Discrete Random Variables (Sheet 2)

Q1.

In a game, a player can score 0, 1, 2, 3 or 4 points each time the game is played.

The random variable S, representing the player's score, has the following probability distribution where a, b and c are constants.

s	0	1	2	3	4
$P(S = s)$	a	b	c	0.1	0.15

The probability of scoring less than 2 points is twice the probability of scoring at least 2 points.

Each game played is independent of previous games played.

John plays the game twice and adds the two scores together to get a total.

Calculate the probability that the total is 6 points.

(Total for question = 6 marks)

Q2.

The discrete random variable D has the following probability distribution

d	10	20	30	40	50
$P(D = d)$	$\frac{k}{10}$	$\frac{k}{20}$	$\frac{k}{30}$	$\frac{k}{40}$	$\frac{k}{50}$

where k is a constant.

(a) Show that the value of k is $\frac{600}{137}$

(2)

The random variables D_1 and D_2 are independent and each have the same distribution as D.

(b) Find $P(D_1 + D_2 = 80)$

Give your answer to 3 significant figures.

(3)

A single observation of D is made.

The value obtained, d, is the common difference of an arithmetic sequence.

The first 4 terms of this arithmetic sequence are the angles, measured in degrees, of quadrilateral Q

(c) Find the exact probability that the smallest angle of Q is more than 50°

(5)

(Total for question = 10 marks)

Q3.

The discrete random variable X has probability distribution

x	-4	-2	1	3	5
$P(X = x)$	0.4	p	0.05	0.15	p

(a) Show that $p = 0.2$

(2)

Find

(b) E(X)

(2)

(c) F(0)

(1)

(d) $P(3X + 2 > 5)$

(2)

Given that Var(X) = 13.35

(e) find the possible values of a such that Var($aX + 3$) = 53.4

(2)

(Total 9 marks)

Q4.

A biased spinner can only land on one of the numbers 1, 2, 3 or 4. The random variable X represents the number that the spinner lands on after a single spin and $P(X = r) = P(X = r + 2)$ for $r = 1, 2$

Given that $P(X = 2) = 0.35$

(a) find the complete probability distribution of X.

(2)

Ambroh spins the spinner 60 times.

(b) Find the probability that more than half of the spins land on the number 4

Give your answer to 3 significant figures.

(3)

The random variable $Y = \frac{12}{X}$

(c) Find $P(Y - X \leq 4)$

(3)

(Total for question = 8 marks)

Q5.

The discrete random variable X has the following probability distribution

x	a	b	c
$P(X = x)$	$\log_{36} a$	$\log_{36} b$	$\log_{36} c$

where

- a, b and c are distinct integers ($a < b < c$)
- all the probabilities are greater than zero

(a) Find

(i) the value of a
(ii) the value of b
(iii) the value of c
Show your working clearly.

(5)

The independent random variables X_1 and X_2 each have the same distribution as X

(b) Find $P(X_1 = X_2)$

(2)

(Total for question = 7 marks)