Probability Distributions of Discrete Random Variables

1 A discrete random variable X has the following probability distribution:

x:	1	2	3	4
$P(X = x)$:	$\frac{1}{3}$	$\frac{1}{3}$	k	$\frac{1}{4}$

where k is a constant.

(a) Find the value of k. (b) Find $P(X \leqslant 3)$.

2 The discrete random variable Y has the following probability distribution:

y:	-1	0	1
$P(Y = y)$:	a	$\frac{1}{4}$	a

where a is a constant.

(a) Find the value of a. (b) Find $P(Y \geqslant 0)$.

3.

A cubical die is biased in such a way that the probability is proportional to the number showing, for example, P(die lands on 5) $= 5k$, where k is a constant. Find the probability distribution for S, the score on the die.

4.

Two tetrahedral dice have the numbers 1, 2, 3 and 4 on their faces. The dice are thrown together. Let S = the sum of their two scores and let D = the difference between their two scores.

(a) Show that $P(S = 6) = \frac{3}{16}$.
(b) Find the probability distribution for the random variable S.
(c) Find $P(S \leqslant 7)$
(d) Show that $P(D = 1) = \frac{3}{8}$.
(e) Find the probability distribution for the random variable D.
(f) Find $P(D \geqslant 2)$.

5.

Sam's pocket contains one £1 coin, one 50p coin and three 20p coins. He selects 2 coins at random to place in a collection box. The random variable X represents the amount, in pence, that he puts in the box.

(a) Show that $P(X = 70) = 0.3$.
(b) Find the probability distribution for X.

6.

A fair coin is tossed repeatedly until a head appears or 3 tosses have been made. The random variable T represents the number of tosses.

(a) Show that $\mathrm{P}(T = 2) = \frac{1}{4}$.

(b) Find the probability distribution of T.

The random variable H represents the number of heads.

(c) Find the probability distribution of H.

7.

The discrete random variable X has probability function given by:

$$\mathrm{P}(X = x) = \begin{cases} (\frac{1}{2})^x, & x = 1, 2, 3, 4, 5, \\ C, & x = 6, \\ 0, & \text{otherwise,} \end{cases}$$

where C is a constant.

Determine the value of C. [E]