2]

3. When Alan types a report, the number of errors on each page has a Poisson distribution with mean 0.95, independently of all other pages.

- (a) Without the use of tables, find the probability that a randomly selected page contains
- (i) no errors,
- (ii) either 3 or 4 errors. [5]
- (b) Alan types a 4-page report. Calculate the probability that
- (i) there are no errors anywhere in the report,
- (ii) the first error occurs on the third page. [5]

4. The random variable  $X$  has the binomial distribution  $B(10, 0.3)$ . Given that  $Y = 3X + 4$ , evaluate

- (a)  $E(Y)$ , [4]
- (b)  $\text{Var}(Y)$ , [2]
- (c)  $P(Y = 16)$ . [3]

5. A factory has three machines making paper clips. Machine A produces 40% of the total output, Machine B produces 35% of the total output and Machine C produces 25% of the total output. It is known that 2% of the paper clips produced by Machine A are defective, 2.5% produced by Machine B are defective and 0.5% produced by Machine C are defective. A paper clip is selected at random from the total output.

- (a) Calculate the probability that it is defective. [3]
- (b) Given that it is defective, find the probability that it was produced by Machine A. [3]

6. The discrete random variable  $X$  has the following probability distribution.

$x$	1	2	3
$P(X = x)$	$\theta$	$2\theta$	$1 - 3\theta$

- (a) State the range of possible values of the constant  $\theta$ . [2]
- (b) Given that  $E(X) = 2.2$ ,
- (i) show that  $\theta = 0.2$ ,
- (ii) calculate the standard deviation of  $X$ ,
- (iii) evaluate  $E\left(\frac{1}{X}\right)$ . [10]

7. On a farm, chickens are bred from eggs under strictly controlled conditions.

- (a) The probability that an egg will produce a female chick is 0.3. When 20 eggs are kept under the controlled conditions, find the probability that the number of female chicks produced will be
- (i) exactly 8,
- (ii) more than 5. [5]
- (b) The probability that an egg will fail to hatch is 0.01. When 1000 eggs are kept under the controlled conditions, use a Poisson approximation to find the probability that the number of eggs failing to hatch will be less than 9. [3]

**TURN OVER.**

8. The continuous random variable  $X$  has probability density function  $f$  given by

$$\begin{aligned} f(x) &= 4 - 2x, & \text{for } 1 \leq x \leq 2, \\ f(x) &= 0, & \text{otherwise.} \end{aligned}$$

(a) Evaluate  $E(X)$ . [4]

(b) Show that, for  $1 \leq x \leq 2$ ,

$$F(x) = 4x - x^2 - 3$$

where  $F$  denotes the cumulative distribution function of  $X$ . [3]

(c) Evaluate  $P(X > 1.2)$ . [3]

(d) Calculate the median of  $X$ , giving your answer correct to two decimal places. [3]