PROBABILITY (PART 1)

Niveau(x) concerné(s):	Première
Notions abordées :	Vocabulaire de probabilité, équiprobabilité et arbres
Nombre de séances :	séances :
Séquence préparée par : ***Sources***	*Jean-Philippe Perret* et Marina Digeon - Nrich , TES, - http://www.mathgoodies.com/lessons/vol6/conditional.html

Descriptif des séances :

document pré-requis : Vocabulaire à étudier à la maison en vue de prendre la parole lors d'une débat : intro BD

Séance 1: **diaporama "Probability lesson Marina.ppt"**
- ***"unit 1 – vocabulary"***
- "**unit 2 – equally likely outcomes.odt"**

A partir de cette séance : en début d'heure " standard route 1 "

DM Probability and statistics Project

Séance 2 : Tree diagram + conditional probability
- Standard route 1 (diaporama)
- document : "**unit 3 – tree diagram.doc**"

Before we enter the strange world of probability...

...we need to start by learning some of the special language involved in probability. (For starters we're going to call it chance because probability is a bit of a mouthful.)

There is also one very simple but vital sum that we need and then by the end of this chapter you'll be ready for some of the strangest stuff you'll ever come across.

The main word is probably probably

The first job is to make sure we know what we're talking about. As chance comes up a lot in everyday life there are lots of different ways of describing it. For instance, all these questions are asking the same thing:

- What is the probability of Pongo McWhiffy turning up?
- What are the chances of Pongo McWhiffy turning up?
- What is the likelihood of Pongo McWhiffy turning up?
- What are the odds on Pongo McWhiffy turning up?
- What are the prospects of Pongo McWhiffy turning up?
- What's the risk of Pongo McWhiffy turning up?

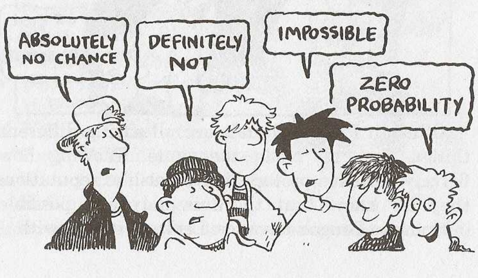
And before we wonder too hard about it, here he is!

As ever, he's going to try his luck with the terribly lovely Veronica Gumfloss, so let's watch and enjoy a truly heartwarming tale of love, passion and romance.

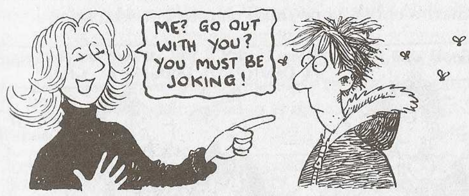
As Pongo debates the outcome of this extraordinarily dangerous suggestion, we'll take this opportunity to develop our language skills.

Although Pongo's friends are all saying different things, they all mean the same. Knowing how fiercely Veronica protects her saint-like reputation, they all know that there is only one possible outcome to Pongo's advance. Let's get it over with.

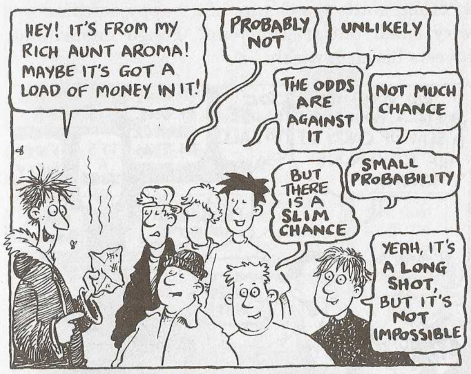
Once again, take note of the profound observations provided by Pongo's ever-supportive chums:



And let's see Veronica's reaction:



So far then, we've seen how to describe things that definitely will happen, and things that definitely will not. But suddenly Pongo finds an old unopened birthday card covered in fluff and old sweet papers in his anorak pocket.



All of a sudden nobody is certain! They think that the envelope probably won't contain any money, but this is where the fun starts. As soon as the word "probably" turns up, we are talking about chance. In this case there's only a very small chance but who knows…

Here we're seeing some choice expressions that often occur when somebody has "beaten the odds" – in other words the chance of a happy outcome was very small but it "came up". Pongo immediately invests his cash wisely.

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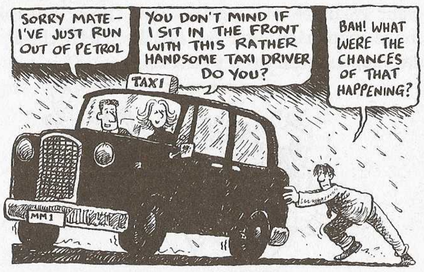
This is exciting stuff! Will Pongo's newfound wealth buy him a place in Veronica's heart? Nobody can guess at the outcome – in fact the kid who says "it's a toss up" is saying the situation is similar to tossing a coin which is just as likely to land on heads as it is tails. But today Pongo is in luck because fate takes a hand.

It looks good, and in fact – yes! – Veronica is getting into the taxi, but…



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Have a look at the statements below, and decide whether the following events are: **certain**, **likely**, **very likely**, **evens** (neither likely or unlikely), **unlikely**, **very unlikely** or **impossible**.

- You buy a lottery ticket and win the jackpot.
- You toss a coin and get heads.
- Christmas will fall on 25 December this year.
- You grow another nose.
- It will rain in the first week of December.

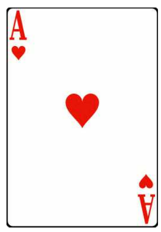
Basic vocabulary

1 : Playing cards : A complete set of cards is called a pack or deck

- 52 cards in total (+ 2 jokers that are removed) or 32 cards (no 2's,3's,4's, 5's or 6's)
- Suits:

- Cards in each suit :
- Picture Cards :

- Ace High or Low :



Task 1 : Answer these questions, using full sentences
For example: How many cards in a pack? *There are 52 cards in a pack*

1) How many red cards in a pack?

2) How many 2's in a pack?

3) How many picture cards in a suit?

4) How many picture cards in the pack?

5) How many 1's in a pack?

6) How many Queens of Hearts in a pack?

7) How many cards with numbers on them in a pack?

Task 2 : Selecting a single card from a full pack of playing cards (no jokers), what is:
p(5 of spades) =

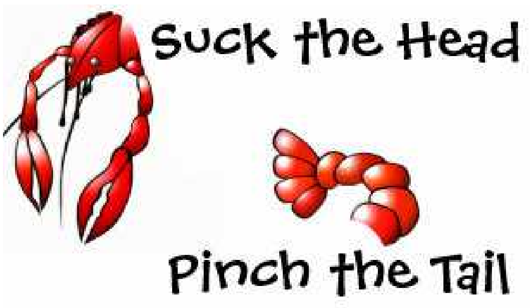
p(jack) =
p(heart) =
p(picture card) =

Create your own question

2: Tossing a coin :

Coin flipping or coin tossing is the practice of throwing a coin in the air to choose between two possible outcomes

when a coin is tossed, there are 2 possible outcomes :



CHANCE

Things that happen are called **<u>events</u>**. There are many events that you can be sure about :

- You are **<u>certain</u>** that the sun will set today.
- It is i**<u>mpossible</u>** for you to grow to be 10 feet tall.

There are also many events that you cannot be sure about.

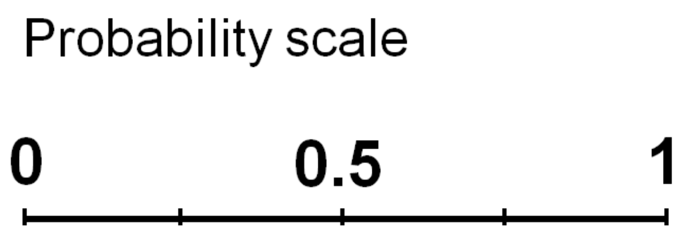
- You cannot be sure that you will get a letter tomorrow.
- You cannot be sure that it will be sunny next friday.

You sometimes talk about the **<u>chance</u>** that something will happen. If Paul is a good chess player, you may say, « Paul has *<u>good chance</u>* of winning the game ». If Paul is a poor player, you may say , « It is very *<u>unlikely</u>* that Paul will win ».

PROBABILITY

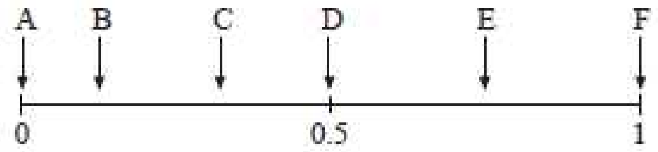
Sometimes a number is used to tell the chance of something happening. This number is called a **<u>probability</u>**. It is a number from 0 to 1.The closer a probability is to 1, the more likely it is that an event will happen.

- A probability of 0 means the event is *impossible*. The probability is 0 that you will live to the age of 150.
- A probability of 1 means the event is *certain*. The probability is 1 that the sun will rise tomorrow.
- A probability of $\frac{1}{2}$ means that,in the long run, an event will happen about 1 in 2 times (half of the time, or 50% of the time).The probability that a tossed coin will land heads up is $\frac{1}{2}$. We often say that the coin has a « 50-50 chance » of landing heads up.



<u>Task 1 (at home) :</u>

The following probability line shows the probabilities of 6 events, A, B, C, D, E and F.



(a) Which event is *certain* to occur?

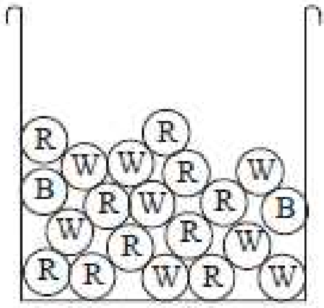
(b) Which event is the *most unlikely* to occur, but is *not impossible*?

(c) Which event is *impossible*?

(d) Which events are *more likely* to occur than C?

<u>Task 2 (at home) :</u>

The diagram shows a jar containing *red* (R), *blue* (B) and *white* (W) balls. One of the balls is taken at random.



(a) What colour is this ball *most likely* to be?

(b) What colour is this ball *least likely* to be?

<u>Task 3 :</u>

In a game you are given one of the following cards at random:

(a) Are you more likely to be given an *odd* number or an *even* number?

(b) Are you more likely to be given a 7 than a 5 ?

(c) Are you more likely to be given a number *greater* or *less* than 5?

Unit 2 : Equally likely outcomes

Finding the probability of an ***event*** is easy if all the outcomes are ***equally likely***. Follow these steps :

1) List all the possible ***outcomes***.
2) Look for any outcomes that will make the event happens. These outcomes are called ***favorable outcomes.***
3) Count the number of possible outcomes. Count the number of favorable outcomes.

The probability of the event is : $\dfrac{number\ of\ \ favorable\, outcomes}{number\ of\ \ possible\, outcomes}$.

Task 1 (at home): Tina rolls a fair dice 300 times. How many times would she expect to obtain :
a) 6
b) an even number
c) a number greater than 1
d) a number less than 3
e) a 2 or a 5

Task 2 : Amy, Beth, Carol , Dave, Edgar, Frank, George and Hank are on camping trip. They decide to choose a leader. Each child writes his or her name on a card. The cards are put into a paper bag and mixed. One card will be drawn, at random, and the child whose name is drawn will become leader. Find the probability that a girl will be selected.

Task 3 : Six red, four green and three blue blocks are placed in a bag. The blocks are the same, excepted for color. One block is drawn without looking.
Find the probability of each event

1. Draw a green block
2. Draw a block that is not green
3. Draw a blue block
4. Draw a red block
5. Draw a block that is not red
6. Draw any block

Task 4 (at home) : Give some situations which are equally likely and some which are not equally likely.

Unit 3 : Tree diagrams

Tree diagrams allow us to see all possible outcomes of events and calculate their probabilities. Each branch in a tree diagram represents a possible outcome for an event.

If two events are independent, then the outcome of one has no effect on the outcome of the other. For example, if we toss two coins, getting heads with the first coin will not affect the probability of getting heads with the second.

Tree diagrams are very helpful for analysing dependent events. A tree diagram allows you to show how each possible outcome of one event affects the probabilities of the other events.

Tree diagrams are not so useful for independent events since we can just multiply the probabilities of separate events to get the probability of the combined event :

- When two events , A and B, are **<u>independent</u>** : **P (A and B) = P(A) x P(B)**

- When two events, A and B, are **<u>mutually exclusive</u>** : **P(A or B) = P(A) + P(B)**

So if you already know that events are independent, it is usually easier to solve a problem without using tree diagrams. But if you are uncertain about whether events are independent or if you know that they are not, you should use a tree diagram.

Remember :

- **The sum of probabilities for any set of branches should always be 1**
- **We multiply horizontally and add vertically the probabilities.**

<u>Task 1 :</u> A drawer contains 4 red socks, 6 blue socks and 8 green socks.

One sock is taken, at random, from the drawer **<u>and not replaced</u>**. Another sock is then taken, at randon, from the drawer.

Find the probibility that both socks are the same color.

<u>Task 2 :</u> In a game of chess, a player can either win, draw or lose.
The probability that Sophie wins any game of chess is 0.5
The probability that Sophie draws any game of chess is 0.2

Sophie plays two games of chess, the result of the both games are independent . Work out the probability that Sophie will win the both games.

<u>Task 3 :</u> If it rains on a given day, the probability that it rains the next day is $\frac{1}{3}$. If it does not rain on a given day, the probability that it rains the next day is $\frac{1}{6}$. The probability that it will rain tomorrow is $\frac{1}{5}$. What is the probability that it will rain the day after tomorrow? Draw a tree diagram of all the possibilities to determine the answer.