**WELSH JOINT EDUCATION COMMITTEE  CYD-BWYLLGOR ADDYSG CYMRU**

**General Certificate of Education**                    **Tystysgrif Addysg Gyffredinol**

**Advanced Level/Advanced Subsidiary**          **Safon Uwch/Uwch Gyfrannol**

**MATHEMATICS S1**

**Statistics**

**Specimen Paper 2005/2006**

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

**INSTRUCTIONS TO CANDIDATES**

Answer **all** questions.

**INFORMATION FOR CANDIDATES**

A calculator may be used for this paper.

A formula booklet is available and may be used.

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 box contains four red balls, three blue balls and two yellow balls.  Three of these balls are selected at random **without replacement**.   Find the probability that

    *(a)*   the three balls are all of different colours,   [3]

    *(b)*   the three balls are all of the same colour.   [4]

**2.**   The random variable *X* has a Poisson distribution with mean 4.  The random  variable *Y*  is defined by

$$Y = 4X + 1.$$

Find the mean and standard deviation of *Y*.   [6]

**3.**   The events *A* and *B* are independent such that $P(A) = 0{\cdot}7$ and $P(B) = 0{\cdot}4$.

    *(a)*   Find $P(A \cup B)$.   [3]

    *(b)*   Find the probability that

        (i)   exactly one of *A* and *B* will occur,

        (ii)   neither *A* nor *B* will occur.   [6]

**4.**   *(a)*   The number of cars sold per week by a car dealer can be modelled as a Poisson random variable with mean 6.  Using the appropriate table, find the probability that, during a randomly chosen week, the dealer sells

        (i)   at least 4 cars,

        (ii)   exactly 6 cars.   [5]

    *(b)*   The dealer also sells motorbikes.   Assuming that the number of motorbikes sold per week is also Poisson distributed, but with mean 1.12, find the probability that, in a randomly chosen week, the dealer sells

        (i)   exactly 2 motorbikes,

        (ii)   at least 2 motorbikes.   [5]

**5.**    Of the eggs received daily at a packing station, 50% come from Farm A, 30% come from Farm B and 20% come from Farm C.  15% of the eggs from Farm A  are  white, 20% of the eggs from Farm B are white and 25% of the eggs from Farm  C  are  white. One of the eggs received on a particular day is chosen at random.

   *(a)*    Calculate the probability that the chosen egg is white.    [3]

   *(b)*    Given that the chosen egg is white, calculate the probability that it came from Farm A.    [3]

**6.**    Independently for each seed of a particular plant that is sown, the probability that    the seed will germinate is 0·8.  Ten such seeds are sown, and *X* denotes the number of these seeds that will germinate.

   *(a)*    Calculate the mean and standard deviation of *X*.    [3]

   *(b)*    Find

      (i)        $P(X = 8)$,

      (ii)       $P(4 \leq X \leq 7)$.    [6]

**7.**    The following table gives the probability distribution of the discrete random variable *X*.

| $x$ | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| $P(X = x)$ | 0.2 | 0.3 | 0.2 | 0.3 |

   *(a)*    Find the mean and variance of *X*.    [5]

   *(b)*    Evaluate $\mathrm{E}\left(\dfrac{1}{X}\right)$.    [3]

   *(c)*    Given that  $X_1, X_2$  are two independent observations of *X*, evaluate

$$P(X_1 + X_2 = 4)$$    [4]

**8.** The probability density function of the time, $X$ hours, that a manager spends on the telephone during the day is given by

$$f(x) = \frac{1}{12}(8x - x^3), \text{ for } 0 \leq x \leq 2$$
$$f(x) = 0, \qquad \text{otherwise.}$$

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

*(b)* The cumulative distribution function of $X$ is denoted by F.

    (i) Obtain an expression for F($x$), valid for $0 \leq x \leq 2$.

    (ii) Find the probability that the manager spends more than 1 hour on the telephone on a randomly chosen day.

    (iii) Show that the median, $m$, of $X$ satisfies the equation

$$m^4 - 16m^2 + 24 = 0.$$

Hence evaluate $m$. [12]