OCR Maths S1

Topic Questions from Papers

Discrete Random Variables

1 The table below shows the probability distribution of the random variable X.

x	-2	-1	0	1	2
$P(X = x)$	$\frac{1}{4}$	$\frac{1}{5}$	k	$\frac{2}{5}$	$\frac{1}{10}$

(i) Find the value of the constant k. [2]

(ii) Calculate the values of $E(X)$ and $Var(X)$. [5]

(Q4, Jan 2005)

2 The probability distribution of a discrete random variable, X, is given in the table.

x	0	1	2	3
$P(X = x)$	$\frac{1}{3}$	$\frac{1}{4}$	p	q

It is given that the expectation, $E(X)$, is $1\frac{1}{4}$.

(i) Calculate the values of p and q. [5]

(ii) Calculate the standard deviation of X. [4]

(Q5, June 2006)

3 Part of the probability distribution of a variable, X, is given in the table.

x	0	1	2	3
$P(X = x)$		$\frac{3}{10}$	$\frac{1}{5}$	$\frac{2}{5}$

(i) Find $P(X = 0)$. [2]

(ii) Find $E(X)$. [2]

(Q1, Jan 2007)

4 The table shows the probability distribution for a random variable X.

x	0	1	2	3
$P(X = x)$	0.1	0.2	0.3	0.4

Calculate $E(X)$ and $Var(X)$. [5]

(Q1, June 2007)

5 Each time a certain triangular spinner is spun, it lands on one of the numbers 0, 1 and 2 with probabilities as shown in the table.

Number	Probability
0	0.7
1	0.2
2	0.1

The spinner is spun twice. The total of the two numbers on which it lands is denoted by X.

(i) Show that $P(X = 2) = 0.18$. **[3]**

The probability distribution of X is given in the table.

x	0	1	2	3	4
$P(X = x)$	0.49	0.28	0.18	0.04	0.01

(ii) Calculate $E(X)$ and $Var(X)$. **[5]**

(Q1, Jan 2009)

6 Last year Eleanor played 11 rounds of golf. Her scores were as follows:

79, 71, 80, 67, 67, 74, 66, 65, 71, 66, 64.

(i) Calculate the mean of these scores and show that the standard deviation is 5.31, correct to 3 significant figures. **[4]**

(ii) Find the median and interquartile range of the scores. **[4]**

This year, Eleanor also played 11 rounds of golf. The standard deviation of her scores was 4.23, correct to 3 significant figures, and the interquartile range was the same as last year.

(iii) Give a possible reason why the standard deviation of her scores was lower than last year although her interquartile range was unchanged. **[1]**

In golf, smaller scores mean a better standard of play than larger scores. Ken suggests that since the standard deviation was smaller this year, Eleanor's overall standard has improved.

(iv) Explain why Ken is wrong. **[1]**

(v) State what the smaller standard deviation does show about Eleanor's play. **[1]**

(Q6, June 2009)

7 A certain four-sided die is biased. The score, X, on each throw is a random variable with probability distribution as shown in the table. Throws of the die are independent.

x	0	1	2	3
$P(X = x)$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{8}$

(i) Calculate $E(X)$ and $Var(X)$. **[5]**

The die is thrown 10 times.

(ii) Find the probability that there are not more than 4 throws on which the score is 1. **[2]**

(iii) Find the probability that there are exactly 4 throws on which the score is 2. **[3]**

(Q4, Jan 2010)

8 Each of four cards has a number printed on it as shown.

1	**2**	**3**	**3**

Two of the cards are chosen at random, without replacement. The random variable X denotes the sum of the numbers on these two cards.

(i) Show that $\mathrm{P}(X = 6) = \frac{1}{6}$ and $\mathrm{P}(X = 4) = \frac{1}{3}$. **[3]**

(ii) Write down all the possible values of X and find the probability distribution of X. **[4]**

(iii) Find $\mathrm{E}(X)$ and $\mathrm{Var}(X)$. **[5]**

(Q5, June 2010)

9 The probability distribution of a discrete random variable, X, is shown below.

x	0	2
$\mathrm{P}(X = x)$	a	$1 - a$

(i) Find $\mathrm{E}(X)$ in terms of a. **[2]**

(ii) Show that $\mathrm{Var}(X) = 4a(1 - a)$. **[3]**

(Q7, Jan 2011)

10 The probability distribution of a random variable X is shown in the table.

x	1	2	3	4
$\mathrm{P}(X = x)$	0.1	0.3	$2p$	p

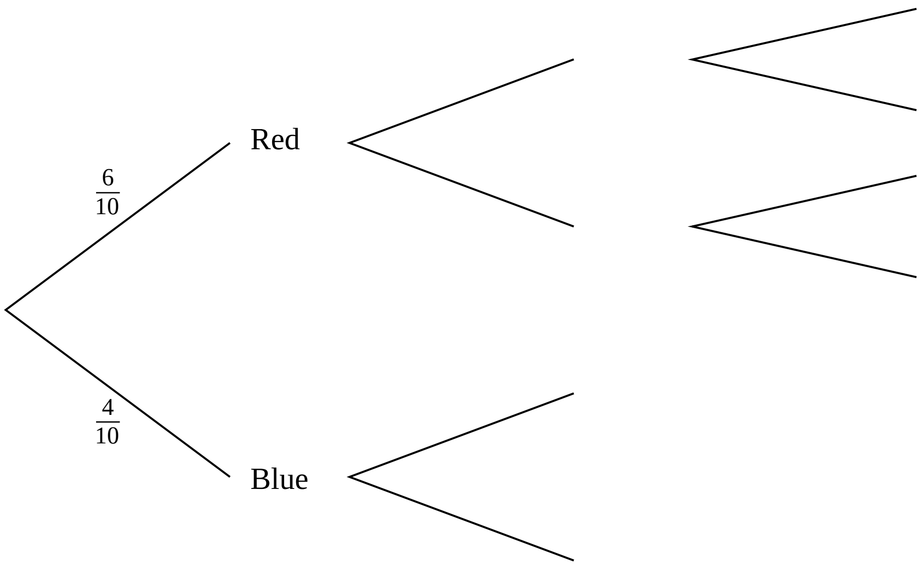
(i) Find p. **[2]**

(ii) Find $\mathrm{E}(X)$. **[2]**

(Q1, Jan 2012)

11 A bag contains 4 blue discs and 6 red discs. Chloe takes a disc from the bag. If this disc is red, she takes 2 more discs. If not, she takes 1 more disc. Each disc is taken at random and no discs are replaced.

(i) Complete the probability tree diagram in your Answer Book, showing all the probabilities. **[2]**



The total number of blue discs that Chloe takes is denoted by X.

(ii) Show that $P(X = 1) = \frac{3}{5}$. **[2]**

The complete probability distribution of X is given below.

x	0	1	2
$P(X = x)$	$\frac{1}{6}$	$\frac{3}{5}$	$\frac{7}{30}$

(iii) Calculate $E(X)$ and $Var(X)$. **[5]**

(Q5, June 2011)

12 The masses, x kg, of 50 bags of flour were measured and the results were summarised as follows.

$$n = 50 \qquad \Sigma(x - 1.5) = 1.4 \qquad \Sigma(x - 1.5)^2 = 0.05$$

Calculate the mean and standard deviation of the masses of these bags of flour. **[6]**

(Q2, June 2012)

13 When a four-sided spinner is spun, the number on which it lands is denoted by X, where X is a random variable taking values 2, 4, 6 and 8. The spinner is biased so that $P(X = x) = kx$, where k is a constant.

(i) Show that $P(X = 6) = \frac{3}{10}$. **[2]**

(ii) Find $E(X)$ and $Var(X)$. **[5]**

(Q1, Jan 2013)