Statistics 1 : Chapter 4 Discrete Random Variables

4.1 Probability Distributions

1 The discrete random variable X has the probability distribution shown in the table.

x	1	2	3	4	5
$P(X = x)$	0.2	0.25	0.4	a	0.05

(i) Find the value of a.

(ii) Draw a vertical line diagram to illustrate the probability distribution.

(iii) Find

(a) $P(1 \leqslant X \leqslant 3)$

(b) the probability that X is at least 3.

(c) $P(2 < X < 5)$

(d) $P(X$ is greater than the mode of $X)$

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

y	10	15	20	25	30
$P(Y = y)$	a	$5a$	$\frac{7}{16}$	$\frac{1}{32}$	$\frac{1}{32}$

(i) Find the value of a.

(ii) Find $P(Y > 18)$.

3 The discrete random variable R takes the values 12, 13, 14 and $P(R = r) = kr$, where k is a constant.

(i) Draw up a probability distribution table in terms of k.

(ii) Find the value of k.

4 A discrete random variable has probability function

$$P(X = x) = \begin{cases} 0.1 & \text{for } x = -1, 0, 5 \\ a & \text{for } x = 1, 3 \\ 0.3 & \text{for } x = 4 \end{cases}$$

(i) Write out the probability distribution table in terms of a.

(ii) Find a.

(iii) Find $P(X \geqslant 3)$.

5 The discrete random variable X can take the values 0, 1, 2, 3 and 4 only and $P(X = x) = k(x^2 - 2)$.

(i) Find the value of the constant k.

(ii) Find $P(1 < X < 4)$.

5 The discrete random variable X can take the values 0, 1, 2, 3 and 4 only and $P(X = x) = k(x^2 - 2)$.

(i) Find the value of the constant k.

(ii) Find $P(1 < X < 4)$.

6 The number of **tails** obtained when two unbiased coins are tossed is denoted by the discrete random variable X.

(i) Find $P(X = 1)$.

(ii) Draw up a probability distribution table for X.

7 A drawer contains 8 brown socks and 4 blue socks. Liam takes two socks at random from the drawer, one after the other.

(i) Show that the probability that Liam takes one brown sock and one blue sock is $\frac{16}{33}$.

(ii) The discrete random variable B is the number of **brown** socks taken. Draw up a probability distribution table for B.

8 William is playing a game in which he tries to throw tennis balls into a bucket. The probability that the tennis ball lands in the bucket is 0.4 for each attempt.

William has three attempts.

(i) By drawing a tree diagram, or otherwise, show that the probability that exactly one tennis ball lands in the bucket is 0.432.

(ii) Draw up a probability distribution table for X, the number of tennis balls that land in the bucket.

William wins a prize if at least two tennis balls land in the bucket.

(iii) What is the probability that he wins a prize?

9 The discrete random variable X has probability function

$$P(X = x) = \frac{x+1}{k} \quad \text{for } x = 0, 1, 3, 4.$$

Find the value of the constant k.

10 The discrete random variable X has probability function

$$P(X = x) = \frac{4x-3}{k} \quad \text{for } x = -1, 0, 1, 2, 3$$

Find the value of the constant k.

11 A fair cubical die has two faces numbered 1, three faces numbered 2 and one face numbered 3. The die is thrown twice. The discrete random variable X is the sum of the two scores.

(i) Complete the possibility space showing the possible value of X.

Second throw

First throw	1	1	2	2	2	3
1			3			
1		2				
2					4	
2				4		
2	3					
3						6

(ii) Draw up a table showing the probability distribution of X.

12 Two fair tetrahedral dice each have faces marked 1, 2, 3 and 4. The two dice are thrown together. The random variable D is zero if both dice land on the same number. If the dice do not land on the same number, then D is the positive difference between the numbers on which they land.

(i) Copy and complete the possibility space.

Second die

First die	1	2	3	4
1			2	
2	1			
3				
4				0

(ii) Draw up a table showing the probability distribution of D.

(iii) Given that $D = 1$, find the probability that one of the dice landed on the face labelled 3.

13 Two ordinary fair cubical dice are thrown. The discrete random variable X is defined as follows. If the two numbers are the same, X is zero. Otherwise X is the smaller of the two numbers.

(i) Show that $P(X = 4) = \frac{1}{9}$.

(ii) Draw up the probability distribution table for X.

4.2 E(*x*), the expectation of *X*

1 The probability distribution of the discrete random variable X is shown in the table below.

x	1	2	3	4	5
$P(X = x)$	0.1	0.3	a	0.2	0.1

Find (i) the value of a (ii) $E(X)$
(iii) $P(X > E(X))$.

2 The probability distribution of the discrete random variable Y is shown in the table below.

y	-2	0	1	6
$P(Y = y)$	0.1	0.3	a	0.2

Find the mean of Y.

3 In a probability distribution the random variable X takes the value x with probability kx, where x takes the values 5, 7 and 8 only.

(i) Draw up a probability distribution table for X, in terms of k, and find the value of k.

(ii) Find $E(X)$.

4 Two fair coins are tossed.

(i) Find the probability that exactly one head is obtained.

(ii) Draw up a probability distribution table for X, the number of heads obtained.

(iii) Find the expected number of heads.

5 A bag contains five green counters and six red counters. Two counters are taken at random from the bag, one at a time, and not replaced. The number of red counters taken is denoted by X.

(i) Draw up a probability distribution table for X.

(ii) Calculate $E(X)$.

6 The probability distribution of the discrete random variable X is given in the table.

x	10	20	30
$P(X = x)$	a	0.5	b

(i) Write down an equation satisfied by a and b.

(ii) Given that $E(X) = 17$, find a and b.

7 Find the expected number of sixes when two fair cubical dice are thrown.

8 A discrete random variable X can take the values 10 and 20 only. The mean of X is 16. Write out the probability distribution of X.

9 The discrete random variable X has probability distribution given by the following, where c is a constant.

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

(i) Find the value of c.

(ii) Find the mode of X.

(iii) Find the mean of X.

10 Paula has three keys on a key ring, just one of which opens the door to her house. As she approaches the door, she selects one key after another, at random without replacement, trying each key in the door until she finds the correct key.

(i) Draw up a probability distribution table for X, the number of keys Paula tries before she opens the door.

(ii) Calculate the expected number of keys that she will try before opening the door.

11 Every day Eduardo tries to phone his friend. Every time he phones there is a 50% chance that his friend will answer. If his friend answers, Eduardo does not phone again on that day. If his friend does not answer, Eduardo tries again in a few minutes' time. If his friend has not answered after 4 attempts, Eduardo does not try again on that day.

(i) Draw a tree diagram to illustrate the situation.

(ii) Let X be the number of unanswered calls made by Eduardo on a day. Copy and complete the table showing the probability distribution of X.

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

(iii) Calculate the expected number of unanswered calls on a day.

Cambridge Paper 6 Q6 J08

4.3 Var(*x*), the variance of *X*

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

x	3	5	7	9
$P(X=x)$	0.2	0.3	0.4	0.1

Calculate (i) the mean of X

(ii) the variance of X.

2 The discrete random variable R has the following probability distribution.

r	-2	-1	0	1	2
$P(R=r)$	0.05	a	0.43	$3a$	0.12

(i) Find the value of a.

(ii) Find $E(R)$ and $Var(R)$.

3 Find $Var(X)$ for each of the following probability distributions.

(i)

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

(ii)

x	1	3	5	7	9
$P(X=x)$	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{1}{6}$

(iii)

x	0	2	5	6
$P(X=x)$	0.11	0.35	0.46	0.08

4 Two boxes each contain three cards. The first box contains cards labelled 1, 3 and 5. The second box contains cards labelled 2, 6 and 8. In a game, a player picks a card at random from each box. The score, X, is the sum of the numbers on the two cards.

(i) By using a possibility space, or otherwise, list the six possible values of X and calculate the corresponding probabilities.

(ii) Calculate the expected score.

(iii) Calculate the variance of X.

(iv) Calculate the standard deviation of X.

5 A computer is programmed to produce a sequence of integers, X, in the range 0 to 5 inclusive, with probabilities as shown in the probability distribution table.

x	0	1	2	3	4	5
$P(X=x)$	k	$\frac{1}{30}$	$\frac{2}{30}$	$\frac{3}{30}$	$\frac{4}{30}$	$\frac{5}{30}$

(i) Show that $k=\frac{1}{2}$.

(ii) Calculate $E(X)$.

(iii) Calculate $Var(X)$.

6 A class consists of 7 girls and 5 boys. Three students from the class are chosen at random to represent the class. The number of boys chosen is denoted by the random variable X.

(i) Show that $P(X=2)=\frac{7}{22}$.

(ii) Draw up the probability distribution of X.

(iii) Calculate $E(X)$.

(iv) Calculate the variance of X.

7 A discrete random variable X has the following probability distribution and can only take the values tabulated. The mean of X is 6.

x	1	3	6	n	12
$P(X=x)$	0.1	0.3	k	0.25	0.15

(i) Find the value of k.

(ii) Find the value of n.

(iii) Find the variance of X.

8 The probability distribution of the random variable X is shown in the following table.

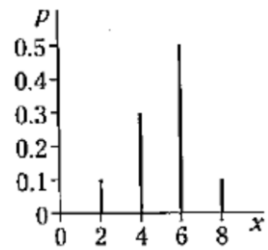
x	2	4	6	8	10
$P(X=x)$	0.06	a	b	b	0.16

The mean is 6.28.

(i) Write down two equations involving a and b and hence find the values of a and b.

(ii) Calculate the variance of X.

9 The random variable X takes values 2, 4, 6 and 8. Its probability distribution is illustrated in the vertical line graph.



Find Var(X).

10 Anne plays a game in which an unbiased cubical die is thrown once. If the score is 1, 2 or 3 Anne loses \$10. If the score is 4 or 5, Anne wins \$$x$. If the score is 6, Anne wins \$$2x$.

(i) Show that the expected value of Anne's profit in a single game is \$$\left(\frac{2}{3}x - 5\right)$.

(ii) Calculate the value of x for which, on average, Anne's profit is zero.

(iii) Given that $x = 12$, calculate the variance of Anne's profit in a single game.

11 The discrete random variable X has probability distribution given by the following, where k is a constant.

$$P(X = x) = \begin{cases} \dfrac{kx}{(x^2+1)} & x = 2, 3 \\ \dfrac{2kx}{(x^2-1)} & x = 4, 5 \end{cases}$$

(i) Show that $k = \frac{20}{33}$.

(ii) Find the probability that X is less than 3 or greater than 4.

(iii) Find E(X).

(iv) Find Var(X).

4.4 Mixed Exercise 1

1 A box contains 10 pens of which 3 are new. A random sample of two pens is taken.

(i) Show that the probability of getting exactly one new pen in the sample is $\frac{7}{15}$.

(ii) Construct a probability distribution table for the number of new pens in the sample.

(iii) Calculate the expected number of new pens in the sample.

Cambridge Paper 6 Q2 J03

2 A fair tetrahedral die has four faces numbered 1, 2, 3 and 6. The die and a fair coin are tossed together. If the coin shows heads the score S is equal to double the number on the hidden face of the die. If the coin shows tails then the score S is equal to the number on the hidden face of the die.

(i) Copy and complete the probability space showing the possible outcomes

		Die			
		1	2	3	6
Coin	H			6	
	T		2		

(ii) Show that $P(S = 6) = \frac{1}{4}$.

(iii) Draw up the probability distribution table for S.

(iv) Show that the expected value of S is 4.5.

(v) Calculate the variance of S.

3 The discrete random variable D is the number of parcels delivered in a day to a particular house. The probability distribution for D is shown below.

d	0	1	2	3	4
$P(D = d)$	0.1	0.4	0.25	0.15	a

(i) Find the value of a.

(ii) Write down the most likely number of parcels delivered.

(iii) Find the mean number of parcels delivered.

(iv) Find the probability that the number of parcels delivered is fewer than the mean.

(v) Find the variance of D.

(iv) Find the probability that the number of parcels delivered is fewer than the mean.

(v) Find the variance of D.

4 The number of spelling mistakes, X, that Jo makes when writing an essay can be modelled by the following probability distribution.

x	0	1	2	3	4
$P(X = x)$	0.23	0.31	0.27	0.14	0.05

The mean number of spelling mistakes is μ and the standard deviation is σ.

(i) Find the values of μ and σ.

(ii) Find $P(X > \mu + \sigma)$.

5 A discrete random variable X has the following probability distribution.

x	1	2	3	4
$P(X = x)$	$3c$	$4c$	$5c$	$6c$

(i) Find the value of the constant c.

(ii) Find $E(X)$ and $Var(X)$.

(iii) Find $P(X > E(X))$.

Cambridge Paper 6 Q8 N03

6 A box contains five balls numbered 1, 2, 3, 4, 5. Three balls are drawn randomly at the same time from the box.

(i) By listing all possible outcomes (123, 124, etc) find the probability that the sum of the three numbers drawn is an odd number.

The random variable L denotes the largest of the three numbers drawn.

(ii) Find the probability that L is 4.

(iii) Draw up a table to show the probability distribution of L.

(iv) Calculate the expectation and variance of L.

Cambridge Paper 6 Q6 N04

7 The probability of there being X unusable matches in a box is given by $P(X = 0) = 8k$, $P(X = 1) = 5k$, $P(X = 2) = P(X = 3) = k$, $P(X \geqslant 4) = 0$.

(i) Find the value of the constant k.

(ii) Find $P(X < E(X))$.

(iii) Find the variance of X.

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

x	0	1	2	3	4
$P(X = x)$	0.26	q	$3q$	0.05	0.09

(i) Find the value of q.

(ii) Find $E(X)$ and $Var(X)$.

Cambridge Paper 6 Q2 N06

9 A bag contains 300 discs of different colours. There are 100 pink discs, 100 blue discs and 100 orange discs. The discs of each colour are numbered from 0 to 99. Five discs are selected at random, one at a time, with replacement. Find

(i) the probability that no orange discs are selected,

(ii) the probability that exactly 2 discs with numbers ending in a 6 are selected,

(iii) the probability that exactly 2 orange discs with numbers ending in a 6 are selected,

(iv) the mean and variance of the number of pink discs selected.

Cambridge Paper 6 Q5 N05

10 The probability distribution of the random variable X is shown in the following table.

x	-2	-1	0	1	2	3
$P(X = x)$	0.08	p	0.12	0.16	q	0.22

The mean of X is 1.05.

(i) Write down two equations involving p and q and hence find the values of p and q.

(ii) Find the variance of X.

Cambridge Paper 61 Q2 N09

10 The probability distribution of the random variable X is shown in the following table.

x	-2	-1	0	1	2	3
$P(X = x)$	0.08	p	0.12	0.16	q	0.22

The mean of X is 1.05.

(i) Write down two equations involving p and q and hence find the values of p and q.

(ii) Find the variance of X.

Cambridge Paper 61 Q2 N09

11 Box A contains 5 red paper clips and 1 white paper clip. Box B contains 7 red paper clips and 2 white paper clips. One paper clip is taken at random from Box A and transferred to Box B. One paper clip is then taken at random from Box B.

(i) Find the probability of taking both a white paper clip from Box A and a red paper clip from Box B.

(ii) Find the probability that the paper clip taken from Box B is red.

(iii) Find the probability that the paper clip taken from Box A was red, given that the paper clip taken from Box B is red.

(iv) The random variable X denotes the number of times that a red paper clip is taken. Draw up a table to show the probability distribution of X.

Cambridge Paper 6 Q7 N07

1 If $X \sim B(10, 0.3)$ find

(i) $P(X = 2)$ (ii) $P(X = 6)$

(iii) $P(X = 10)$ (iv) $P(X = 0)$

2 If $X \sim B(8, 0.25)$ find

(i) $P(X = 5)$ (ii) $P(X = 3)$

(iii) $P(X \leqslant 3)$ (iv) $P(X \geqslant 7)$

3 If $X \sim B(9, \frac{1}{3})$ find

(i) $P(X = 5)$

(ii) $P(X < 2)$

(iii) $P(X > 7)$

4 If $X \sim B(9, 0.45)$ find

(i) $P(2 \leqslant X \leqslant 4)$

(ii) $P(5 < X < 8)$

5 If $X \sim B(13, 0.7)$ find

(i) $P(8 < X \leqslant 10)$

(ii) $P(8 \leqslant X < 10)$

6 A fair coin is tossed 12 times. Find the probability that the number of tails obtained is

(i) exactly 6,

(ii) at least 10,

(iii) no more than 2.

7 The probability that a patient attending a clinic has a particular health condition is $\frac{2}{5}$. Find the probability that in a randomly chosen group of 7 patients attending the clinic

(i) exactly 3 have the condition,

(ii) more than 5 have the condition,

(iii) fewer than 2 have the condition,

(iv) at least 2 but no more than 4 have the condition.

8 A fair tetrahedral die with faces numbered 1, 2, 3 and 4 is thrown 10 times. Find the probability of obtaining

(i) exactly 4 fours,

(ii) fewer than 3 odd numbers.

9 In a particular region 10% of people have blood type B.

(i) Find the probability that exactly 3 have blood type B in a random sample of 5 people from the region.

(ii) Find the probability that at most 2 have blood type B in a random sample of 9 people from the region.

(iii) Find the probability that exactly 13 do **not** have blood type B in a random sample of 15 people from the region.

10 In a survey it is found that 48% of pupils travel to the local school by bus. Find the probability that, in a random sample of 6 pupils, more than half of the pupils travel to school by bus.

11 A bag contains counters, 35% of which are red and the rest are yellow. Alex selects a counter at random from the bag, notes its colour and puts it back into the bag. Alex does this 8 times in all. Find the probability that Alex picks

(i) exactly 3 red counters,

(ii) more than 6 yellow counters.

12 In an experiment 5 fair coins are tossed together. Find the probability that they land showing

(i) exactly 3 tails,

(ii) fewer than 3 tails,

(iii) more than 3 heads.

1 If $Y \sim B\left(6, \frac{1}{4}\right)$, find
(i) $P(Y = 2)$, (ii) $P(Y \geqslant 2)$.

2 If $M \sim B(9, 0.73)$, find
(i) $P(M < 7)$, (ii) $P(M > 6)$.

3 In a survey it is found that 65% of shoppers choose Soapy Suds when buying washing powder. A random sample of 10 shoppers buying washing powder is taken. Find the probability that no more than 8 shoppers in the sample choose Soapy Suds.

4 A 5-sided spinner is equally likely to stop on any of the numbers 1, 2, 3, 4 or 5. Kate spins it 10 times. Find the probability that the spinner stops on
(i) an even number on exactly 7 spins,
(ii) an odd number on more than 7 spins.

5 (i) A fair cubical die is thrown 12 times. Find the probability of throwing more than 2 sixes.
(ii) Two fair cubical dice are thrown. Find the probability of throwing a double six (a six on each die).
(iii) Two fair cubical dice are thrown 12 times. Show that the probability of throwing at least 3 double sixes is approximately 0.4%.

6 An experiment consists of taking shots at a target and counting the number of hits. The probability of hitting the target with a single shot is 0.8.
Find the probability that in 13 consecutive attempts the target is hit at most 11 times.

7 If $X \sim B(4, p)$ and $P(X > 0) = 0.9744$, find
(i) p (ii) $P(X = 2)$.

8 A coin is biased so that it is twice as likely to show heads as tails.
(i) What is the probability that the coin will show heads when it is tossed?
(ii) Andy tosses the coin n times. Find the least value of n for which the probability that the coin shows heads each time is less than 0.01.

9 Charlie finds that when she takes a cutting from a particular plant, the probability that it roots successfully is $\frac{1}{4}$.
(i) She takes 9 cuttings. Find the probability that at least one cutting roots successfully.
(ii) Charlie takes n cuttings. Find the smallest value of n if there is to be a probability of at least 0.99 that at least one cutting roots successfully.

10 On a production line making light bulbs, the probability of any light bulb being faulty is 0.05.
The light bulbs are packed into boxes of 10.
(i) A pack is selected at random. Show that the probability that the pack contains fewer than 2 faulty light bulbs is 0.9139, correct to 4 significant figures.
Six packs of light bulbs are selected at random.
(ii) Find the probability that exactly five of these packs contain fewer than 2 faulty light bulbs.

4.7 Binomial Distributions

1 The random variable X has distribution $B(14, 0.36)$. Find

(i) the mean,

(ii) the variance,

(iii) the standard deviation.

2 The random variable Y has distribution $B(20, 0.4)$. Find the probability that Y is equal to the mean of Y.

3 In a large consignment of apples, 15% are rejected for being too small. A random sample of 20 apples is taken from the consignment.

(i) Find the expected number of rejected apples in the sample.

(ii) Explain why the most likely number of rejected apples in the sample is 3.

4 The probability that an item produced by a machine is satisfactory is 0.92.

(i) Find the expected number of satisfactory items in a random sample of 25 items produced by the machine.

(ii) Find the standard deviation of the number of **unsatisfactory** items in a random sample of 50 produced by the machine.

5 The random variable Y has distribution $B(n, 0.3)$ and $E(Y) = 2.4$.

(i) Find n.

(ii) Find $P(Y = 5)$.

(iii) Find the standard deviation of Y.

6 X is the number of tails when an unbiased coin is tossed 10 times. The mean of X is μ and the standard deviation of X is σ.

(i) Find μ and σ.

(ii) Find $P(X < \mu - 2\sigma)$.

(iii) Find $P(X > \mu + 2\sigma)$.

(iv) Find the probability that X is **more than** two standard deviations away from the mean.

(iv) Find the probability that X is **more than** two standard deviations away from the mean.

7 In a multiple choice test, for each question students have to choose the correct answer from a choice of four answers. There are 20 questions in the test. Jack decides not to read any of the questions, but to select an answer at random each time.

(i) What is the probability that Jack answers any one question correctly?

(ii) Find the mean and standard deviation of the number of correct answers that Jack gets.

(iii) Find the probability that the number of correct answers that Jack gets is within one standard deviation of the mean.

8 In a bag there are 6 red counters, 8 yellow counters and 6 green counters.

Ronami selects a counter at random from the bag, notes its colour and then puts it back into the bag. She does this four times in all.

Find

(i) the probability that she selects 4 red counters,

(ii) the expected number of yellow counters she selects,

(iii) the variance of the number of green counters she selects.

9 The probability that a person chosen at random wears glasses is p. A random sample of n people is chosen and the number of people in the sample who wear glasses is denoted by X. It is given that $E(X) = 2.4$ and $\mathrm{Var}(X) = 1.68$.

(i) Find the value of p.

(ii) Find the value of n.

(iii) Find the probability that exactly 6 people in the sample wear glasses.

10 It is given that $X \sim B(n, p)$. The mean of X is 3.6 and the variance of X is 2.16. Find

(i) n and p, (ii) $P(X \leqslant 2)$.

11 A calculator generates the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 randomly so that each digit has an equal chance of occurring.

(i) What is the probability that a zero is generated?

(ii) Six digits are generated. Find the probability that there is exactly one zero.

(iii) Twenty digits are generated. Find the expected number of digits that are multiples of 3.

(iv) One hundred digits are generated. Find the variance of the number of odd digits.

12 The discrete random variable X is such that $X \sim B(n, p)$ with $n = 3$ and $p = 0.4$.

(i) Complete the probability distribution table for X.

x	0	1	2	3
$P(X = x)$		0.432		0.064

(ii) Use the values in the table to calculate $E(X)$ and $Var(X)$.

(iii) Calculate np and npq, where $q = 1 - p$, and confirm that $E(X) = np$ and $Var(X) = npq$.

1 If $X \sim B(11, 0.65)$, find

(i) $P(X = 6)$,

(ii) $P(X < 3)$,

(iii) $P(X \geqslant 9)$.

2 The probability that a component produced by a particular machine is defective is 0.05. A random sample of 12 components is selected from the production line of the machine. Find the probability that the number of defective components in the sample is

(i) exactly 3, (ii) at least 2.

3 On average, 1 in 8 people living in a particular country were not born in that country. In a randomly selected group of 20 people living in the country, find the probability that

(i) exactly 5 were not born in the country,

(ii) at least 3 were not born in the country,

(iii) more than 18 were born in the country.

4 The random variable X has a binomial distribution with $n = 30$ and $p = 0.5$. Find

(i) $P(12 < X < 15)$,

(ii) $P(X = E(X))$.

5 The random variable X has the distribution $B(9, 0.45)$. Find

(i) $E(X)$,

(ii) the standard deviation of X.

6 The random variable X has a binomial distribution with $n = 16$ and $p = 0.15$. Find

(i) $E(X)$,

(ii) the probability that X is greater than $E(X)$,

(iii) $Var(X)$.

7 In the holiday period, the probability that Peter plays tennis on any particular day is $\frac{2}{3}$.

(i) Find the probability that Peter plays tennis on exactly 5 days in a holiday period of 14 days.

7 In the holiday period, the probability that Peter plays tennis on any particular day is $\frac{2}{3}$.

(i) Find the probability that Peter plays tennis on exactly 5 days in a holiday period of 14 days.

(ii) Find the mean number of days on which Peter plays tennis in a holiday period of 21 days.

(iii) If the standard deviation of the number of days Peter plays tennis is $\frac{4}{3}$, how many days are there in the holiday period?

8 The table shows the probability distribution of the discrete random variable X.

x	0	1	2	3
$P(X = x)$	0.4	0.3	0.2	0.1

(i) Find the probability that a random observation from X is odd.

(ii) Ten random observations of X are made. Find the mean number of observations that are odd numbers.

9 Balloons are packaged in party bags. Each bag contains 20 balloons. The colours of the balloons in a party bag are shown in the table.

Colour	Red	Blue	Green	Yellow
Frequency	8	5	4	3

Serene buys 10 party bags of balloons and selects a balloon at random from each bag.

(i) Find the probability that she selects at least 2 green balloons.

(ii) Find the mean number of blue balloons that she selects.

(iii) Find the variance of the number of yellow balloons she selects.

10 The probability that Jenny receives at least one telephone call on any day is 0.8. The number of telephone calls she receives is independent from day to day.

(i) Calculate the probability that, during a particular fortnight, Jenny receives at least one telephone call on exactly 9 days.

(ii) Calculate the mean number of days in April on which she does not receive any telephone calls.

11 Crocus and tulip bulbs are sold in mixed packs of 36 bulbs. On average, a pack contains three times as many crocus bulbs as tulip bulbs.

(i) A pack is selected at random. Find the probability that two-thirds of the bulbs in the pack are crocus bulbs.

(ii) Find the variance of the number of tulip bulbs in a pack.

12 A fair cubical die has one face numbered 1, two faces numbered 2 and three faces numbered 3.

Find the probability of obtaining fewer than 6 odd numbers in 7 throws of the die.