WJEC CBAC

GCE AS/A level

0983/01

MATHEMATICS – S1

Statistics

P.M. THURSDAY, 12 June 2014

1 hour 30 minutes plus your additional time allowance

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, black ball-point pen or your usual method.

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.   The events A and B are such that

$$P(A) = 0\cdot3, \ P(B) = 0\cdot4,$$

$$P(A \cup B) = 0\cdot5$$

(a)   Determine whether or not A and B are independent.   [3 marks]

(b)   Evaluate $P(A|B')$ [3 marks]

2.   The random variable X has the binomial distribution $B(n, p)$. Given that the mean and the standard deviation of X are both equal to $0\cdot9$, find the value of n and the value of p [5 marks]

3. A bag contains 9 coloured balls, of which 3 are red, 3 are blue and 3 are yellow. Huw selects 3 of these balls at random, without replacement. Calculate the probability that he selects

(a) 1 ball of each colour, [3 marks]

(b) 2 balls of the same colour and 1 ball of a different colour. [4 marks]

4. In a junior football match, it may be assumed that the number of goals scored in any interval of length t minutes has a Poisson distribution with mean $0\cdot1\,t$

WITHOUT THE USE OF TABLES, find the probability that the number of goals scored in the first 15 minutes of play is

(a) 2, [3 marks]

(b) more than 2 [3 marks]

5. **A zoologist is studying a certain breed of dog.**

(a) **He knows from past experience that the probability of a newly born puppy being female is 0·55. He selects a random sample of 20 newly born puppies. Calculate the probability that the number of females in the sample is**

  (i) **exactly 12,**

  (ii) **between 8 and 16 (both inclusive).**

[8 marks]

(b) **The probability of a newly born puppy being yellow is 0·05. Use an approximating distribution to find the probability that less than 5 out of a random sample of 60 newly born puppies are yellow.** **[3 marks]**

6. A purse contains three fair coins and one double-headed coin. A coin is selected at random from the purse and tossed.

(a) Find the probability that a head is obtained.

[3 marks]

(b) Given that a head is obtained,

 (i) determine the probability that the double-headed coin was selected,

 (ii) find the probability that a head will be obtained if the selected coin is tossed a second time. [6 marks]

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

x	1	2	3	4	5
$P(X = x)$	0·1	0·3	θ	0·2	0·4 − θ

(a)   State the range of possible values of the constant θ [1 mark]

(b)   State the range of possible values of $E(X)$ [3 marks]

(c)   Given that $Var(X) = 1.5$, determine the value of θ [8 marks]

8.   Ann and Brenda each have a calculator which can generate a single digit random number from the set {1, 2, 3, 4, 5, 6, 7, 8}. They each generate a random number on their calculator.

(a)   Find the probability that the two numbers are equal.   [2 marks]

(b)   Find the probability that the sum of the two numbers is 12.   [3 marks]

(c)   Given that the sum of the two numbers is 12, find the probability that the two numbers are equal.   [2 marks]

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

$$F(x) = 0 \qquad \text{for } x < 0$$
$$F(x) = 2x^3 - x^6 \quad \text{for } 0 \leqslant x \leqslant 1$$
$$F(x) = 1 \qquad \text{for } x > 1$$

(a) (i) Determine $P(0 \cdot 4 \leqslant X \leqslant 0 \cdot 6)$

   (ii) Find the median of X [6 marks]

(b) (i) Find an expression for $f(x)$, valid for $0 \leqslant x \leqslant 1$, where f denotes the probability density function of X

   (ii) Calculate $E(X^3)$ [6 marks]

END OF PAPER