FS1 (Year 1) – Discrete Random Variables Exam Questions (Edexcel)

Q1.

The score S when a spinner is spun has the following probability distribution.

s	0	1	2	4	5
$P(S = s)$	0.2	0.2	0.1	0.3	0.2

(a) Find $E(S)$.

(2)

(b) Show that $E(S^2) = 10.4$

(2)

(c) Hence find $Var(S)$.

(2)

(d) Find

(i) $E(5S - 3)$,
(ii) $Var(5S - 3)$.

(4)

(e) Find $P(5S - 3 > S + 3)$

(3)

The spinner is spun twice.

The score from the first spin is S_1 and the score from the second spin is S_2

The random variables S_1 and S_2 are independent and the random variable $X = S_1 \times S_2$

(f) Show that $P(S_1 = 1 \cap X < 5) = 0.16$

(2)

(g) Find $P(X < 5)$.

(3)

(Total 18 marks)

(Q01 6683/01/R, June 2013)

Q2.
A fair blue die has faces numbered 1, 1, 3, 3, 5 and 5. The random variable B represents the score when the blue die is rolled.

(a) Write down the probability distribution for B.

(2)

(b) State the name of this probability distribution.

(1)

(c) Write down the value of E(B).

(1)

A second die is red and the random variable R represents the score when the red die is rolled.

The probability distribution of R is

r	2	4	6
$\mathrm{P}(R = r)$	$\frac{2}{3}$	$\frac{1}{6}$	$\frac{1}{6}$

(d) Find E(R).

(2)

(e) Find Var(R).

(3)

Tom invites Avisha to play a game with these dice.

Tom spins a fair coin with one side labelled 2 and the other side labelled 5. When Avisha sees the number showing on the coin she then chooses one of the dice and rolls it. If the number showing on the die is greater than the number showing on the coin, Avisha wins, otherwise Tom wins.

Avisha chooses the die which gives her the best chance of winning each time Tom spins the coin.

(f) Find the probability that Avisha wins the game, stating clearly which die she should use in each case.

(4)

(Total 13 marks)
(Q01 6683/01, Jan 2013)

Q3.

The random variable X has probability distribution

x	1	3	5	7	9
$P(X = x)$	0.2	p	0.2	q	0.15

(a) Given that $E(X) = 4.5$, write down two equations involving p and q.

(3)

Find

(b) the value of p and the value of q,

(3)

(c) $P(4 < X \leq 7)$.

(2)

Given that $E(X^2) = 27.4$, find

(d) $\text{Var}(X)$,

(2)

(e) $E(19 - 4X)$,

(1)

(f) $\text{Var}(19 - 4X)$.

(2)

(Total 13 marks)

(Q01 6683/01, June 2007)

Q4.
The discrete random variable X has probability function

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

(a) Find $P(X = 2)$ 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 $\text{Var}(X) = 1.64$

(3)

(f) Calculate $\text{Var}(3X - 2)$.

(2)

(Total 15 marks)

(**Q01 6683/01, June 2009**)

Q5.

The discrete random variable X has probability distribution

x	-3	-1	1	2	4
$P(X = x)$	q	$\frac{7}{30}$	$\frac{7}{30}$	q	r

where q and r are probabilities.

(a) Write down, in terms of q, $P(X \leq 0)$

(1)

(b) Show that $E(X^2) = \frac{7}{15} + 13q + 16r$

(2)

Given that $E(X^3) = E(X^2) + E(6X)$

(c) find the value of q and the value of r

(7)

(d) Hence find $P(X^3 > X^2 + 6X)$

(4)

(Total for question = 14 marks)

(Q04 8FM0/23, June 2019)

Q6.

The probability distribution of the discrete random variable X is

$$P(X = x) = \begin{cases} \frac{k}{x} & \text{for } x = 1, 2 \text{ and } 3 \\ \frac{m}{2x} & \text{for } x = 6 \text{ and } 9 \\ 0 & \text{otherwise} \end{cases}$$

where k and m are positive constants.

Given that $E(X) = 3.8$, find $\text{Var}(X)$

(7)

(Total for question = 7 marks)

(Q03 8FM0/23, Oct 2020)

Q7.

The discrete random variable X has probability distribution

x	-3	-2	-1	0	2	5
$P(X = x)$	0.3	0.15	0.1	0.15	0.1	0.2

(a) Find $E(X)$

(1)

Given that $Var(X) = 8.79$

(b) find $E(X^2)$

(2)

The discrete random variable Y has probability distribution

y	-2	-1	0	1	2
$P(Y = y)$	$3a$	a	b	a	c

where a, b and c are constants.

For the random variable Y

$$P(Y \leqslant 0) = 0.75 \quad \text{and} \quad E(Y^2 + 3) = 5$$

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

(5)

The random variable $W = Y - X$ where Y and X are independent.

The random variable $T = 3W - 8$

(d) Calculate $P(W > T)$

(4)

(Total for question = 12 marks)

(Q03 8FM0/23, Oct 2021)

Q8.
The discrete random variable X has the following probability distribution

x	0	2	3	6
$P(X=x)$	p	0.25	q	0.4

(a) Find in terms of q

(i) $E(X)$
(ii) $E(X^2)$

(2)

Given that $\text{Var}(X) = 3.66$

(b) show that $q = 0.3$

(3)

In a game, the score is given by the discrete random variable X

Given that games are independent,

(c) calculate the probability that after the 4th game has been played, the total score is exactly 20

(3)

A round consists of 4 games plus 2 bonus games. The bonus games are only played if after the 4th game has been played the total score is exactly 20

A prize of £10 is awarded if 6 games are played in a round **and** the total score for the round is at least 27

Bobby plays 3 rounds.

(d) Find the probability that Bobby wins at least £10

(6)

(Total for question = 14 marks)

(Q04 8FM0/23, June 2022)

Q9.
The discrete random variable X has the following distribution

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

where r and k are positive constants.

The standard deviation of X equals the mean of X

Find the exact value of r

(6)

(Total for question = 6 marks)

(Q01 8FM0/23, June 2023)

Q10.

The score, X, for a biased spinner is given by the probability distribution

x	0	3	6
$P(X = x)$	$\frac{1}{12}$	$\frac{2}{3}$	$\frac{1}{4}$

Find

(a) E(X)

(2)

(b) Var(X)

(3)

A biased coin has one face labelled 2 and the other face labelled 5
The score, Y, when the coin is spun has

$$P(Y = 5) = p \qquad \text{and} \qquad E(Y) = 3$$

(c) Form a linear equation in p and show that $p = \frac{1}{3}$

(3)

(d) Write down the probability distribution of Y.

(1)

Sam plays a game with the spinner and the coin.
Each is spun once and Sam calculates his score, S, as follows

if $X = 0$ then $S = Y^2$
if $X \neq 0$ then $S = XY$

(e) Show that $P(S = 30) = \frac{1}{12}$

(2)

(f) Find the probability distribution of S.

(3)

(g) Find E(S).

(2)

Charlotte also plays the game with the spinner and the coin.
Each is spun once and Charlotte ignores the score on the coin and just uses X^2 as her score.
Sam and Charlotte each play the game a large number of times.

(h) State, giving a reason, which of Sam and Charlotte should achieve the higher total score.

(2)

(Total for question = 18 marks)

(Q01 6683/01, June 2017)

Q11.

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)

Find the values of

(d) E(T),

(2)

(e) Var(T).

(4)

(Total 14 marks)

(Q01 6683/01, Jan 2008)