

**SESSION 11: PROBABILITY****Key Concepts**

Without realising it we make use of probability just about every day. We say there is a chance that it might rain today, or I will probably go out for supper tonight.

Probabilities are expressed in three different ways:

- Common fractions
- Decimal fractions
- Percentage.

It is important to remember that however the probability is expressed, the smallest value is always 0 and the biggest value is always 1.

**X-planation****1. CALCULATING PROBABILITY**

- When doing probability calculations, all the possible ways in which the calculation could work are called the outcomes.
- The specific outcome that you are looking for is called an event.
- Probability =  $\frac{\text{Number of ways the event can occur}}{\text{Total number of possible outcomes}}$

Example:

In a box of pencils there are 5 yellow, 3 green, 5 blue and 7 red. Calculate the probability that you will pick a

- a) Yellow pencil
- b) Yellow or red pencil

**2. WAYS TO CALCULATE THE NUMBER OF OUTCOMES****a) Tree diagrams**

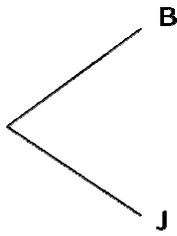
A tree diagram is a visual representation of all the possible outcomes. Each branch of the tree provides all the possible outcomes for that particular event.

Example

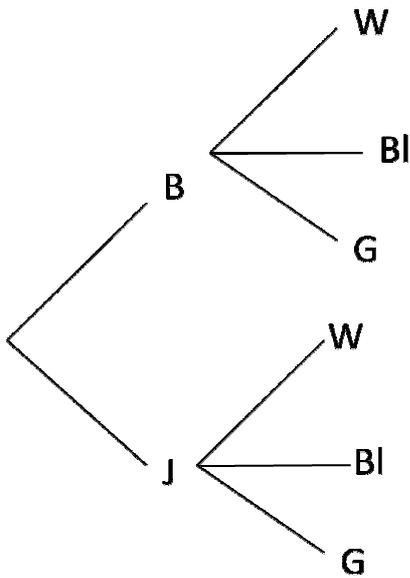
When you get dressed in the morning you have the following options: two pairs of pants; Black pants (B) or Jeans (J), Three different shirts; White (W), Blue (Bl) or Green (G) and two pairs of shoes: Takkies (T) or Sandals (S).

When drawing the tree diagram we look at each event on its own.

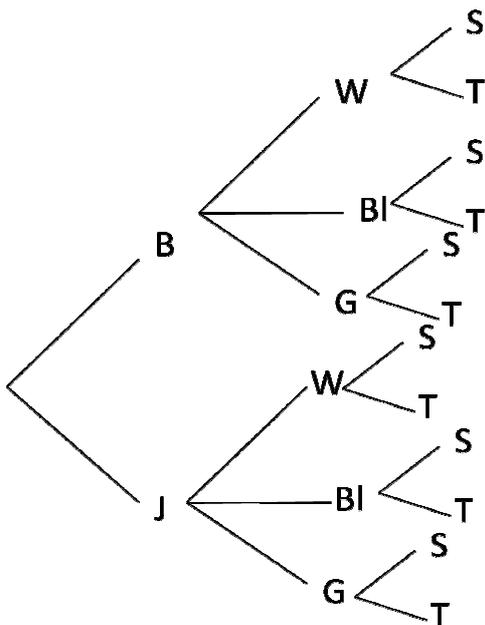
We start with the pants.



Next we look at the shirts. Whether we choose black pants or jeans, we still have three choices of shirts.



Finally, we look at the last event.



The number of end branches is the number of different outcomes, in this case 12.

**b) Contingency table**

These tables are used to record the relationship between two or more categories. It is usually set up in rows and columns with the rows indicating one category and the columns indicating the other category.

Example:

The possible outcomes of throwing two dice.

	1	2	3	4	5	6
1	1 1	2 1	3 1	4 1	5 1	6 1
2	1 2	2 2	3 2	4 2	5 2	6 2
3	1 3	2 3	3 3	4 3	5 3	6 3
4	1 4	2 4	3 4	4 4	5 4	6 4
5	1 5	2 5	3 5	4 5	5 5	6 5
6	1 6	2 6	3 6	4 6	5 6	6 6

You can see in this case that there are 36 possible outcomes.

**3. KINDS OF EVENTS**

**a) Mutually exclusive events**

When it is impossible for events to occur at the same time, in other words the probability of one thing happening or the other, we add the probability of each event.

Example

What is the probability of a die landing on 3 or 6?

**b) Independent events**

When the occurrence of one event does not affect the occurrence of another event, the events are independent of each other; we multiply the probabilities of each event.

Example

What is the probability of throwing a 6 on a die and heads on a coin.

**4. REPLACING OR NOT REPLACING**

When dealing with any probability it is important to know whether once the first event has occurred, the item in the set is no longer part of the outcomes or whether it has rejoined the set.

Example

If a bag contains 12 balls made up of 4 red, 6 blue and two green, and if a red ball is drawn randomly and not replaced in the bag, the total number of balls becomes 11 before the next ball is randomly chosen.

## X-ample Questions

### Question 1

Express each of the following probabilities as:

- i) A common fraction (do not simplify the fraction)
  - ii) A decimal fraction
  - iii) A percentage
- a) A jar has 12 blue marbles, 21 red marbles and 17 green marbles. What is the probability of selecting a red marble? (3)
  - b) What is the probability of not selecting a red marble? (6)
  - c) What is the probability of selecting two red marbles without replacing the first marble selected? (6)

### Question 2

A box of chocolates is randomly selected from a production line to check to see if any of the chocolates are faulty. Each box contains 12 chocolates with soft-centres and 8 with hard-centres. Two chocolates are randomly selected from the box and are tested to see if they have any faults.

- a) Draw a tree diagram to show all the outcomes indicating the probabilities on the branches of the tree. (5)
- b) Calculate the probability of selecting two soft-centered chocolates. (2)
- c) Calculate the probability of selecting a soft-centred and a hard-centred chocolate (not in any particular order). (3)

### Question 3

A survey was done at the local shopping mall to determine how many males and how many females actually enjoy shopping. Use the contingency table of the survey results given below to answer the following questions.

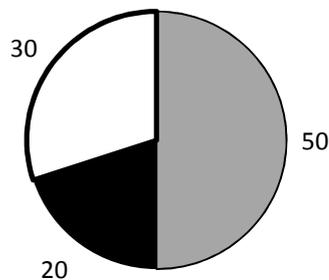
	Enjoy Shopping	Do not enjoy shopping	Totals
Males	115	212	327
Females	372	101	473
Totals	487	313	800

- a) If we select someone at random, what is the probability that they will be female? (2)
- b) If we select someone at random, what is the probability that they will be a male who does not enjoy shopping? (2)
- c) If 70 people were selected from the sample, how many of them could we expect to be females who do not enjoy shopping? (5)

#### Question 4

Christian goes off to a funfair with his buddies, Stefan and Edoardo. There they find a game where they can make R500 quickly. The game is as follows:

A circular dartboard is divided into segments as shown in the diagram below. The colour white makes up 30% of the board, black makes up 20% and grey makes up 50% of the board.



The board is spun around on a pivot point so that there is no way the boys can aim for a specific colour. The boys each get a dart to throw at the board. Christian has the first throw, Stefan the second and Edoardo throws his dart last.

In order to win R500 the three darts must hit the following colours (in any order): white and grey, or black and grey.

What is the probability that the boys are going to win R500? (8)

#### X-ercise

##### Question 1

- a) The probability that event A will occur is 0,2 and the probability that event B will occur is 0,6. The probability that both A and B will occur is 0,12. Are events A and B independent of each other? Explain your answer. (2)
- b) A study was done about the airing of a particular television programme. 150 men and 100 women took part in the survey

The table below shows the results of the survey:

	<b>Men</b>	<b>Women</b>	<b>Total</b>
Enjoyed the programme	60	(1)	130
Did not enjoy the programme	(2)	30	(3)
Total	150	100	(4)

- i) Calculate the unknown values (1, 2, 3 and 4) in the table. (4)
- ii) Is a person's preference for the programme dependent on gender? Use relevant calculations to support your answer. (4)
- iii) What is the probability that a person chosen at random enjoyed the programme? (2)
- c) Patience has just got her driver's licence. She wants to buy a motor car and has narrowed down her options to the following:
- Model: VW Polo or Toyota Yaris  
Type: Sedan or Hatch-back  
Colour: White, black or red
- i) Draw a tree-diagram to show all the possible combinations Patience has for her car. (6)
- ii) Patience does not have any preferences and there is an equal probability that she will choose any of the options above.
- a) What is the probability that she will choose a red car? (2)
- b) What is the probability that she will choose a VW Polo hatchback? (2)