WELSH JOINT EDUCATION COMMITTEE
General Certificate of Education
Advanced Subsidiary/Advanced

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983/01

MATHEMATICS S1

Statistics

P.M. TUESDAY, 18 January 2005

($1\frac{1}{2}$ hours)

NEW SPECIFICATION

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. A bag contains 12 sweets of which 5 are red, 4 are green and 3 are yellow.
A boy chooses 3 of these sweets at random **without replacement**. Find the probability that

(a) he chooses 3 red sweets, [2]

(b) he chooses no red sweets, [2]

(c) he chooses 1 sweet of each colour. [3]

2. The discrete random variable X has the binomial distribution B (48, 0·25). The random variable Y is defined by

$$Y = 2X - 1.$$

Find the mean and the standard deviation of Y. [7]

3. The number of emergency admissions into a certain hospital during a 24-hour period can be modelled by a Poisson distribution with mean 4. **Use an appropriate table** to find the probability that, during a randomly selected 24-hour period, the number of emergency admissions into this hospital is

(a) less than 6, [2]

(b) exactly 3. [3]

4. The events A and B are such that

$$P(A) = 0{\cdot}2,\ P(B) = 0{\cdot}6 \text{ and } P(A \mid B) = 0{\cdot}3.$$

Find

(a) $P(A \cap B)$, [2]

(b) $P(B \mid A)$, [3]

(c) $P(A \cup B)$. [3]

(d) $P(A' \cap B')$. [2]

5. It is estimated that 0·7% of the population of university students have a rare blood disease. In a faculty of 550 such students, use a Poisson approximation to find the probability that the number of students with this disease is

(a) exactly 4, [4]

(b) more than 2. [4]

6. A desk has 3 drawers. Drawer A contains 3 gold medals. Drawer B contains 2 gold medals and 1 silver medal. Drawer C contains 1 gold medal and 2 silver medals. Two fair coins are tossed and a drawer is chosen as follows.

Drawer A is chosen if two heads are obtained.
Drawer B is chosen if two tails are obtained.
Drawer C is chosen if one head and one tail are obtained.

(a) Write down the probabilities of choosing Drawer A, Drawer B and Drawer C. [2]

(b) A medal is then selected at random from the chosen drawer.

(i) Find the probability that the selected medal is gold.

(ii) Given that this medal is gold, find the probability that it came from Drawer A. [6]

7. A scientist researching a new breed of chicken knows that the probability of a newly born chick of the breed being female is 0·6. Let X denote the number of female chicks in a batch of 20 randomly chosen newly born chicks. Find

(a) $P(X = 12)$, [3]

(b) $P(9 \leqslant X \leqslant 15)$. [4]

8. The following table gives the probability distribution of the discrete random variable X, where a and b are positive constants.

x	1	2	3	4	5
$P(X = x)$	0·1	a	b	0·3	0·2

(a) Show that

$$a + b = 0{\cdot}4.$$ [2]

(b) Given that $E(X) = 3{\cdot}4$,

(i) write down and simplify another equation for a and b,

(ii) find the values of a and b. [5]

(c) Evaluate $E\left(\frac{1}{1+X}\right)$. [3]

TURN OVER

9. The continuous random variable X has probability density function f where

$$f(x) = \frac{1}{21}x^2, \qquad \text{for } 1 \leqslant x \leqslant 4,$$

$$f(x) = 0, \qquad \text{otherwise.}$$

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

(b) Find an expression for $F(x)$, valid for $1 \leqslant x \leqslant 4$, where F denotes the cumulative distribution function of X. [3]

(c) Calculate $P(2 \leqslant X \leqslant 3)$. [3]

(d) Find the median of X correct to two decimal places. [3]