Probability Distributions

Question Paper 1

Level	A LEVEL
Exam Board	Edexcel
Subject	Mathematics
Module	Mechanics and Statistics
Topic	Statistical distributions
Sub-Topic	Probability distributions
Booklet	Question Paper 1

Time Allowed: **45 minutes**

Score: **/38**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

1. The discrete random variable X has probability function

$$\mathrm{P}(X = x) = \begin{cases} k(2 - x), & x = 0, 1, 2, \\ k(x - 2), & x = 3, \\ 0, & \text{otherwise}, \end{cases}$$

where k is a positive constant.

a Show that $k = 0.25$. **(2)**

Two independent observations X_1 and X_2 are made of X.

(a) Show that $\mathrm{P}(X_1 + X_2 = 5) = 0$. **(1)**

(b) Find the complete probability function for $X_1 + X_2$. **(3)**

(c) Find $\mathrm{P}(1.3 \leq X_1 + X_2 \leq 3.2)$. **(3)**

(Total 9 marks)

2. A discrete random variable X has the probability function shown in the table below.

x	0	1	2	3
$P(X = x)$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{1}{12}$	$\frac{1}{12}$

Find

(2)

a $P(1 < X \leq 3)$,

(Total 2 marks)

3. The random variable X has probability function

$$P(X = x) = kx, \qquad x = 1, 2, ..., 5.$$

(*a*) Show that $k = \frac{1}{15}$.

(2)

(b) Find

$P(X < 4)$,

(2)

(Total 4 marks)

4. A discrete random variable is such that each of its values is assumed to be equally likely.

(a) Write down the name of the distribution that could be used to model this random variable. **(1)**

(b) Give an example of such a distribution. **(1)**

(c) Comment on the assumption that each value is equally likely. **(2)**

(d) Suggest how you might refine the model in part (*a*). **(2)**

(Total 6 marks)

5. The random variable X has probability function

$$P(X = x) = \frac{(2x-1)}{36} \qquad x = 1, 2, 3, 4, 5, 6.$$

(a) Construct a table giving the probability distribution of X.

(3)

Find

(b) $P(2 < X \leqslant 5)$,

(2)

(Total 5 marks)

6. Tetrahedral dice have four faces. Two fair tetrahedral dice, one red and one blue, have faces numbered 0, 1, 2, and 3 respectively. The dice are rolled and the numbers face down on the two dice are recorded. The random variable R is the score on the red die and the random variable B is the score on the blue die.

(a) Find P(R=3 and B=0).

(2)

The random variable T is R multiplied by B.

(b) Complete the diagram below to represent the sample space that shows all the possible values of T.

3				
2		2		
1	0			
0				
B \ R	**0**	**1**	**2**	**3**

Sample space diagram of *T*

(3)

(c) The table below represents the probability distribution of the random variable T.

t	0	1	2	3	4	6	9
P(T=t)	a	b	1/8	1/8	c	1/8	d

Find the values of a, b, c and d.

(3)

(Total 8 marks)

7. The probability function of a discrete random variable X is given by

$$p(x) = kx^2 \qquad x = 1, 2, 3$$

where k is a positive constant.

(a) Show that $k = \frac{1}{14}$

(2)

Find

(b) $P(X \geqslant 2)$

(2)

(Total 4 marks)