

FACT FILE
Converting to Binary Number

When counting in decimal, we use the number 0, 1, 2, 3, 4, 5, 6, 7, 8, 9... but what happens after 9? We place a 1 to the left, to give us 10. And after 99? We place a 1 again to the left to give 100.

In decimal we can see that the place value increases by powers of 10 i.e. 1,10,100,1000, ...

In binary we do something similar, but rather than the ten digits we have in decimal, we have two. **So we have 0,1 then 10. We have 0,1,10,11 then 100.** And so on. In binary the place values increase by powers of 2 i.e. 1, 2, 4, 8, 16, 32,



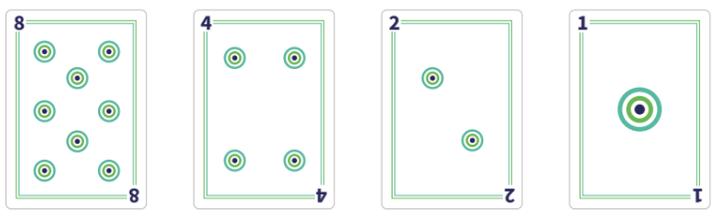
For example, the binary number 101 is the number 5 in decimal:

Place	8	4	2	1
Binary number	1	0	1	1
	4	0	1	5

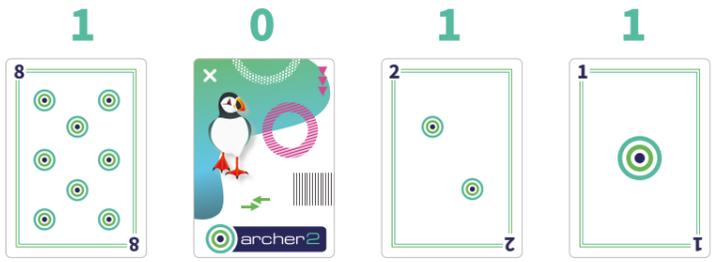
Cracking conversion cards

Can you use the playing cards to convert binary numbers to decimal numbers and visa-versa?

Lay the playing cards out with increasing powers of 2:



For each binary number provided, turn the card over if it is a 0. E.g. for the binary number 1011, we would have:



Add up the remaining numbers: 8+2+1 = 11. The binary number 1011 is the decimal number 11. See if you can work out the decimal numbers for the following binary numbers using the cards provided.

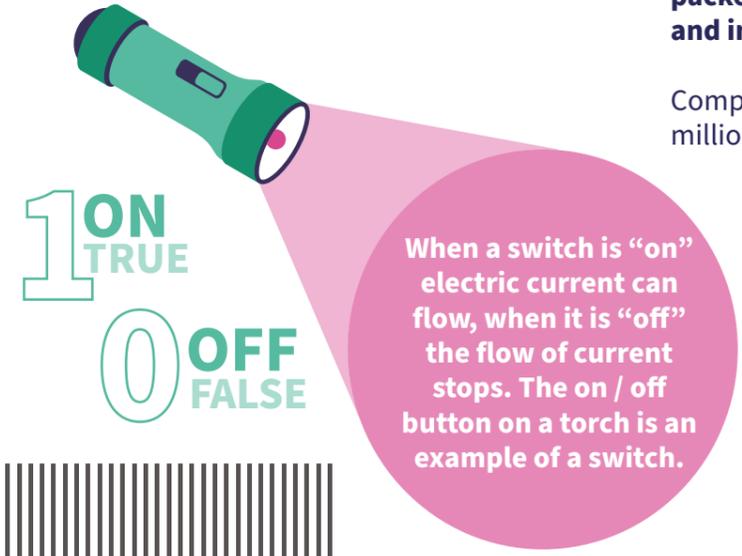
Binary Number	Decimal Number / Letter
1	
10	
111	
1011	

Brilliantly Beautiful Binary Numbers

FACT FILE
Switches and Binary Numbers

Just like your own memory, which remembers things like where the biscuits are kept and how to open a packet of crisps, a computer memory holds the data and instructions needed by the computer.

Computers, including computer memory, are built from millions and millions of transistors, microscopic switches.



1 ON TRUE
0 OFF FALSE

When a switch is "on" electric current can flow, when it is "off" the flow of current stops. The on / off button on a torch is an example of a switch.

These on/off states can be represented using the binary number system, which has only two symbols "1" and "0".

We are used to using the decimal numbering system within our daily lives. We can however convert decimal numbers to binary numbers.

We can represent characters in binary by giving each character a unique decimal number and then converting this decimal number to binary.

In fact, all the data that we want a computer to process, numbers, characters and instructions, can be converted to binary numbers and stored in memory in this way.

ACTIVITY

Crack the binary code using a binary wheel

A binary wheel allows you to quickly convert characters and decimal numbers to binary numbers. Use the wheel to work out your age or your initials, filling in the table below may help you.

Decimal Number / Letter	Binary Number

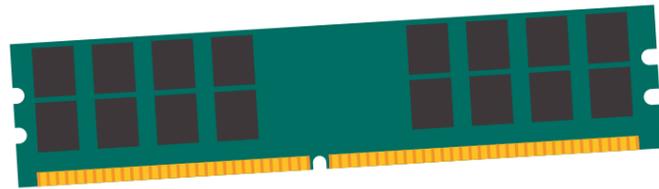


ACTIVITY

FACT FILE
Computer Memory

In computer memory, the transistors store single binary digits, called bits. These are usually stored in groups of 8 called a byte.

Bits and bytes are the basic building block of computer memory and bytes are used to define the size of memory e.g. in megabytes (MB) or gigabytes (GB).



Use the binary wheel to create a binary keyring or bracelet. Use the beads provided to create your binary numbers – use one colour of bead to represent “0” and another to represent “1”. You will need a third colour of bead to separate your binary numbers.

ACTIVITY

Create a bracelet or keyring with your very own binary number code

STAGE 1

Select a button, any button will do!



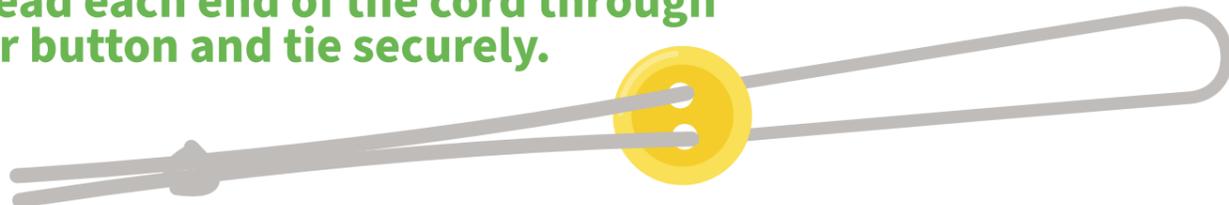
STAGE 2

Select a piece of cord and cut to length.



STAGE 3

Thread each end of the cord through your button and tie securely.



STAGE 4

Decide on the word, letter(s) or decimal number you want to create

Don't make it too long, 2 or 3 letters is plenty. Our example creates a bracelet with the letters UOE, for the University of Edinburgh.

Using the binary wheel, we can find the binary number for each of the letters:

Letter	Binary Number
U	0101 0101
O	0100 1111
E	0100 0101

Use the binary wheel to complete the table for your number / letter

Letter	Binary Number

STAGE 5

Select three different colours of beads.

Thread the beads on to your cord, being careful to follow the pattern of your binary numbers. Use your third colour of bead to separate the numbers. For example, our bracelet for UOE looks like:



STAGE 6

Once you have finished threading your beads, tie a knot in the end to hold the beads in place and create a loop to go over the button.

