4 Every morning, Samath has one glass of fruit juice with his breakfast. He chooses at random orange juice or pineapple juice or mango juice. The probability that he chooses orange juice is 0.6 The probability that he chooses pineapple juice is 0.3

(a) Work out the probability that he chooses mango juice.

(b) There are 30 days in April.
Work out an estimate for the number of days in April on which Samath chooses orange juice.

2 John throws a biased coin 120 times.
It shows heads 90 times.

(a) John throws the coin once more.
Work out an estimate for the probability that the coin shows tails.

Carly throws the same coin 200 times.

(b) Work out an estimate for the number of times the coin shows tails.
17 Alan has to attend a meeting on Monday and on Tuesday.

The probability that he is late for a meeting is $\frac{1}{8}$

(a) Complete the probability tree diagram.

(b) Calculate the probability that Alan is late for at least one of these meetings.
2 Here is a fair 5-sided spinner.

Hans spins the spinner 30 times.

Work out an estimate for the number of times the spinner lands on Red.
16 Here are 8 dominoes.

The 8 dominoes are put in a bag.
Riaz takes at random a domino from the bag.
(a) Find the probability that he takes a domino with a total of 8 spots or a domino with a total of 9 spots.

Helima takes at random 2 dominoes from the bag of 8 dominoes without replacement.
(b) Work out the probability that
   (i) the total number of spots on the two dominoes is 18
   (ii) the total number of spots on the two dominoes is 17

4 Abid is waiting for a bus.
The probability that his bus will be early is 0.2
The probability that his bus will be on time is 0.7

Work out the probability that his bus will be either early or on time.
In Box X, there are 4 black discs and 1 white disc.
In Box Y, there are 2 black discs and 2 white discs.

Vikram takes at random a disc from Box X and puts it in Box Y.
He then takes at random a disc from Box Y.

(a) Calculate the probability that the disc he takes from Box X and the disc he takes from Box Y will both be black discs.

(b) Calculate the probability that the disc he takes from Box Y will be a white disc.
1 A box contains some coloured cards.  
Each card is red or blue or yellow or green.  
The table shows the probability of taking a red card or a blue card or a yellow card.

<table>
<thead>
<tr>
<th>Card</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>0.3</td>
</tr>
<tr>
<td>Blue</td>
<td>0.35</td>
</tr>
<tr>
<td>Yellow</td>
<td>0.15</td>
</tr>
<tr>
<td>Green</td>
<td></td>
</tr>
</tbody>
</table>

George takes at random a card from the box.

(a) Work out the probability that George takes a green card.

George replaces his card in the box.  
Anish takes a card from the box and then replaces the card.  
Anish does this 40 times.

(b) Work out an estimate for the number of times Anish takes a yellow card.
18 Boris and Nigel play games of chess against each other in a match. In each game, Boris wins or Nigel wins or the game is a draw.

When a player wins a game, he wins the match. When a game is a draw, the players play another game against each other. Boris and Nigel play a maximum of 3 games.

The probability that Boris wins a game is \( \frac{1}{3} \)

The probability that a game is a draw is \( \frac{1}{2} \)

(a) Complete the probability tree diagram.

(b) Calculate the probability that Boris wins the match.
17 Parveen travels to school either by bicycle or by bus.
   The probability that, on any day, she will travel by bicycle is 0.7
   When she travels by bicycle, the probability that she will be late for school is 0.2
   When she travels by bus, the probability that she will be late for school is 0.1

   (a) Calculate the probability that, on a randomly chosen day, Parveen will travel by bus
       and be late for school.

   (b) Calculate the probability that, on a randomly chosen day, Parveen will not be late for
       school.
18 Here are ten counters.
Each counter has a number on it.

Fern puts the ten counters in a bag.
She takes at random a counter from the bag.

(a) Find the probability that the number on the counter is 3 or 4

Fern puts the counter back into the bag.
Then Rajan takes at random one of the ten counters from the bag.
He does not put the counter back into the bag.
He then takes at random a second counter from the bag.

(b) Calculate the probability that 3 is the number on each of the two counters he takes.

(c) Calculate the probability that the sum of the numbers on the two counters he takes is an odd number.
13 A box contains 20 nails. The table shows information about the length of each nail.

<table>
<thead>
<tr>
<th>Length of nail (mm)</th>
<th>25</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of nails</td>
<td>1</td>
<td>8</td>
<td>4</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

(a) Viraj takes at random one nail from the box.
Find the probability that the length of the nail he takes is
(i) 50 mm or 60 mm,
(ii) less than 35 mm.

(b) Jamila puts all 20 nails into a bag.
She takes at random one of the nails and records its length.
She replaces the nail in the bag.
She then takes at random a second nail from the bag and records its length.
Calculate the probability that the two nails she takes
(i) each have a length of 60 mm,
(ii) have a total length of 80 mm.
8  Morse Code uses dots (●) and dashes (−) to represent each letter of the alphabet. 
Here are 10 cards. Each card has the Morse Code for a letter on it.

(a) Kelly takes at random one of the cards. 
Find the probability that she takes a card with 2 dots or a card with 3 dots.

(b) Hashim has the 10 cards. 
He takes at random a card 200 times. 
He replaces the card each time. 
Work out an estimate for the number of times he will take a card with exactly 2 dots.

(c) Shani takes at random two of the 10 cards without replacement. 
Calculate the probability that
(i) there is exactly 1 dot on each card she takes,
(ii) there is a total of 4 dots on the two cards she takes.
14 Peter wants to pass his driving test.
The probability that he passes at his first attempt is 0.7
When Peter passes his driving test, he does not take it again.
If he fails, the probability that he passes at the next attempt is 0.8

(a) Complete the probability tree diagram for Peter’s first two attempts.

First attempt          Second attempt

Pass

0.7

---------

Fail

(b) Calculate the probability that Peter needs exactly two attempts to pass his driving test.

(c) Calculate the probability that Peter passes his driving test at his third or fourth attempt.
19 Amberish plays two games of tennis.

Each time he plays a game of tennis, the probability that he will win is \( \frac{2}{7} \).

(a) Complete the probability tree diagram.

First game  Second game

\[ \frac{2}{7} \]  Win

Not win

(b) Calculate the probability that Amberish wins at least one of the two games of tennis.
20 Here are nine counters.
Each counter has a number on it.

The counters are turned over to hide their numbers and are then mixed up.
Susan takes at random a counter and turns it over to reveal its number.
She takes at random a second counter, from the remaining eight counters, and turns it over to reveal its number.

(a) Calculate the probability that the number 5 is on both of the two counters Susan takes.

(b) Calculate the probability that the sum of the numbers on the two counters Susan takes is divisible by 3
Probability IGCSE Higher Tier Exam Questions

May 2014 3HR Paper

17 The table shows information about the 40 coins in Karam’s money box.

<table>
<thead>
<tr>
<th></th>
<th>Bronze coins</th>
<th>Silver coins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of coin (pence)</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Number of coins</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

Karam shakes his money box until a coin falls out at random.
He does not replace the coin in the money box.
Karam shakes his money box again until a second coin falls out at random.

(a) Work out the probability that both the coins that fall out are silver coins.

(b) Work out the probability that the total value of the two coins that fall out is 60 pence or more.

May 2014 4H Paper

2 Sarah has a biased 4-sided spinner.
The spinner can land on 1, 2, 3 or 4

The probability that the spinner will land on 1, 2 or 4 is given in the table.

<table>
<thead>
<tr>
<th>Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>0.4</td>
<td>0.35</td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>

(a) Work out the probability that the spinner will land on 3

Ryan is going to spin the spinner 80 times.

(b) Work out an estimate for the number of times he should expect the spinner to land on 2
7 Reeta has a biased dice.

Each time Reeta rolls the dice, the probability that she will get a six is 0.1

(a) Write down the probability that she will not get a six.

Reeta rolls the dice 50 times.

(b) Work out an estimate for the number of times that she will get a six.
15 Maria has two bags.
   In bag A, there are 5 white counters and 2 red counters.
   In bag B, there are 3 white counters and 2 red counters.

   Maria is going to take at random one counter from bag A and one counter from bag B.
   (a) Complete the probability tree diagram.

   (b) Work out the probability that both counters will be white.

   (c) Work out the probability that exactly one of the counters will be white.
5 A jar contains coloured beads.
   Ajit takes at random a bead from the jar.
   The probability that the bead is yellow is 0.08
   The probability that the bead is pink is 0.1
   The probability that the bead is blue is 0.25

   (a) (i) Find the probability that the bead is yellow or blue.

   (ii) Find the probability that the bead is neither yellow nor pink.

   Ajit replaces the first bead in the jar.
   He then takes at random a second bead from the jar.

   (b) Find the probability that the first bead is yellow and the second bead is blue.

   A second jar contains 100 coloured beads.
   20 of these beads are brown.

   Ajit takes at random a bead from the jar.
   He records the colour of the bead and then returns the bead to the jar.
   He does this 60 times.

   (c) Work out an estimate for the number of times Ajit records a brown bead.
16 Gemma has 9 counters.
Each counter has a number on it.

1 2 3 4 5 6 7 8 9

Gemma puts the 9 counters into a bag.
She takes at random a counter from the bag and does not replace the counter.
She then takes at random a second counter from the bag.

(a) Work out the probability that the number on each counter is an even number.

(b) Work out the probability that the number on the first counter added to the number on
the second counter gives an odd number.

22 Here are 7 cards.
Each card has a number on it.

1 2 2 3 3 3 4

Harry takes at random two cards.

(a) Calculate the probability that the numbers on the two cards are the same.

(b) Calculate the probability that the sum of the numbers on the two cards is 5
3 A bag contains only red counters, blue counters and yellow counters. The number of red counters in the bag is the same as the number of blue counters. Mikhail takes at random a counter from the bag. The probability that the counter is yellow is 0.3 Work out the probability that the counter Mikhail takes is red.

16 Chris and Sunil each take a driving test.

The probability that Chris passes the driving test is 0.9
The probability that Sunil passes the driving test is 0.65

(a) Complete the probability tree diagram.

(b) Work out the probability that exactly one of Chris or Sunil passes the driving test.
13 Jim has a biased coin.
The probability that Jim will throw Heads on any throw is $p$.
Jim throws the coin twice.

(a) Complete the probability tree diagram.
Give your probabilities in terms of $p$.

(b) Find an expression, in terms of $p$, for the probability that Jim will throw two Heads.

Given that $p = 0.8$,
(c) work out the probability that Jim will throw exactly one Head.
May 2015 3H Paper

20 Leonidas has a fair dice.
He throws the dice twice.
(a) Work out the probability that he gets the number 5 both times.

Alicia has a fair dice.
She throws the dice 3 times.
(b) Work out the probability that she gets the number 5 exactly once.

May 2015 3HR Paper

17 Two bags contain discs.
Bag A contains 12 discs.
5 of the discs are red, 6 are blue and 1 is white.
Bag B contains 25 discs.
$n$ of the discs are red and the rest are blue.

James takes at random a disc from Bag A.
Lucy takes at random a disc from Bag B.

Given that the probability that James and Lucy both take a red disc is $\frac{2}{15}$
(i) find the value of $n$, the number of red discs in Bag B.

(ii) Hence calculate the probability that James and Lucy take discs of different colours.
1 A bag contains only red bricks and blue bricks. There is a total of 20 bricks in the bag. The probability that a brick taken at random from the bag will be red is $\frac{2}{5}$. How many blue bricks are there in the bag?

4 Becky has a biased 6-sided spinner. She spins the spinner 25 times. She records the score for each spin. The table shows information about her scores.

<table>
<thead>
<tr>
<th>Score</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

(a) Find her median score.

(b) Work out her mean score.
There are 6 milk chocolates and 4 plain chocolates in a box. Rob takes at random a chocolate from the box and eats it. Then Alison takes at random a chocolate from the box and eats it.

(a) Complete the probability tree diagram.

(b) Work out the probability that there are now exactly 3 plain chocolates in the box.
6. The table shows the probabilities of people in Wales being in blood group O or in blood group A or in blood group AB.

<table>
<thead>
<tr>
<th>Blood group</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>0.44</td>
</tr>
<tr>
<td>A</td>
<td>0.42</td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>AB</td>
<td>0.04</td>
</tr>
</tbody>
</table>

All people in Wales are in exactly one of the blood groups O, A, B or AB.

A person is selected at random from the people in Wales.

(a) Find the probability that this person is in blood group B.

(b) Find the probability that this person is in blood group O or A.

There are 1200 students in Aled’s school.
Aled’s school is in Wales.

(c) Work out an estimate for the number of pupils in Aled’s school who are in blood group AB.

16. When a fair dice is thrown the probability of scoring 6 is \( \frac{1}{6} \)

Arun throws four fair dice.

Work out the probability that he scores 6 with at least one of the four dice.
21 Peter travels to work either by bus or by bike.

The probability that Peter will travel to work by bus on any one day is 0.7
Whenever Peter travels to work by bus, the probability that he will be late is 0.1
Whenever Peter travels to work by bike, the probability that he will be late is 0.05

Peter is going to go to work on Monday and on Tuesday.

Work out the probability that he will be late for work on at least one of these days.
Maisie plays a game.
Each time she plays, she can win a prize of $1 or $5 or $10.
When she does not win one of these prizes, she loses.
The table gives the probability of winning each of the prizes.

<table>
<thead>
<tr>
<th>Prize</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1</td>
<td>0.50</td>
</tr>
<tr>
<td>$5</td>
<td>0.15</td>
</tr>
<tr>
<td>$10</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Maisie plays the game once.

(a) Work out the probability that Maisie loses.

(b) Maisie plays the game 40 times.
(i) Work out an estimate for the number of $5 prizes she wins.

(ii) Work out an estimate for the total value of the prizes she wins.
There are 100 tiles in a bag.
Each tile is marked with a number.
The table shows information about the tiles.

<table>
<thead>
<tr>
<th>Number on tile</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>68</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

Carmen takes at random a tile from the bag.
She records the number on the tile and then replaces the tile in the bag.
Pablo takes at random a tile from the bag.

(a) Work out the probability that Carmen takes a tile with the number 0 or the number 1 and Pablo takes a tile with a number greater than 1

All 100 tiles are in the bag.
Juan takes at random a tile from the bag without replacing it.
He then takes a second tile from the bag.

(b) (i) Work out the probability that the number on each tile is 4

(ii) Work out the probability that the total of the numbers on the two tiles is 2
4 Karen has a spinner.

When the spinner is spun once, the probability that it will land on yellow is $\frac{2}{5}$
Karen spins the spinner 30 times.

Work out an estimate for the number of times the spinner lands on yellow.

8 A box contains toy cars.
Each car is red or blue or black or silver.
Emily takes at random a car from the box.
The table shows the probabilities that Emily takes a red car or a blue car or a black car.

<table>
<thead>
<tr>
<th>Colour of car</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>red</td>
<td>0.20</td>
</tr>
<tr>
<td>blue</td>
<td>0.05</td>
</tr>
<tr>
<td>black</td>
<td>0.15</td>
</tr>
<tr>
<td>silver</td>
<td></td>
</tr>
</tbody>
</table>

(a) Work out the probability that Emily takes a silver car.

Emily puts the car back into the box.
There are 6 blue cars in the box.

(b) Work out the total number of cars in the box.
17 Chaiwat either cycles to work or goes by bus.

On any day that he goes to work, the probability that he cycles is 0.6
When he cycles, the probability that he is late is 0.1
When he goes by bus, the probability that he is late is 0.3

(a) Complete the probability tree diagram.

(b) Calculate the probability that on a day Chaiwat goes to work, he cycles and is late for work.

(c) Calculate the probability that on a day Chaiwat goes to work, he is not late for work.
21 There are 9 counters in a bag.
   There is a number on each counter.
   \[\begin{array}{cccccccc}
   1 & 1 & 2 & 2 & 2 & 3 & 3 & 3 & 3 \\
   \end{array}\]

   Kal takes at random 3 counters from the bag.
   He adds together the numbers on the 3 counters to get his Total.
   Work out the probability that his Total is 6

3 There are 50 marbles in a bag.
   35 of the marbles are brown.

   Otti takes at random a marble from the bag.
   He records the colour of the marble and puts the marble back in the bag.
   He does this 300 times.

   Work out an estimate for the number of brown marbles he takes.
9 Li throws a 6-sided biased dice once.

The table shows the probability that the dice will land on 1, 2, 3, 5 or 6

<table>
<thead>
<tr>
<th>Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>0.15</td>
<td>0.1</td>
<td>0.05</td>
<td></td>
<td>0.2</td>
<td>0.15</td>
</tr>
</tbody>
</table>

(a) Work out the probability that the dice will land on 4

(b) Work out the probability that the dice will land on an odd number.
14 Linford and Alan race against each other in a competition.

If one of them wins a race, he wins the competition.
If the race is a draw, they run another race.

They run a maximum of three races.

Each time they race, the probability that Linford wins is 0.35
Each time they race, the probability that there is a draw is 0.05

(a) Complete the probability tree diagram.

(b) Calculate the probability that Linford wins the competition.
16 In a bag there is a total of 20 coins.

10 coins are 20 cent coins
6 coins are 10 cent coins
4 coins are 5 cent coins

Emma takes at random two of the coins from the bag.

(a) Complete the probability tree diagram.
(b) Work out the probability that Emma takes two 5 cent coins.

(c) Work out the probability that the total value of the two coins is 20 cents or less.

**June 2016 4HR Paper**

15 Naveed has two bags of tiles, bag A and bag B.

There are 10 tiles in bag A.
7 of these tiles are red.
The other 3 tiles are white.

There are 8 tiles in bag B.
5 of these tiles are red.
The other 3 tiles are white.

Naveed takes at random one tile from each bag.

(a) Work out the probability that the tiles are the same colour.

All 18 tiles are put in a box.
Naveed takes at random one tile from the box.
He does not replace the tile.
Naveed then takes at random a second tile from the box.

(b) Work out the probability that both tiles are red.
17. Here is a fair dice.

It has six faces numbered 1, 2, 3, 4, 5 and 6
The dice shows a score of 6

Hari throws the dice three times.

(a) Work out the probability that the sum of the scores is 3

(b) Work out the probability that the dice shows a score of 1 on exactly one of the three throws.
4. A bag contains some shapes.
   Each shape is a circle or a triangle or a square.
   Lewis takes at random a shape from the bag.
   The probability that he will take a circle is 0.3
   The probability that he will take a triangle is 0.1

   (a) Work out the probability that he will take a square.

   (b) Work out the probability that he will take a shape with straight sides.

   Grace takes at random one of the shapes from the bag and then replaces the shape.
   She does this 160 times.

   (c) Work out an estimate for the number of times she will take a circle.
14. There are 9 beads in a bag.
4 of the beads are red.
3 of the beads are white.
2 of the beads are blue.
Sanjay takes at random a bead from the bag and does not replace it.
He then takes at random a second bead from the bag.

(a) Complete the probability tree diagram.

(b) Calculate the probability that one of Sanjay’s beads is red and his other bead is blue.
19.

Ashok has six coins in his pocket.
He has one 5 cent coin, two 10 cent coins and three 20 cent coins.
He takes at random a coin from his pocket.
He records its value and puts the coin back into his pocket.
He then takes at random a second coin from his pocket and records its value.

(a) Calculate the probability that he takes two 20 cent coins.

(b) Calculate the probability that the second coin he takes has a higher value than the first coin he takes.

3. A spinner can land on red or blue or yellow.
The spinner is biased.
The probability that it will land on red is 0.5
The probability that it will land on blue is 0.2

(a) Imad spins the spinner once.
Work out the probability that it will land on yellow.

(b) Janet spins the spinner 30 times.
Work out an estimate for the number of times the spinner will land on blue.
16. A bag contains 3 white discs and 1 black disc.
John takes at random 2 discs from the bag without replacement.

(a) Complete the probability tree diagram.

\[
\begin{array}{c|c|c}
\text{First disc} & \text{Second disc} \\
\hline
\frac{3}{4} & \text{White} \\
\frac{1}{4} & \text{Black}
\end{array}
\]

(b) Find the probability that both discs are white.

(c) All the discs are now replaced in the bag.
Pradeep takes at random 3 discs from the bag without replacement.

Find the probability that the disc left in the bag is white.
8. James throws a biased dice once.
The table shows all the possible scores and their probabilities.

<table>
<thead>
<tr>
<th>Score</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>2</td>
<td>0.3</td>
</tr>
<tr>
<td>3</td>
<td>0.1</td>
</tr>
<tr>
<td>4</td>
<td>0.1</td>
</tr>
<tr>
<td>5</td>
<td>0.05</td>
</tr>
<tr>
<td>6</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Find the probability that the score is more than 3

20. Each time Jeni plays a computer game the probability that she will win is \( \frac{2}{3} \)

Jeni plays the computer game 3 times.

Calculate the probability that Jeni will win

(a) all 3 games,

(b) exactly 2 out of the 3 games.
4. A bag contains some beads.  
The colour of each bead is red or green or blue.  
Binita is going to take a bead at random from the bag.  
The probability that she will take a red bead is 0.4  
The probability that she will take a green bead is 0.5

(a) Work out the probability that she will take a blue bead.

(b) There are 80 beads in the bag.  
Work out the number of red beads in the bag.
16. There are 10 chocolates in a box. 
7 of the chocolates have soft centres and 3 of the chocolates have hard centres. 
Kyla takes at random a chocolate from the box and eats it. 
She then takes at random another chocolate from the box and eats it.

(a) Complete the probability tree diagram.

First chocolate  
\[ \frac{7}{10} \]  soft centre  
\[ \ldots \ldots \] hard centre  
Second chocolate

(b) Calculate the probability that at least one of the chocolates Kyla eats has a hard centre.

May 2009 3H Paper

4. A bag contains 10 coloured beads.
Ella is going to take at random a bead from the bag.
She says, “The probability that I will take a red bead is 0.35”

Explain why Ella is wrong.
You must show working to justify your answer.
17. Here are five counters.
    Each counter has a number on it.

    1  3  3  3  5

    Layla puts the five counters in a bag.
    She takes two counters at random from the bag without replacement.

    Calculate the probability that

    (i) both counters will have the number 3 on them,

    (ii) the sum of the numbers on the two counters will be 6
6. The diagram shows a biased spinner, numbered 1, 2, 3 and 4

When the spinner is spun, the number on which it lands is the score.

The table shows the probabilities for three of the scores.

<table>
<thead>
<tr>
<th>Score</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>2</td>
<td>0.1</td>
</tr>
<tr>
<td>3</td>
<td>0.4</td>
</tr>
</tbody>
</table>

The spinner is spun once.
Work out the probability that the score is

(a) 4

(b) an odd number.
14. A coin is biased so that when it is thrown, the probability that it will show Heads is \( \frac{3}{4} \).

The coin is thrown twice.

(a) Complete the probability tree diagram.

First throw

\[
\begin{array}{c}
\text{Heads} \\
\frac{3}{4}
\end{array}
\]

Second throw

(b) Work out the probability that the coin shows Tails on both throws.
3. Jamila spins this 5-sided spinner 50 times. The table shows information about her scores.

<table>
<thead>
<tr>
<th>Score</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
</tr>
</tbody>
</table>

(a) Work out the mean score.

(b) Jamila is going to spin the spinner once more. Find an estimate of the probability that her score will be

(i) 4

(ii) 1 or 3

(c) Is the spinner fair? Yes ☐ ☐ No

Tick (✓) the appropriate box.

Give a reason for your answer.
15. There are 9 counters in a bag.
   7 of the counters are red and 2 of the counters are white.

   Ajit takes at random two counters from the bag without replacement.

   (a) Calculate the probability that the two counters are red.

   (b) Calculate the probability that the two counters have different colours.

Nov 2008 4H Paper

5. When Peter goes to work, he can be early or on time or late.
   The probability that he will be early is 0.2
   The probability that he will be late is 0.1

   (a) Work out the probability that he will be on time.

   (b) Peter will go to work 20 times next month.
       Work out an estimate for the number of times he will be early next month.
11. A coin is biased.

When it is thrown, the probability that it shows Heads is $\frac{2}{3}$

Dorcas throws the coin twice.

(a) Complete the probability tree diagram.

(b) Find the probability that the coin shows Heads both times.

(c) Find the probability that the coin shows Heads at least once.
2. A bag contains red discs, black discs and white discs. The number of black discs is equal to the number of white discs. Selina is going to take a disc at random from the bag. The probability that she will take a red disc is 0.6

Work out the probability that she will take a black disc.

16. Here are 9 cards. Each card has a number on it.

\[
\begin{array}{cccccc}
20 & 21 & 22 & 23 & 24 & 25 \\
26 & 27 & 28 & & & \\
\end{array}
\]

Lee takes a card at random. He records the number which is on the card and replaces the card. He then takes a second card at random and records the number which is on the card.

(a) Calculate the probability that he will take two even numbers.

(b) Calculate the probability that he will take two numbers with a sum of 43
5. The table shows information about the number of letters delivered to Manjit’s house each day.

<table>
<thead>
<tr>
<th>Number of letters delivered</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.2</td>
</tr>
<tr>
<td>1 to 5</td>
<td>0.5</td>
</tr>
<tr>
<td>6 to 10</td>
<td>0.2</td>
</tr>
<tr>
<td>More than 10</td>
<td>0.1</td>
</tr>
</tbody>
</table>

(a) There are 30 days in June.
Calculate an estimate of the number of days in June on which the number of letters delivered is 0

(b) Find the probability that on a particular day the number of letters delivered is 6 or more.
13. Each time Astrid takes a shot at goal, the probability that she will score is $\frac{1}{3}$.

Astrid takes two shots.

(a) Complete the probability tree diagram.

```
  First shot   Second shot
     Goal       No Goal
         \frac{1}{3}
```

(b) Calculate the probability that Astrid scores at least 1 goal.
8. Jim fires an arrow at a target.

The table shows all the possible outcomes and the probabilities of three of these outcomes.

The table shows all the possible outcomes and the probabilities of three of these outcomes.

<table>
<thead>
<tr>
<th>Result</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bull’s Eye</td>
<td></td>
</tr>
<tr>
<td>Inner Ring</td>
<td>0.3</td>
</tr>
<tr>
<td>Outer Ring</td>
<td>0.4</td>
</tr>
<tr>
<td>Miss</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Work out the probability that Jim’s arrow will hit either the Bull’s Eye or the Inner Ring.
17. Each time Nikos has a shot at goal, the probability that he will score a goal is \( \frac{3}{4} \).

Nikos takes two shots.

(a) Complete the probability tree diagram.

\[
\begin{array}{ccc}
\text{First shot} & \text{Second shot} \\
\frac{3}{4} & \text{Goal} & \text{Miss} \\
\end{array}
\]

(b) Calculate the probability that Nikos will score

(i) two goals,

(ii) exactly one goal.

Nikos now takes another three shots.

(c) Calculate the probability that he will score exactly 1 goal or exactly 2 goals.
21. A coin is biased so that the probability that it shows heads on any one throw is $p$. The coin is thrown twice.

The probability that the coin shows heads exactly once is $\frac{8}{25}$

Show that $25p^2 - 25p + 4 = 0$

Nov 2007 4H Paper

24.

In Box A, there are 3 black counters and 2 white counters. In Box B, there are 2 black counters and 1 white counter.

Farah takes at random a counter from Box A and puts it in Box B. She then takes at random a counter from Box B.

Work out the probability that the counter she takes from Box B will be a black counter.
10. Here are five shapes.

- □
- □
- □
- □
- ◆

Four of the shapes are squares and one of the shapes is a circle.
One square is black.
Three squares are white.
The circle is black.
The five shapes are put in a bag.

(a) Jasmine takes a shape at random from the bag 150 times.
   She replaces the shape each time.

   Work out an estimate for the number of times she will take a white square.

(b) Alec takes a shape at random from the bag and does not replace it.
   Bashir then takes a shape at random from the bag.

   Work out the probability that

   (i) they both take a square,

   (ii) they take shapes of the same colour.
18. A fair, 6-sided dice has faces numbered 1, 2, 3, 4, 5 and 6. When the dice is thrown, the number facing up is the score. The dice is thrown three times.

(a) Calculate the probability that the total score is 18

(b) Calculate the probability that the score on the third throw is exactly double the total of the scores on the first two throws.

May 2007 4H Paper

8. A bag contains some marbles. The colour of each marble is red or blue or green or yellow.

A marble is taken at random from the bag. The table shows the probability that the marble is red or blue or green.

<table>
<thead>
<tr>
<th>Colour</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>0.1</td>
</tr>
<tr>
<td>Blue</td>
<td>0.2</td>
</tr>
<tr>
<td>Green</td>
<td>0.1</td>
</tr>
<tr>
<td>Yellow</td>
<td></td>
</tr>
</tbody>
</table>

(a) Work out the probability that the marble is yellow.

(b) Work out the probability that the marble is blue or green.
The probability that the marble is made of glass is 0.8

(c) Beryl says “The probability that the marble is green or made of glass is 0.1 + 0.8 = 0.9”

Is Beryl correct? ........................................

Give a reason for your answer.

8. Four girls run in a race.
   The table shows the probability that each of three girls will win the race.

<table>
<thead>
<tr>
<th>Name</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angela</td>
<td>0.5</td>
</tr>
<tr>
<td>Beverley</td>
<td>0.1</td>
</tr>
<tr>
<td>Caris</td>
<td>0.3</td>
</tr>
<tr>
<td>Danielle</td>
<td></td>
</tr>
</tbody>
</table>

Calculate the probability that either Caris or Danielle will win the race.
9. There are 48 beads in a bag. 
Some of the beads are red and the rest of the beads are blue. 
Shan is going to take a bead at random from the bag. 
The probability that she will take a red bead is $\frac{3}{8}$.

(a) Work out the number of red beads in the bag.

Shan adds some red beads to the 48 beads in the bag. 
The probability that she will take a red bead is now $\frac{1}{2}$.

(b) Work out the number of red beads she adds.

22. Younis spins a biased coin twice. 
The probability that it will come down heads both times is 0.36

Calculate the probability that it will come down tails both times.
14. Here is a biased spinner.

When the pointer is spun, the score is 1 or 2 or 3 or 4
The probability that the score is 1 is 0.3
The probability that the score is 2 is 0.6

Hajra spins the pointer once.

(a) Work out the probability that

(i) the score is 1 or 2

(ii) the score is 3 or 4

Nassim spins the pointer twice.

(b) Work out the probability that

(i) the score is 1 both times,

(ii) the score is 2 exactly once.
16. The sides of a fair six-sided dice are numbered from 1 to 6.
The dice is thrown three times.
Find the probability that it shows a 1 at least twice.

Nov 2005 3H Paper

19. The probability that Gill will walk to school on Monday is $\frac{3}{5}$.
If Gill walks to school on Monday, the probability that she will walk to school on
Tuesday is $\frac{1}{5}$.
If she does not walk to school on Monday, the probability that she will walk to school on
Tuesday is $\frac{7}{10}$.

(a) Calculate the probability that she walks to school on Monday but not on Tuesday.

(b) Calculate the probability that she walks to school on at least one of the two days.
7. Here is a four sided spinner.

Its sides are labelled 1, 2, 3 and 4

The spinner is biased.
The probability that the spinner lands on each of the numbers 1, 2 and 3 is given in the table.

<table>
<thead>
<tr>
<th>Number</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.25</td>
</tr>
<tr>
<td>2</td>
<td>0.25</td>
</tr>
<tr>
<td>3</td>
<td>0.1</td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

The spinner is spun once.

(a) Work out the probability that the spinner lands on 4

(b) Work out the probability that the spinner lands on either 2 or 3
13. A bag contains 1 red disc, 2 blue discs and 3 green discs.

Xanthe chooses a disc at random from the bag. She notes its colour and replaces it. Then Xanthe chooses another disc at random from the bag and notes its colour.

(a) Complete the probability tree diagram showing all the probabilities.
(b) Calculate the probability that both discs are the same colour.

(c) Calculate the probability that neither disc is red.

May 2005 3H Paper

5. The probability that a person chosen at random has brown eyes is 0.45
   The probability that a person chosen at random has green eyes is 0.12
   (a) Work out the probability that a person chosen at random has either brown eyes or
green eyes.

250 people are to be chosen at random.
(b) Work out an estimate for the number of people who will have green eyes.
19. The diagram shows six counters.

\[ \text{B} \quad \text{A} \quad \text{N} \quad \text{A} \quad \text{N} \quad \text{A} \]

Each counter has a letter on it.

Bishen puts the six counters into a bag. 
He takes a counter at random from the bag.
He records the letter which is on the counter and replaces the counter in the bag.
He then takes a second counter at random and records the letter which is on the counter.

(a) Calculate the probability that the first letter will be A and the second letter will be N.

(b) Calculate the probability that both letters will be the same.

May 2005 4H Paper

6. In a club, \( \frac{1}{2} \) of the members are left-handed and \( \frac{1}{4} \) of the members wear glasses.
   A member is chosen at random.

   Stavros says “The probability that this member is left-handed or wears glasses is \( \frac{3}{4} \)”
   Is he correct?

   Explain your answer.
18. In order to start a course, Bae has to pass a test. He is allowed only two attempts to pass the test.

   The probability that Bae will pass the test at his first attempt is \( \frac{2}{5} \).

   If he fails at his first attempt, the probability that he will pass at his second attempt is \( \frac{3}{4} \).

(a) Complete the probability tree diagram.

   **First attempt**

   - Pass
   - ........
   - ........
   - Fail

   **Second attempt**

(b) Calculate the probability that Bae will be allowed to start the course.
13. A bag contains 4 black discs and 5 white discs.

Ranjit takes a disc at random from the bag and notes its colour. He then replaces the disc in the bag. Ranjit takes another disc at random from the bag and notes its colour.

(a) Complete the probability tree diagram to show all the possibilities.

First disc                      Second disc

[Diagram of tree diagram with branches for black and white, with probabilities]

(b) Calculate the probability that Ranjit takes two discs of different colours.
20. A box contains 7 good apples and 3 bad apples.

Nick takes two apples at random from the box, without replacement.

(a) (i) Calculate the probability that both of Nick’s apples are bad.

(ii) Calculate the probability that at least one of Nick’s apples is good.

Another box contains 8 good oranges and 4 bad oranges.

Crystal keeps taking oranges at random from the box one at a time, without replacement, until she gets a good orange.

(b) Calculate the probability that she takes exactly three oranges.

4. Here is a 4-sided spinner.

![Spinner Diagram]

The sides of the spinner are labelled 1, 2, 3 and 4.
The spinner is biased.
The probability that the spinner will land on each of the numbers 1, 2 and 3 is given in the table.

<table>
<thead>
<tr>
<th>Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>0.2</td>
<td>0.1</td>
<td>0.4</td>
<td></td>
</tr>
</tbody>
</table>

(a) Work out the probability that the spinner will land on 4.
Tom spun the spinner a number of times. 
The number of times it landed on 1 was 85 

(b) Work out an estimate for the number of times the spinner landed on 3 

Nov 2004 4H Paper 

23. There are 10 beads in a box. 
   \( n \) of the beads are red. 
   Meg takes one bead at random from the box and does not replace it. 
   She takes a second bead at random from the box. 
   The probability that she takes 2 red beads is \( \frac{1}{3} \). 

   Show that \( n^2 - n - 30 = 0 \)
4. The diagram shows a pointer which spins about the centre of a fixed disc.

When the pointer is spun, it stops on one of the numbers 1, 2, 3 or 4. The probability that it will stop on one of the numbers 1 to 3 is given in the table.

<table>
<thead>
<tr>
<th>Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>0.35</td>
<td>0.16</td>
<td>0.27</td>
<td></td>
</tr>
</tbody>
</table>

Magda is going to spin the pointer once.

(a) Work out the probability that the pointer will stop on 4.

(b) Work out the probability that the pointer will stop on 1 or 3.

Omar is going to spin the pointer 75 times.

(c) Work out an estimate for the number of times the pointer will stop on 2.
14. Here is a fair 3-sided spinner.

Its sides are labelled 1, 2 and 3 as shown.

(a) Aisha is going to spin the spinner twice.
   Work out the probability that it will land on 1 both times.

(ii) Work out the probability that the spinner will land on an odd number 3 times.

(iii) Work out the probability that the spinner will land on an even number exactly once.

(b) Harry is going to spin the spinner 3 times.

   (i) Complete the probability tree diagram.
(ii) Work out the probability that the spinner will land on an odd number 3 times.

(iii) Work out the probability that the spinner will land on an even number exactly once.
Bill and Jo play some games of table tennis.
The probability that Bill wins the first game is 0.7
When Bill wins a game, the probability that he wins the next game is 0.8
When Jo wins a game, the probability that she wins the next game is 0.5

The first person to win two games wins the match.
(a) Complete the probability tree diagram.

(b) Calculate the probability that Bill wins the match.