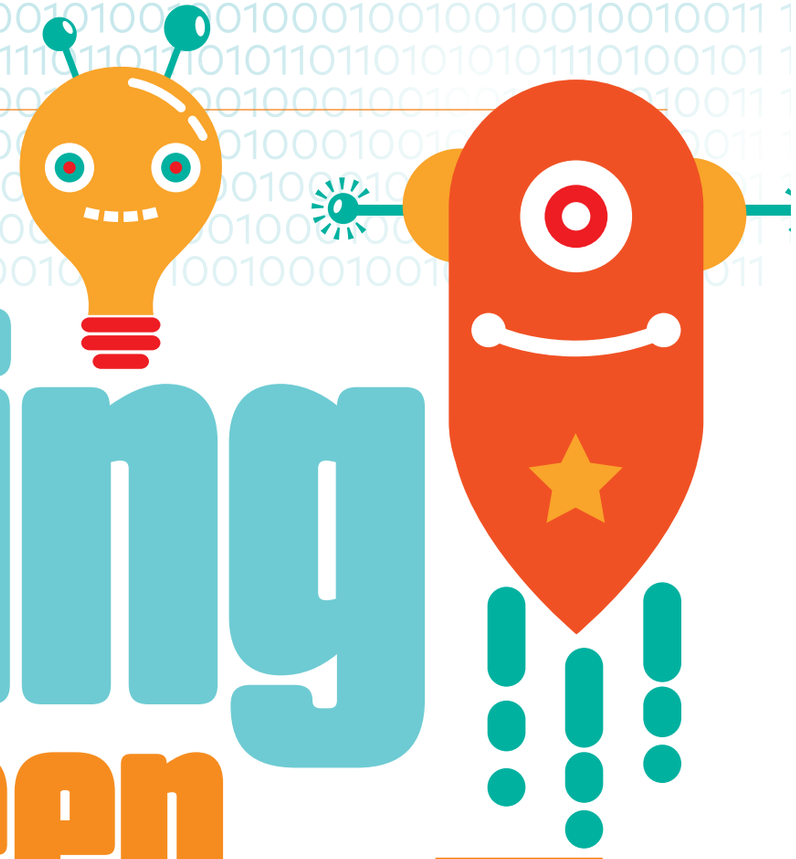


Practise coding off-screen

Get to grips with computer coding using just a pencil and paper.

PIXEL PERFECT

Using numbers from 1 to 256 to indicate the level of red, green and blue in each pixel, a computer can produce 16.8 million colours.

Decode a hidden image

Follow the number clues to reveal a coded character.

What you need

- A pencil or felt-tip pen
- A piece of paper

How does it work?

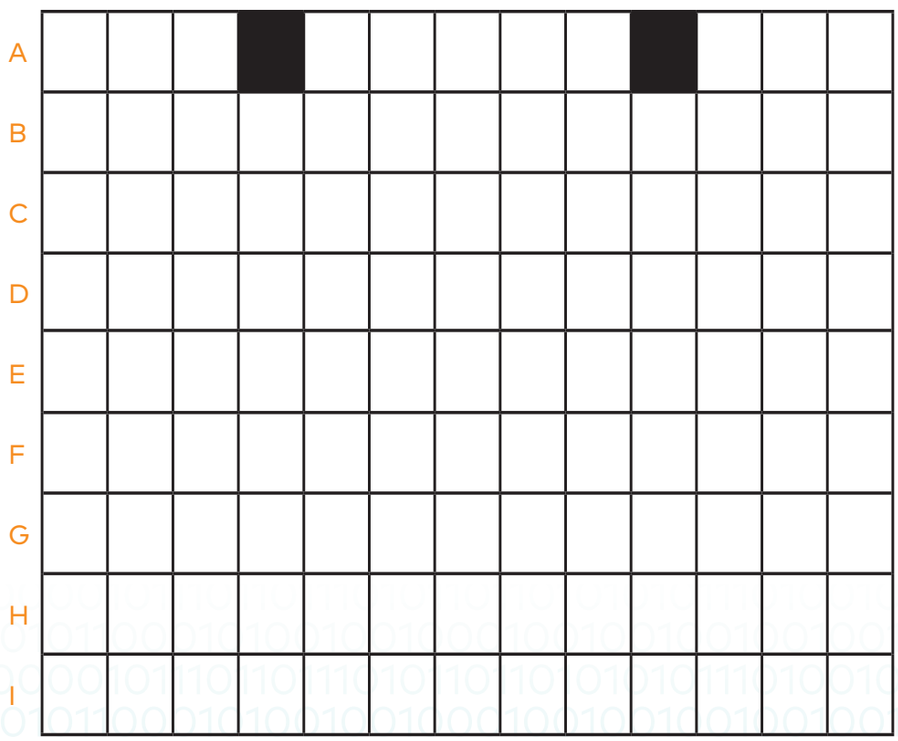
This activity uses a type of coding called run-length coding. This method is often used to reduce the size of images – an idea called data compression. Digital images are broken up into tiny blocks called pixels that form a grid just like this one but often with millions of blocks. Using a pattern of code – instead of recording the value of every single pixel – drastically reduces the space that files take up on a device and makes them faster to transmit. Run-length coding works well for simple pictures with only a few colours. You can use the grid to make your own picture codes and test them on your friends and family.

1 Use this grid, or make a copy on a separate sheet of paper.

2 Fill in the grid using the code below. Each number in the code tells you how many squares to leave blank (white) or fill in (black). Begin counting in the top left-hand corner. Start with white and then alternate between white and black. The first row has been filled in for you.

A: 3, 1, 5, 1,
B: 4, 1, 3, 1
C: 4, 5
D: 3, 7
E: 2, 2, 1, 3, 1, 2
F: 1, 11
G: 1, 1, 1, 1, 5, 1, 1, 1
H: 1, 1, 1, 1, 5, 1, 1, 1
I: 4, 2, 1, 2

3 Check your answer on page 58.



Program a human robot

Turn a friend or sibling into a bot and take control of their movements.

What you need

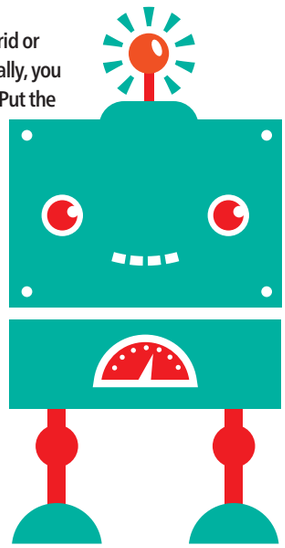
- A friend or family member
- Outdoor chalk (optional)
- A ball
- Paper
- Pencil or pen

How does it work?

Computer programs consist of simple instructions carried out in an organised way. Programmers must calculate how a program is going to work, and create instructions to achieve their goals. They then test the programs, modifying any instructions that haven't worked as they'd hoped. Be sure to let your robot run (complete) the full program before you tweak it, so you can see what changes need to be made.

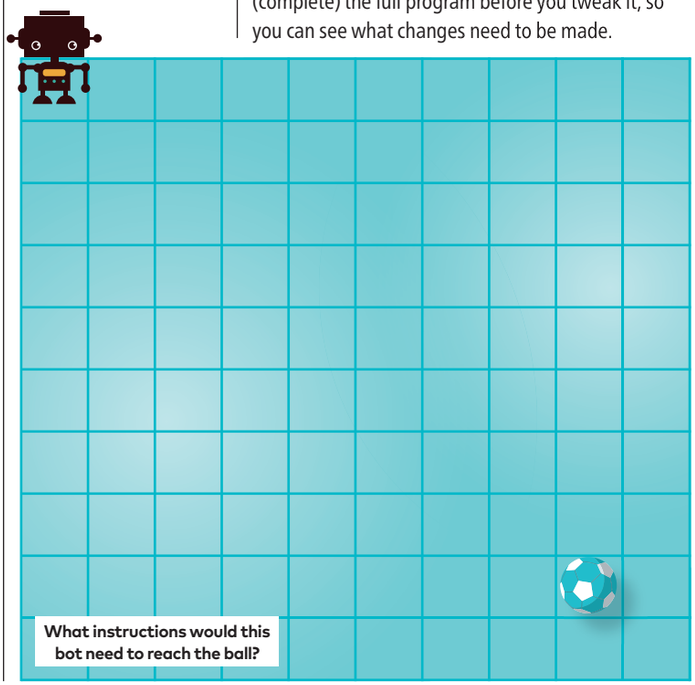
1 Ask a friend, sibling or grown-up if they will be your robot (being sure to follow your local lockdown rules). As a robot, they can only move following your written instructions.

2 Find an area with paving stones that form a grid or create your own grid using outdoor chalk. Ideally, you want a square grid with 6–10 rows and columns. Put the ball in one square and get your robot to stand anywhere else on the grid.



3 Now, write down a program for your robot to reach the ball, using pen and paper. Write F for a forward step, B to go backwards, and L or R for turning left or right. Once you've finished, show your robot the sequence of instructions.

4 Your robot must now follow the program without making any changes to it. Do they end up at the ball? If not, you'll need to "debug" your program – this means finding out where it went wrong. Keep going until your robot succeeds. Then switch places and try adding extra obstacles and barriers to get around.



What instructions would this bot need to reach the ball?

Become a supercomputer

This hangman-style game reveals the inner workings of messaging software.

What you need

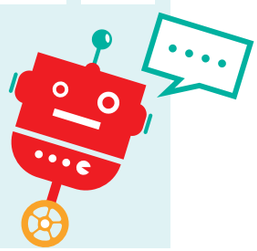
- Someone to play with (you can also play on a video call)
- Several sheets of paper
- Pen or pencil

How does it work?

This activity shows how much information you can accurately guess from limited data – for example, if a word starts with BL, you can be pretty sure the next letter is a vowel. As more data is revealed, it's easier to guess what comes next. This principle is used by a wide range of software, including autocomplete features on smartphones and web browsers.

I LOVE READING ABOUT DIFFERENT ANIMALS

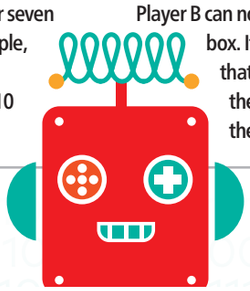
I	-	L	O	V	E	-	R	E	A
A		T		T			B		
Y		E					S		
O									



1 This game needs two players: A and B. Player A comes up with a secret sentence that player B will try to guess. The sentence should be six or seven words long and make sense. In this example, we used "I love reading about different animals". Both players should now draw 10 boxes along the top of a sheet of paper.

2 Player A fills in the boxes with the first 10 letters, punctuation marks and spaces in their sentence. Player B can now start guessing the letter in the first box. If they get a letter right, they can fill in that box and move on to the next one. If they guess wrong, write the letter under the box (to keep a record) and try again.

3 You'll soon find that it's easy to guess the remaining letters of some words, whereas others are trickier. In our example, the word "reading" might be easy to guess once you have the first three letters. Add extra boxes and keep going until the full sentence has been guessed. Now switch roles and try again with a new sentence.



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