S1 Discrete Random Variables Questions

June 2011

3. The discrete random variable Y has probability distribution

y	1	2	3	4
$P(Y = y)$	a	b	0.3	c

where a, b and c are constants.

The cumulative distribution function $F(y)$ of Y is given in the following table

y	1	2	3	4
$F(y)$	0.1	0.5	d	1.0

where d is a constant.

(a) Find the value of a, the value of b, the value of c and the value of d.

(5)

(b) Find $P(3Y + 2 \geqslant 8)$.

(2)

June 2011

8. A spinner is designed so that the score S is given by the following probability distribution.

s	0	1	2	4	5
$P(S = s)$	p	0.25	0.25	0.20	0.20

(a) Find the value of p.

(2)

(b) Find $E(S)$.

(2)

(c) Show that $E(S^2) = 9.45$

(2)

(d) Find $Var(S)$.

(2)

Tom and Jess play a game with this spinner. The spinner is spun repeatedly and S counters are awarded on the outcome of each spin. If S is even then Tom receives the counters and if S is odd then Jess receives them. The first player to collect 10 or more counters is the winner.

(e) Find the probability that Jess wins after 2 spins.

(2)

(f) Find the probability that Tom wins after exactly 3 spins.

(4)

(g) Find the probability that Jess wins after exactly 3 spins.

(3)

Jan 2011

6. The discrete random variable X has the probability distribution

x	1	2	3	4
$P(X = x)$	k	$2k$	$3k$	$4k$

(*a*) Show that $k = 0.1$

(1)

Find

(*b*) E(X)

(2)

(*c*) E(X^2)

(2)

(*d*) Var $(2 - 5X)$

(3)

Two independent observations X_1 and X_2 are made of X.

(*e*) Show that $P(X_1 + X_2 = 4) = 0.1$

(2)

(*f*) Complete the probability distribution table for $X_1 + X_2$.

(2)

y	2	3	4	5	6	7	8
$P(X_1 + X_2 = y)$	0.01	0.04	0.10		0.25	0.24	

(g) Find $P(1.5 < X_1 + X_2 \leq 3.5)$

(2)

June 2010

3. The discrete random variable X has probability distribution given by

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

where a is a constant.

(a) Find the value of a.

(2)

(b) Write down $E(X)$.

(1)

(c) Find $Var(X)$.

(3)

The random variable $Y = 6 - 2X$.

(d) Find $Var(Y)$.

(2)

(e) Calculate $P(X \geq Y)$.

(3)

June 2009

6. The discrete random variable X has probability function

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

(*a*) Find P(X = 2) and copy and complete the table below.

x	0	1	2	3
P(X=x)	3a	2a		b

(1)

Given that E(X) = 1.6,

(*b*) find the value of a and the value of b. **(5)**

Find

(*c*) P(0.5 < X < 3) **(2)**

(d) E(3X – 2). **(2)**

(*e*) Show that the Var(X) = 1.64 **(3)**

(*f*) Calculate Var(3X – 2). **(2)**

Jan 2012

3. The discrete random variable X can take only the values 2, 3, 4 or 6. For these values the probability distribution function is given by

x	2	3	4	6
$P(X = x)$	$\frac{5}{21}$	$\frac{2k}{21}$	$\frac{7}{21}$	$\frac{k}{21}$

where k is a positive integer.

(a) Show that $k = 3$

(2)

Find

(b) F(3)

(1)

(c) E(X)

(2)

(d) E(X^2)

(2)

(e) Var($7X - 5$)

(4)

Jan 2007

3. 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)

(c) the exact value of $E(X)$.

(2)

(d) Show that $Var(X) = 1.97$ to 3 significant figures.

(4)

(e) Find $Var(2 - 3X)$.

(2)