OCR Statistics 01

Past paper questions on

- Binomial distribution
- Geometric distribution

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Binomial And Geometric Distributions

- The **binomial distribution** is applicable when you have fixed number of *repeated, independent* 'trials' such that each trial can be viewed as 'success' (p) or 'fail' ($q = 1 - p$). In justifying a binomial distribution you must not just quote the previous sentence; you must apply it to the situation in the question. For example: "Binomial is applicable because the probability of each tulip flowering is independent of each other tulip and the probability of flowering is a constant".

- For example if I throw darts at a dart board and my chance of hitting a double is 0.1 and I throw 12 darts at the board and my chance of hitting a double is independent of all the other throws then a binomial distribution will be applicable. We let X be the number of doubles I hit. X can therefore take the values $\{0, 1, 2 \dots, 11, 12\}$; i.e. there are 13 possible outcomes. $p = 0.1$; the probability of success and $q = 1 - p = 0.9$; the probability of failure. We write $X \sim B(n, p)$ which here is $X \sim B(12, 0.1)$.

- I would always advise you to visualise the tree diagram. From this we can 'see' that $\mathbb{P}(X = 12) = 0.1^{12}$ and $\mathbb{P}(X = 0) = 0.9^{12}$. In general

$$\mathbb{P}(X = x) = \binom{n}{x} \times p^x \times q^{n-x}.$$

So in the example, the probability I hit exactly 7 doubles is $\mathbb{P}(X = 7) = \binom{12}{7} \times 0.1^7 \times 0.9^5$.

- For questions such as $\mathbb{P}(X \leqslant 5)$ or $\mathbb{P}(X \geqslant 8)$ you must be able to use the tables in the formula book. The tables always give $\mathbb{P}(X \leqslant \text{something})$. You must be able to convert probabilities to this form and then read off from the table. For $X \sim B(10, 0.35)$.

$$\begin{aligned}
&\mathbb{P}(X \leqslant 7) = 0.9952,\\
&\mathbb{P}(X < 5) = \mathbb{P}(X \leqslant 4) = 0.7515,\\
&\mathbb{P}(X \geqslant 7) = 1 - \mathbb{P}(X \leqslant 6) = 1 - 0.9740 = 0.0260,\\
&\mathbb{P}(X > 3) = 1 - \mathbb{P}(X \leqslant 3) = 1 - 0.5138 = 0.4862.
\end{aligned}$$

- The **geometric distribution** is applicable when you are looking for how long you wait until an event has occurred. The events must be *repeated, independent and success/fail.* Potentially you could wait forever until a success occurs; something to look for if you are unsure what distribution to apply. Similar to the binomial you must justify *in the context of the question.*

- Going back to the darts example, we could rephrase it as how long must I wait until I hit a double? Let X be the number of throws until I hit a double. We write $X \sim \text{Geo}(0.1)$. X can take the values $\{1, 2, 3, \dots\}$.

- Obviously $\mathbb{P}(X = 1) = 0.1$. Less obviously $\mathbb{P}(X = 4) = 0.9^3 \times 0.1$ (I must have three failures and *then* my success). In general

$$\mathbb{P}(X = x) = q^{x-1} \times p.$$

- There are no tables for the geometric distribution because there does not need to be. To calculate $\mathbb{P}(X \geqslant 5)$ we must have had 4 failures. Therefore $\mathbb{P}(X \geqslant 5) = q^4 = (1-p)^4$. Also to calculate $\mathbb{P}(X \leqslant 6)$ we use the fact that $\mathbb{P}(X \leqslant 6) = 1-\mathbb{P}(X \geqslant 7) = 1-q^6 = 1-(1-p)^6$. In general

$$\mathbb{P}(X \geqslant x) = (1-p)^{x-1} \qquad \text{and} \qquad \mathbb{P}(X \leqslant x) = 1-(1-p)^x.$$

- The expectation of a binomial distribution $B(n,p)$ is np. The variance of $B(n,p)$ is npq.
- The expectation of a geometric distribution $\mathrm{Geo}(p)$ is $\frac{1}{p}$.

1.

The probability that a certain sample of radioactive material emits an alpha-particle in one unit of time is 0.14. In one unit of time no more than one alpha-particle can be emitted. The number of units of time up to and including the first in which an alpha-particle is emitted is denoted by T.

(i) Find the value of

(a) $\mathrm{P}(T = 5)$, [3]

(b) $\mathrm{P}(T < 8)$. [3]

(ii) State the value of $\mathrm{E}(T)$. [2]

Q2 June 2005

2.

In a supermarket the proportion of shoppers who buy washing powder is denoted by p. 16 shoppers are selected at random.

(i) Given that $p = 0.35$, use tables to find the probability that the number of shoppers who buy washing powder is

(a) at least 8, [3]

(b) between 4 and 9 inclusive. [2]

(ii) Given instead that $p = 0.38$, find the probability that the number of shoppers who buy washing powder is exactly 6. [3]

Q3 June 2005

3.

Andrea practises shots at goal. For each shot the probability of her scoring a goal is $\frac{2}{5}$. Each shot is independent of other shots.

(i) Find the probability that she scores her first goal

(a) on her 5th shot, [2]

(b) before her 5th shot. [3]

(ii) **(a)** Find the probability that she scores exactly 1 goal in her first 5 shots. [3]

(b) Hence find the probability that she scores her **second** goal on her 6th shot. [2]

Q5 Jan 2006

4.

Past experience has shown that when seeds of a certain type are planted, on average 90% will germinate. A gardener plants 10 of these seeds in a tray and waits to see how many will germinate.

(i) Name an appropriate distribution with which to model the number of seeds that germinate, giving the value(s) of any parameters. State any assumption(s) needed for the model to be valid. [4]

(ii) Use your model to find the probability that fewer than 8 seeds germinate. [2]

Later the gardener plants 20 trays of seeds, with 10 seeds in each tray.

(iii) Calculate the probability that there are at least 19 trays in each of which at least 8 seeds germinate. [4]

Q7 Jan 2006

5.

(i) The random variable X has the distribution $B(25, 0.2)$. Using the tables of cumulative binomial probabilities, or otherwise, find $P(X \geqslant 5)$. [2]

(ii) The random variable Y has the distribution $B(10, 0.27)$. Find $P(Y = 3)$. [2]

(iii) The random variable Z has the distribution $B(n, 0.27)$. Find the smallest value of n such that $P(Z \geqslant 1) > 0.95$. [3]

Q4 June 2006

6.

Henry makes repeated attempts to light his gas fire. He makes the modelling assumption that the probability that the fire will light on any attempt is $\frac{1}{3}$.

Let X be the number of attempts at lighting the fire, up to and including the successful attempt.

(i) Name the distribution of X, stating a further modelling assumption needed. [2]

In the rest of this question, you should use the distribution named in part **(i)**.

(ii) Calculate

(a) $P(X = 4)$, [3]

(b) $P(X < 4)$. [3]

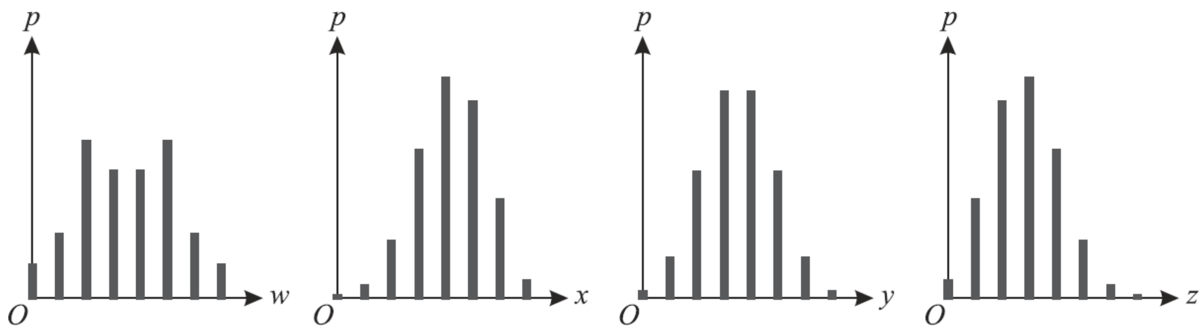
(iii) State the value of $E(X)$. [1]

(iv) Henry has to light the fire once a day, starting on March 1st. Calculate the probability that the first day on which fewer than 4 attempts are needed to light the fire is March 3rd. [3]

Q8 June 2006

7.

Each of the variables W, X, Y and Z takes eight integer values only. The probability distributions are illustrated in the following diagrams.



(i) For which one or more of these variables is

(a) the mean equal to the median, [1]

(b) the mean greater than the median? [1]

(ii) Give a reason why **none** of these diagrams could represent a geometric distribution. [1]

(iii) Which one of these diagrams could **not** represent a binomial distribution? Explain your answer briefly. [2]

Q4 Jan 2007

8.

A coin is biased so that the probability that it will show heads on any throw is $\frac{2}{3}$. The coin is thrown repeatedly.

The number of throws up to and including the first head is denoted by X. Find

(i) $P(X = 4)$, [3]

(ii) $P(X < 4)$, [3]

(iii) $E(X)$. [2]

Q6 Jan 2007

9.

A variable X has the distribution $B(11, p)$.

(i) Given that $p = \frac{3}{4}$, find $P(X = 5)$. [2]

(ii) Given that $P(X = 0) = 0.05$, find p. [4]

(iii) Given that $\text{Var}(X) = 1.76$, find the two possible values of p. [5]

Q9 Jan 2007

10.

On average, 25% of the packets of a certain kind of soup contain a voucher. Kim buys one packet of soup each week for 12 weeks. The number of vouchers she obtains is denoted by X.

(i) State two conditions needed for X to be modelled by the distribution $B(12, 0.25)$. [2]

In the rest of this question you should assume that these conditions are satisfied.

(ii) Find $P(X \leqslant 6)$. [2]

In order to claim a free gift, 7 vouchers are needed.

(iii) Find the probability that Kim will be able to claim a free gift at some time during the 12 weeks. [1]

(iv) Find the probability that Kim will be able to claim a free gift in the 12th week but not before. [4]

Q7 June 2007

11.

(i) A biased coin is thrown twice. The probability that it shows heads both times is 0.04. Find the probability that it shows tails both times. [3]

(ii) Another coin is biased so that the probability that it shows heads on any throw is p. The probability that the coin shows heads exactly once in two throws is 0.42. Find the two possible values of p. [5]

Q8 June 2007

12.

(i) A random variable X has the distribution $\text{Geo}(\frac{1}{5})$. Find

(a) $E(X)$, [2]

(b) $P(X = 4)$, [2]

(c) $P(X > 4)$. [2]

(ii) A random variable Y has the distribution $\text{Geo}(p)$, and $q = 1 - p$.

(a) Show that $P(Y \text{ is odd}) = p + q^2p + q^4p + \dots$. [1]

(b) Use the formula for the sum to infinity of a geometric progression to show that

$$P(Y \text{ is odd}) = \frac{1}{1+q}.$$ [4]

Q9 June 2007

13.

A random variable T has the distribution $\text{Geo}(\frac{1}{5})$. Find

(i) $P(T = 4)$, [2]

(ii) $P(T > 4)$, [2]

(iii) $E(T)$. [1]

Q2 Jan 2008

14.

(i) 20% of people in the large town of Carnley support the Residents' Party. 12 people from Carnley are selected at random. Out of these 12 people, the number who support the Residents' Party is denoted by U.

Find

(a) $P(U \leqslant 5)$, [2]

(b) $P(U \geqslant 3)$. [3]

(ii) 30% of people in Carnley support the Commerce Party. 15 people from Carnley are selected at random. Out of these 15 people, the number who support the Commerce Party is denoted by V.

Find $P(V = 4)$. [3]

Q5 Jan 2008

15.

(i) Andrew plays 10 tennis matches. In each match he either wins or loses.

(a) State, in this context, two conditions needed for a binomial distribution to arise. [2]

(b) Assuming these conditions are satisfied, define a variable in this context which has a binomial distribution. [1]

(ii) The random variable X has the distribution $B(21, p)$, where $0 < p < 1$.

Given that $P(X = 10) = P(X = 9)$, find the value of p. [5]

Q7 Jan 2008

16.

(i) A random variable X has the distribution $B(8, 0.55)$. Find

(a) $P(X < 7)$, [1]

(b) $P(X = 5)$, [2]

(c) $P(3 \leqslant X < 6)$. [3]

(ii) A random variable Y has the distribution $B\left(10, \frac{5}{12}\right)$. Find

(a) $P(Y = 2)$, [2]

(b) $\mathrm{Var}(Y)$. [1]

Q3 June 2008

17.

Once each year, Paula enters a lottery for a place in an annual marathon. Each time she enters the lottery, the probability of her obtaining a place is 0.3. Find the probability that

(i) the first time she obtains a place is on her 4th attempt, [3]

(ii) she does not obtain a place on any of her first 6 attempts, [2]

(iii) she needs fewer than 10 attempts to obtain a place, [3]

(iv) she obtains a place exactly twice in her first 5 attempts. [3]

Q3 June 2008

18.

At a factory that makes crockery the quality control department has found that 10% of plates have minor faults. These are classed as 'seconds'. Plates are stored in batches of 12. The number of seconds in a batch is denoted by X.

(i) State an appropriate distribution with which to model X. Give the value(s) of any parameter(s) and state any assumptions required for the model to be valid. **[4]**

Assume now that your model is valid.

(ii) Find

(a) $P(X = 3)$, **[2]**

(b) $P(X \geqslant 1)$. **[2]**

(iii) A random sample of 4 batches is selected. Find the probability that the number of these batches that contain at least 1 second is fewer than 3. **[4]**

Q7 Jan 2009

19.

A game uses an unbiased die with faces numbered 1 to 6. The die is thrown once. If it shows 4 or 5 or 6 then this number is the final score. If it shows 1 or 2 or 3 then the die is thrown again and the final score is the sum of the numbers shown on the two throws.

(i) Find the probability that the final score is 4. **[3]**

(ii) Given that the die is thrown only once, find the probability that the final score is 4. **[1]**

(iii) Given that the die is thrown twice, find the probability that the final score is 4. **[3]**

Q8 Jan 2009

20.

20% of packets of a certain kind of cereal contain a free gift. Jane buys one packet a week for 8 weeks. The number of free gifts that Jane receives is denoted by X. Assuming that Jane's 8 packets can be regarded as a random sample, find

(i) $P(X = 3)$, **[3]**

(ii) $P(X \geqslant 3)$, **[2]**

(iii) $E(X)$. **[2]**

Q1 June 2009

21.

30% of people own a Talk-2 phone. People are selected at random, one at a time, and asked whether they own a Talk-2 phone. The number of people questioned, up to and including the first person who owns a Talk-2 phone, is denoted by X. Find

(i) $P(X = 4)$, **[3]**

(ii) $P(X > 4)$, **[2]**

(iii) $P(X < 6)$. **[3]**

Q4 June 2009

22.

Repeated independent trials of a certain experiment are carried out. On each trial the probability of success is 0.12.

(i) Find the smallest value of n such that the probability of at least one success in n trials is more than 0.95. **[3]**

(ii) Find the probability that the 3rd success occurs on the 7th trial. **[5]**

Q9 June 2009

23.

Andy makes repeated attempts to thread a needle. The number of attempts up to and including his first success is denoted by X.

(i) State two conditions necessary for X to have a geometric distribution. **[2]**

(ii) Assuming that X has the distribution Geo(0.3), find

(a) $P(X = 5)$, **[2]**

(b) $P(X > 5)$. **[3]**

(iii) Suggest a reason why one of the conditions you have given in part **(i)** might not be satisfied in this context. **[2]**

Q1 Jan 2010

24.

R and S are independent random variables each having the distribution Geo(p).

(i) Find $P(R = 1 \text{ and } S = 1)$ in terms of p. **[1]**

(ii) Show that $P(R = 3 \text{ and } S = 3) = p^2q^4$, where $q = 1 - p$. **[1]**

(iii) Use the formula for the sum to infinity of a geometric series to show that

$$P(R = S) = \frac{p}{2 - p}.$$ **[5]**

Q10 Jan 2010

25.

(i) The random variable W has the distribution $B\left(10, \frac{1}{3}\right)$. Find

(a) $P(W \leqslant 2)$, **[1]**

(b) $P(W = 2)$. **[2]**

(ii) The random variable X has the distribution B(15, 0.22).

(a) Find $P(X = 4)$. **[2]**

(b) Find $E(X)$ and $Var(X)$. **[3]**

Q4 June 2010

26.

The proportion of people who watch *West Street* on television is 30%. A market researcher interviews people at random in order to contact viewers of *West Street*. Each day she has to contact a certain number of viewers of *West Street*.

(i) Near the end of one day she finds that she needs to contact just one more viewer of *West Street*. Find the probability that the number of further interviews required is

(a) 4, **[3]**

(b) less than 4. **[3]**

(ii) Near the end of another day she finds that she needs to contact just two more viewers of *West Street*. Find the probability that the number of further interviews required is

(a) 5, **[4]**

(b) more than 5. **[2]**

Q8 June 2010

27.

The random variable X has the distribution $\text{Geo}(0.2)$. Find

(i) $P(X = 3)$, **[2]**

(ii) $P(3 \leqslant X \leqslant 5)$, **[3]**

(iii) $P(X > 4)$. **[3]**

Two independent values of X are found.

(iv) Find the probability that the total of these two values is 3. **[3]**

Q2 Jan 2011

28.

30% of packets of Natural Crunch Crisps contain a free gift. Jan buys 5 packets each week.

(i) The number of free gifts that Jan receives in a week is denoted by X. Name a suitable probability distribution with which to model X, giving the value(s) of any parameter(s). State any assumption(s) necessary for the distribution to be a valid model. **[4]**

Assume now that your model is valid.

(ii) Find

(a) $P(X \leqslant 2)$, **[1]**

(b) $P(X = 2)$. **[2]**

(iii) Find the probability that, in the next 7 weeks, there are exactly 3 weeks in which Jan receives exactly 2 free gifts. **[3]**

Q5 Jan 2011

29.

(i) A random variable, X, has the distribution $B(12, 0.85)$. Find

(a) $P(X > 10)$, **[2]**

(b) $P(X = 10)$, **[2]**

(c) $Var(X)$. **[2]**

(ii) A random variable, Y, has the distribution $B(2, \frac{1}{4})$. Two independent values of Y are found. Find the probability that the sum of these two values is 1. **[4]**

Q3 June 2011

30.

Ann, Bill, Chris and Dipak play a game with a fair cubical die. Starting with Ann they take turns, in alphabetical order, to throw the die. This process is repeated as many times as necessary until a player throws a 6. When this happens, the game stops and this player is the winner.

Find the probability that

(i) Chris wins on his first throw, **[1]**

(ii) Dipak wins on his second throw, **[3]**

(iii) Ann gets a third throw, **[2]**

(iv) Bill throws the die exactly three times. **[4]**

Q8 June 2011

31.

A random variable X has the distribution $B(13, 0.12)$.

(i) Find $P(X < 2)$. **[3]**

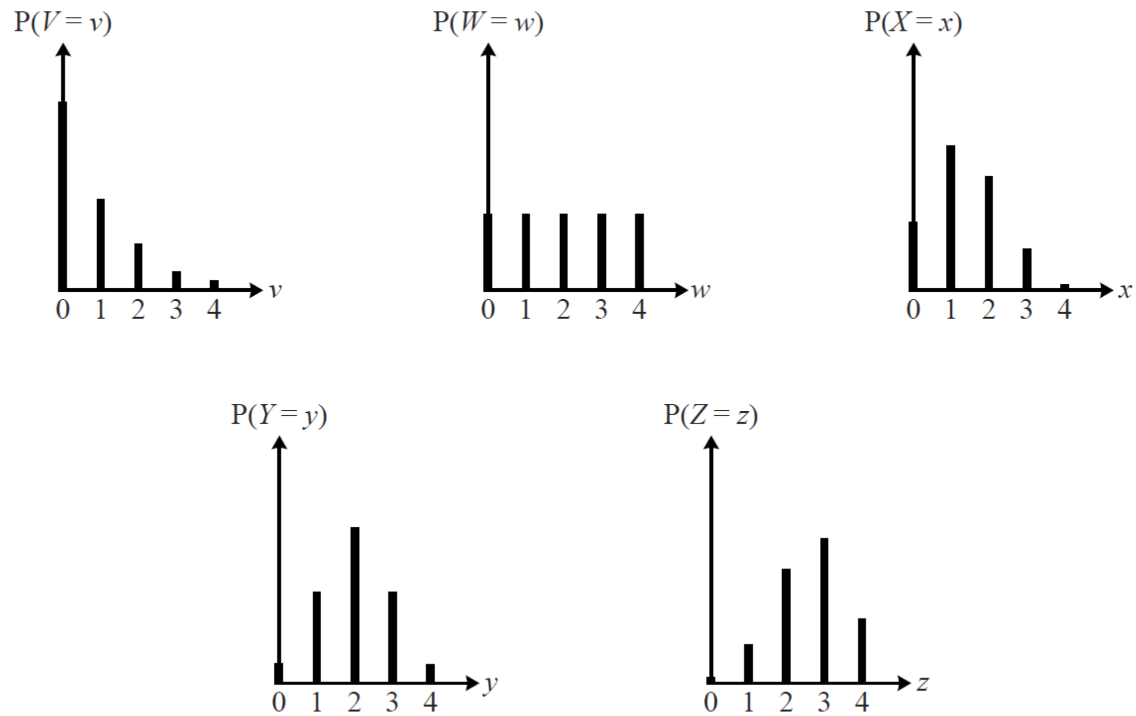
Two independent values of X are found.

(ii) Find the probability that exactly one of these values is equal to 2. **[3]**

Q3 Jan 2012

32.

The diagrams illustrate all or part of the probability distributions of the discrete random variables V, W, X, Y and Z.



(i) One of these variables has the distribution Geo($\frac{1}{2}$). State, with a reason, which variable this is. **[2]**

(ii) One of these variables has the distribution B(4, $\frac{1}{2}$). State, with reasons, which variable this is. **[3]**

Q6 Jan 2012

33.

60% of the voters at a certain polling station are women. Voters enter the polling station one at a time. The number of voters who enter, up to and including the first woman, is denoted by X.

(i) State a suitable distribution that can be used as a model for X, giving the value(s) of any parameter(s). State also any necessary condition(s) for this distribution to be a good model. **[4]**

Use the distribution stated in part **(i)** to find

(ii) $P(X = 4)$, **[2]**

(iii) $P(X \geqslant 4)$. **[2]**

Q7 Jan 2012

34.

On average, half the plants of a particular variety produce red flowers and the rest produce blue flowers.

(i) Ann chooses 8 plants of this variety at random. Find the probability that more than 6 plants produce red flowers. **[3]**

(ii) Karim chooses 22 plants of this variety at random.

(a) Find the probability that the number of these plants that produce blue flowers is equal to the number that produce red flowers. **[2]**

(b) Hence find the probability that the number of these plants that produce blue flowers is greater than the number that produce red flowers. **[3]**

Q8 Jan 2012

35.

(i) The random variable X has the distribution B(30, 0.6). Find $P(X \geqslant 16)$. **[2]**

(ii) The random variable Y has the distribution B(4, 0.7).

(a) Find $P(Y = 2)$. **[2]**

(b) Three values of Y are chosen at random. Find the probability that their total is 10. **[6]**

Q8 June 2012

36.

(i) A clock is designed to chime once each hour, on the hour. The clock has a fault so that each time it is supposed to chime there is a constant probability of $\frac{1}{10}$ that it will not chime. It may be assumed that the clock never stops and that faults occur independently. The clock is started at 5 minutes past midnight on a certain day. Find the probability that the first time it does not chime is

(a) at 0600 on that day, **[3]**

(b) before 0600 on that day. **[3]**

(ii) Another clock is designed to chime twice each hour: on the hour and at 30 minutes past the hour. This clock has a fault so that each time it is supposed to chime there is a constant probability of $\frac{1}{20}$ that it will not chime. It may be assumed that the clock never stops and that faults occur independently. The clock is started at 5 minutes past midnight on a certain day.

(a) Find the probability that the first time it does not chime is at either 0030 or 0130 on that day. **[2]**

(b) Use the formula for the sum to infinity of a geometric progression to find the probability that the first time it does not chime is at 30 minutes past some hour. **[3]**

Q9 June 2012

37.

A random variable X has the distribution $B(5, \frac{1}{4})$.

(i) Find

(a) $E(X)$, **[1]**

(b) $P(X = 2)$. **[2]**

(ii) Two values of X are chosen at random. Find the probability that their sum is less than 2. **[4]**

(iii) 10 values of X are chosen at random. Use an appropriate formula to find the probability that exactly 3 of these values are 2s. **[3]**

Q5 Jan 2013

38.

Sandra makes repeated, independent attempts to hit a target. On each attempt, the probability that she succeeds is 0.1.

(i) Find the probability that

(a) the first time she succeeds is on her 5th attempt, **[2]**

(b) the first time she succeeds is after her 5th attempt, **[2]**

(c) the second time she succeeds is before her 4th attempt. **[4]**

Jill also makes repeated attempts to hit the target. Each attempt of either Jill or Sandra is independent. Each time that Jill attempts to hit the target, the probability that she succeeds is 0.2. Sandra and Jill take turns attempting to hit the target, with Sandra going first.

(ii) Find the probability that the first person to hit the target is Sandra, on her

(a) 2nd attempt, **[2]**

(b) 10th attempt. **[3]**

Q8 Jan 2013

39.

In a factory, an inspector checks a random sample of 30 mugs from a large batch and notes the number, X, which are defective. He then deals with the batch as follows.

- If $X < 2$, the batch is accepted.
- If $X > 2$, the batch is rejected.
- If $X = 2$, the inspector selects another random sample of only 15 mugs from the batch. If this second sample contains 1 or more defective mugs, the batch is rejected. Otherwise the batch is accepted.

It is given that 5% of mugs are defective.

(i) **(a)** Find the probability that the batch is rejected after just the first sample is checked. **[3]**

(b) Show that the probability that the batch is rejected is 0.327, correct to 3 significant figures. **[5]**

(ii) Batches are checked one after another. Find the probability that the first batch to be rejected is either the 4th or the 5th batch that is checked. **[3]**

Q7 June 2013

40.

A game is played with a token on a board with a grid printed on it. The token starts at the point (0, 0) and moves in steps. Each step is either 1 unit in the positive x-direction with probability 0.8, or 1 unit in the positive y-direction with probability 0.2. The token stops when it reaches a point with a y-coordinate of 1. It is given that the token stops at $(X, 1)$.

(i) **(a)** Find the probability that $X = 10$. **[2]**

(b) Find the probability that $X < 10$. **[3]**

(ii) Find the expected number of steps taken by the token. **[2]**

(iii) Hence, write down the value of $\mathrm{E}(X)$. **[1]**

Q9 June 2013

41.

Each time Ben attempts to complete a crossword in his daily newspaper, the probability that he succeeds is $\frac{2}{3}$. The random variable X denotes the number of times that Ben succeeds in 9 attempts.

(i) Find

(a) $P(X = 6)$, **[3]**

(b) $P(X < 6)$, **[1]**

(c) $E(X)$ and $Var(X)$. **[2]**

Ben notes three values, X_1, X_2 and X_3, of X.

(ii) State the total number of attempts to complete a crossword that are needed to obtain three values of X. Hence find $P(X_1 + X_2 + X_3 = 18)$. **[4]**

Q4 June 2014

42.

Each day Harry makes repeated attempts to light his gas fire. If the fire lights he makes no more attempts. On each attempt, the probability that the fire will light is 0.3 independent of all other attempts. Find the probability that

(i) the fire lights on the 5th attempt, **[2]**

(ii) Harry needs more than 1 attempt but fewer than 5 attempts to light the fire. **[3]**

If the fire does not light on the 6th attempt, Harry stops and the fire remains unlit.

(iii) Find the probability that, on a particular day, the fire lights. **[3]**

(iv) Harry's week starts on Monday. Find the probability that, during a certain week, the first day on which the fire lights is Wednesday. **[2]**

Q9 June 2014

43.

Each year Jack enters a ballot for a concert ticket. The probability that Jack will win a ticket in any particular year is 0.27.

(i) Find the probability that the first time Jack wins a ticket is

(a) on his 8th attempt, **[2]**

(b) after his 8th attempt. **[2]**

(ii) Write down an expression for the probability that Jack wins a ticket on exactly 2 of his first 8 attempts, and evaluate this expression. **[3]**

(iii) Find the probability that Jack wins his 3rd ticket on his 9th attempt and his 4th ticket on his 12th attempt. **[3]**

Q5 June 2015

44.

Froox sweets are packed into tubes of 10 sweets, chosen at random. 25% of Froox sweets are yellow.

(i) Find the probability that in a randomly selected tube of Froox sweets there are

(a) exactly 3 yellow sweets, **[3]**

(b) at least 3 yellow sweets. **[2]**

(ii) Find the probability that in a box containing 6 tubes of Froox sweets, there is at least 1 tube that contains at least 3 yellow sweets. **[3]**

Q7 June 2015