grok academy

Digital Technologies @ School

Unplugged activities for students

PRIMARY STUDENTS

Robot Dance (F-2)
Messy Drawer (F-2)
We're going on a computer hunt (F-2)
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DT Laundry (F-2, 3-4)
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Pirate Treasure Hunt (3-4, 5-6)
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Wombot Carrot Hunt (5-6)
Maze Escape (5-6)
Cracking a Code (5-6)
Unscrambling a secret message (5-6)

Developed by the Australian Computing Academy, the University of Sydney
Find out more: aca.edu.au, get help: help@aca.edu.au

This page is for

Teachers

Digital Technologies @ School
Unplugged activities for students

This activity is for: Years F-2, 3-4

Robot Dance

With thanks to the South Australian Commissioner for Children and Young People, who developed this activity with the Australian Computing Academy for the Commissioner's Digital Challenge.

This activity teaches the importance of clear instructions to computers.

This activity is targeted towards students in **years F to 4**. The activity is expected to take **1 to 2 hours**.

Students will construct a set of instructions for them or someone else to follow. These instructions are made up of image **representations** of movements and sounds (claps).

This activity will teach students that robots and computers follow instructions that are given to them and that those instructions will be followed by the robot or computer precisely and in order from start to finish. Accurate instructions are important. To accurately instruct dance moves, you can either perform them for someone to follow or represent them somehow, in this case we are representing the dance moves as pictures.

Representing the world around us occurs constantly. Symbols, images, and written language are all **representations** of the world. Emoji representing emotions and objects, symbols on our clothes tell us how to wash them, even our names representing us! Learning to associate representations with the world around them and how accuracy in representation is important are also learning outcomes of this activity.

You will need…

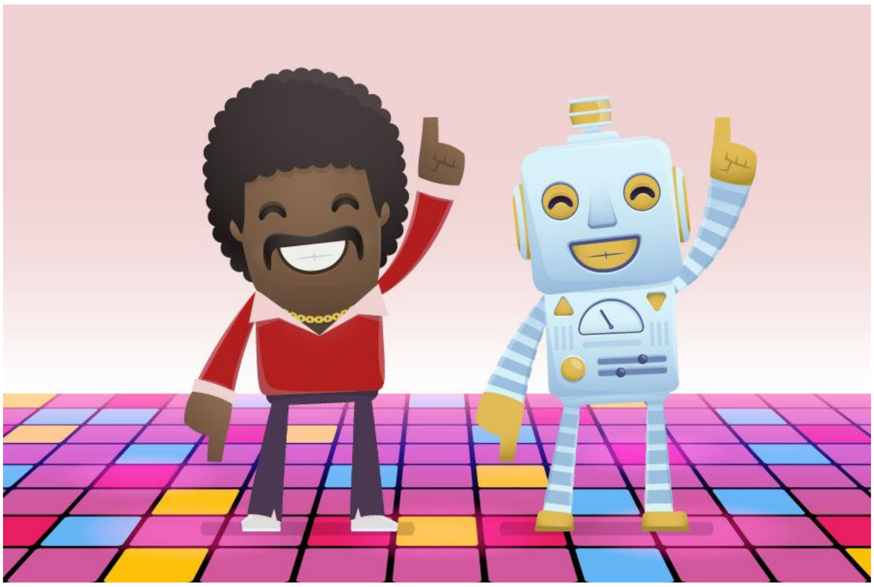
- 2 printed sets of dance moves (pages 3-5)
- 1 dance card (either printed from page 5 or a blank sheet of paper).
- For the extension option, a Cody Buttons torso and body parts printout. (Page 6)
- Craft supplies, coloured pens, scissors and glue to decorate the Cody Buttons robot and attach it to the dance card.

Getting started:

- You will make your very own dance routine for our robot, Cody Buttons.
- Choose the pictures of Cody doing different dance moves and put them in the order you like best.
- Stick them to your Dance Card.
- Share the Dance Card with other people so they can do your dance!

Step by step

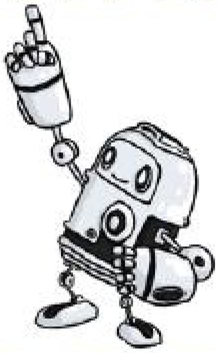
1. Print the pages in this pack to suit your needs.
2. Cut out the dance moves – depending on the age of the students, they might like to do this themselves.
3. Tell students they can create their own dance routine by putting together a set of instructions. They will do this by sticking the 6 moves from the print outs onto their base card (use glue or other method) in the order they want it performed to create their unique 'dance card'.
4. Students can further personalise their set of instructions by colouring or adding further craft materials to their 'dance card'.
5. Put on some of your student's favourite music.
6. Students can perform their dance themselves or present their 'dance card' to another student to perform the moves. Students are able to present their work by displaying their dance card if there are limitations on their movement.

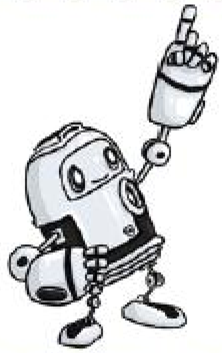


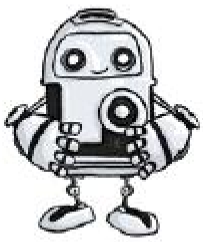
This page is for
Students

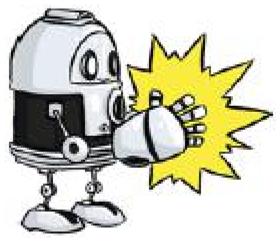
Robot Dance

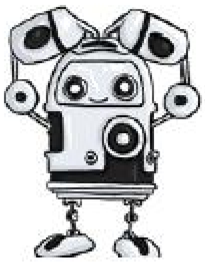
Create Cody Button’s own dance: print out and cut up these moves.

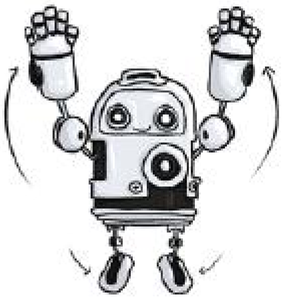










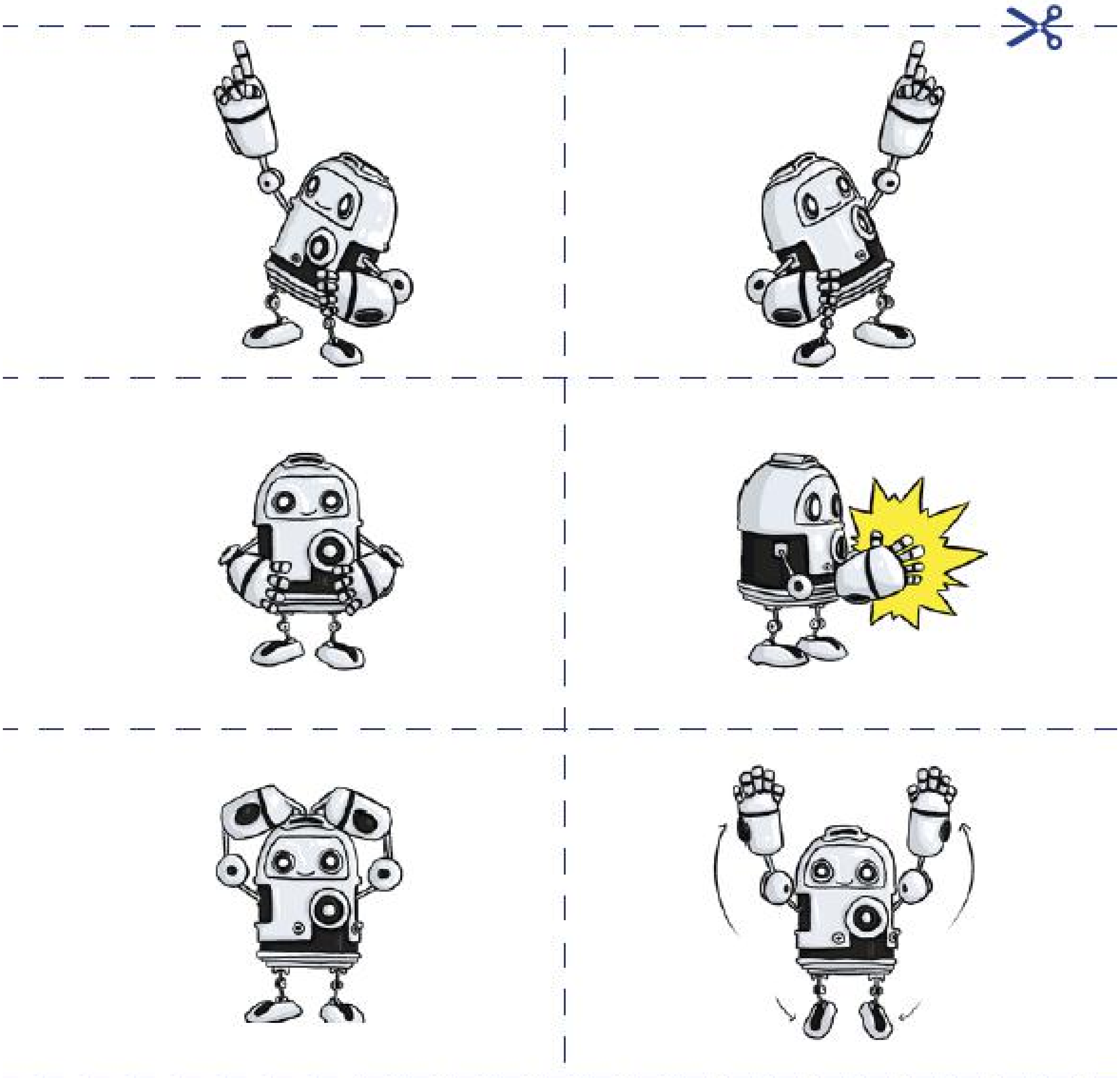


Robot Dance

Create Cody Button's own dance.

This page is for

Students



Robot Dance

Glue your dance moves onto this dance card.

This page is for Students

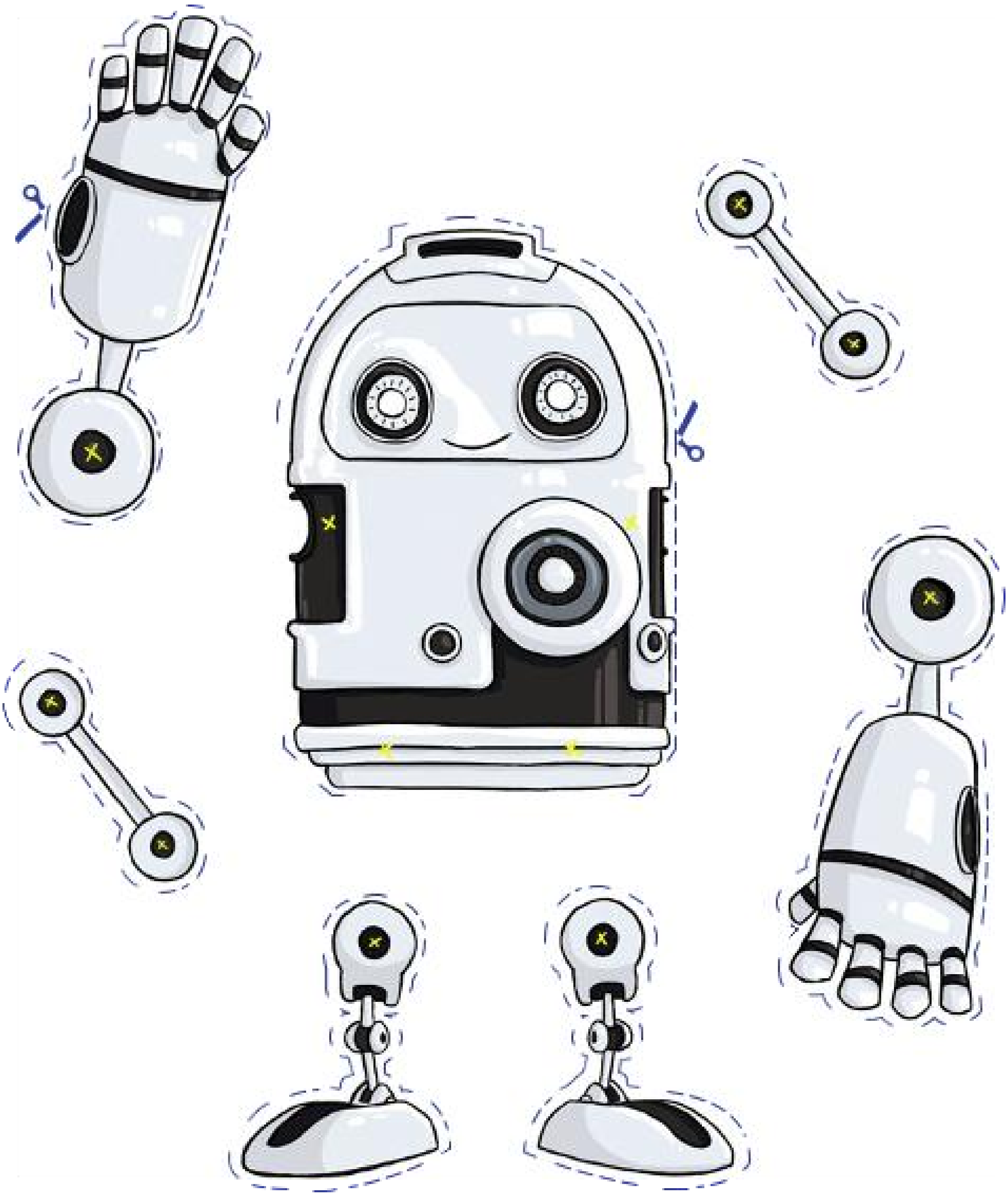
1	2
3	4
5	6

Robot Dance

This page is for

Students

Use this page if you want to create a Cody Buttons with moveable arms and legs.



This page is for

Teachers

Want more?

Here are some further activities, online resources, assessment ideas and curriculum references.

Adapting this activity

As an extension, provide children with a template or multiple templates of Cody with detachable limbs that can be attached with butterfly clips to create custom dance moves.

If students would like to create multiple repeats of the same move, they could write the number of repetitions on the card. You could even create discs with different numbers on them to add to each move as an additional part of the Challenge.

Keep the conversation going

- Was it easy or difficult to create a dance for Cody?
- When others performed your dance, did they do it in the way you expected?
- Are there other ways you could create a dance routine for someone else? (Students consider other ways - maybe making a video?)
- How many dances could you create with these 6 moves? The same moves, in different orders, can create many different dances.
- Where else have you seen instructions with pictures? (Building blocks? Recipes?)
- How would you like to improve your dance?
- If students did the extension activity using a Cody with moveable limbs, could a person actually do that dance move?

Keep learning

Dancing is an example of a small set of instructions that are repeated in different combinations.

Students can explore using a set of instructions to control a wombot (similar to wombats, but programmable!) , in an online activity available here: cmp.ac/blockly-wombot

Students can explore other symbols around the house by completing our DT Laundry unplugged activity: cmp.ac/laundrySchool

For teachers creating a portfolio of learning or considering this task for assessment

Ask students to create a six step dance and submit their dance card, and if possible, demonstrate their dance.

Linking it back to the Australian Curriculum: Digital Technologies

Data representation: Recognise and explore patterns in data and represent data as pictures, symbols and diagrams (ACTDIK002 - see cmp.ac/datarep)

Refer to aca.edu.au/curriculum for more curriculum information.

This page is for

Digital Technologies @ School
Unplugged activities for students

Teachers

This activity is for: Years F-2

Mystery drawer - tidy up and reveal secrets

This activity teaches data collection
This activity introduces Data Collection and Representation (Digital Technologies key concepts) by having students count, sort and explore items around the house.

This activity is targeted towards students in **years F to 2** and is expected to take up to **60 minutes.**

You will need…
Some messy drawers!
Optional textas and craft materials.

Getting started:
Every classroom has a messy drawer. Maybe it's full of craft supplies, pens, bits of string or lego. Let's see what we can find (while we tidy up, hopefully!)

Print pages 2-4 for students.

Step by step
Choose a messy drawer, check there's nothing sharp or hazardous before you start. Students can tip out (or carefully remove) the items. Now they sort the contents, how they are sorted is up to the student. For example, sorting by shape, purpose, size, colour.

They should record the number of each type on the grid on the next page (there is a finished example on page 5). When they are finished, they mix the items up and sort a second time using a different criteria. And then sort a third time!

Students now choose their two favourite sorting criteria and represent their sorting visually using a graph or drawing for example.

Finally, put everything away (tidily, of course.)

This page is for

Students

Mystery drawer - tidy up and reveal secrets

Find patterns, sort and count things in a messy drawer.

What's in the drawer?	
My drawer is in the: (eg Classroom)	
It is a place for: (eg Pens and pencils)	
Round 1: I'm sorting by: (eg item)	
This is what I found: (eg blue pens, 3)	

Round 2: I’m sorting by:	
This is what I found:	
Round 3: I’m sorting by:	
This is what I found:	

This page is for

Students

Mystery drawer - tidy up and reveal secrets

Find patterns, sort and count things in a messy drawer.

Step 2

Choose your favourite way of sorting.

Present your data below, in two different ways. You can use colour, pictures or numbers. (Use another sheet of paper if you like.)

Step 3: What's the silliest way you could sort the drawer?

Step 4: What's an interesting fun fact to share about what's in the drawer?

This page is for

Teachers

Mystery drawer - tidy up and reveal secrets

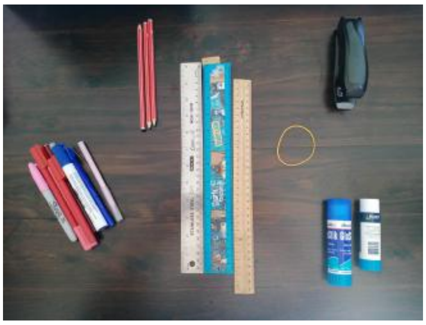
Find patterns, sort and count things in a messy drawer.

Here's a picture of what was in the stationery drawer. To keep it manageable, we've chosen around 20 items. We've picked three ways to sort items, and recorded them in the worksheet. If students have a phone handy they can take pictures of this activity too.

What's in the drawer?	
My drawer is in the:	Science Room
It is a place for:	Pens and pencils
Round 1: I'm sorting by:	What they are
I found:	
Pencils	3
Pens	9
Rubber bands	1

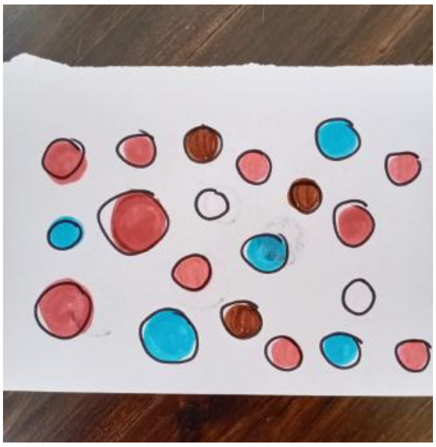
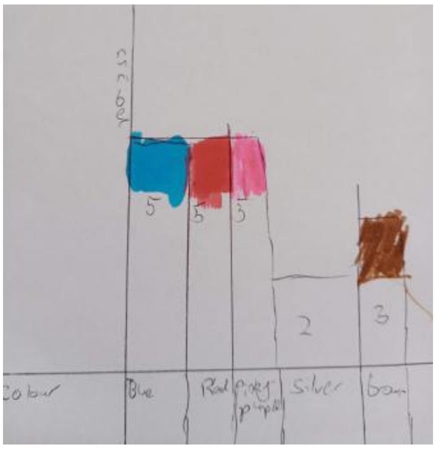
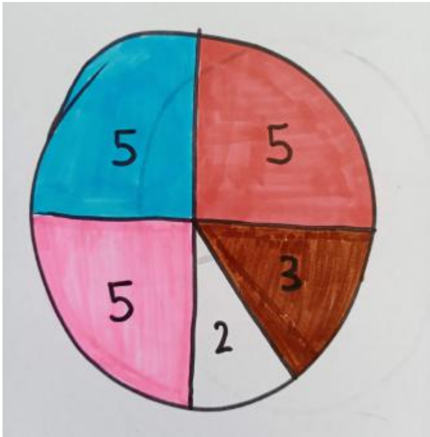
Rulers	4
Glue sticks	2
Stapler	1
Round 2: I'm sorting by:	Colour
I found:	
Blue things	5
Red things	5
Pinky purple things	5
Things with silver on them	2
Brown things	3
Round 3: I'm sorting by:	What they are made of
I found:	
Plastic things	12
Wooden things	5
Metal things	2
Rubber things	1

Images of each way of sorting the drawer contents.

Round 1	Round 2	Round 3
		

Step 2

Choose your favourite way of sorting. Show your data below, in two different ways. (Students might use tally marks, numbers, pictures, blocks of colours or other ways to present their findings.) Here are some examples.

This page is for

Teachers

Want more?

Here are some further activities, online resources, assessment ideas and curriculum references.

Adapting this activity

Older students could explore presenting their work in histograms or pie charts.
Older students could work with larger sets of items.
This activity could be adapted for the wider school by having students compare different classrooms, the library, or even explore the school grounds and collect leaves, twigs etc in various locations.

Keep learning

Explore ways that we can represent information in our unplugged drawing activity: cmp.ac/pig-dogSchool

Investigate creating sets of instructions in a fun unplugged activity with our favourite friend, the Wombot: cmp.ac/wombot

An interesting reflection question is to ask what the sorting activity taught students about the drawer contents, which they might not have otherwise realised. (An example is that in the third example above we can see that most of our stationery is made of plastic.)

For teachers creating a portfolio of learning or considering this task for assessment

Ask students to submit their worksheets from this activity, with photos if possible.

Linking it back to the Australian Curriculum: Digital Technologies

Data Representation
Recognise and explore patterns in data and represent data as pictures, symbols and diagrams (ACTDIK002)
cmp.ac/datarep

Data Collection + Data Interpretation
Collect, explore and sort data, and use digital systems to present the data creatively (ACTDIP003)
cmp.ac/dataint

Refer to aca.edu.au/curriculum for more curriculum information.

Digital Technologies @ School
Unplugged activities for students

This activity is for: Years F-2

We're going on a computer hunt

This activity teaches students about what a computer is, and how many are around us

We are surrounded by computers and digital systems, often without realizing it. Some digital systems are obvious - a laptop computer, or a smartphone. Others are much harder to find, because they don't look like a computer. A washing machine, air conditioner or fridge that adapts to different situations probably contains a computer. Cars are full of digital systems to help us with navigation, safety, entertainment and driving.

Digital systems are made of components. On a laptop, components include a screen, keyboard, power supply, processor, and storage. Digital systems also consist of both hardware and software. Hardware is what you can see and touch (or physical parts inside the device) while software is the code that gives the device instructions to perform a specific task.

Digital systems are created to do a specific task: for example, a smart washing machine is really good at washing clothes, but terrible at toasting bread. A laptop lets us view, change, and create data. You wouldn't expect it to keep food cold though! In this activity students explore digital systems around them and consider the components that make those systems, and what the purpose of the system is.

It is expected to take up to 1 hour. Students can do the activity in the classroom, school library, or at home (or all 3 places, to compare the computers in each place.)

Getting started (read this with your students):

Have you ever thought about how many computers are in your home or classroom? Computers come in all shapes and sizes and do lots of different things. We call them digital systems. We're going to explore and find digital systems around our home/classroom. Once we find them we'll figure out what they do!

Step by step

Follow the instructions on the following pages with your students.
Print pages 2 to 5 for students to use a worksheet. Pages 6 and 7 contain more information for teachers.

This page is for

Students

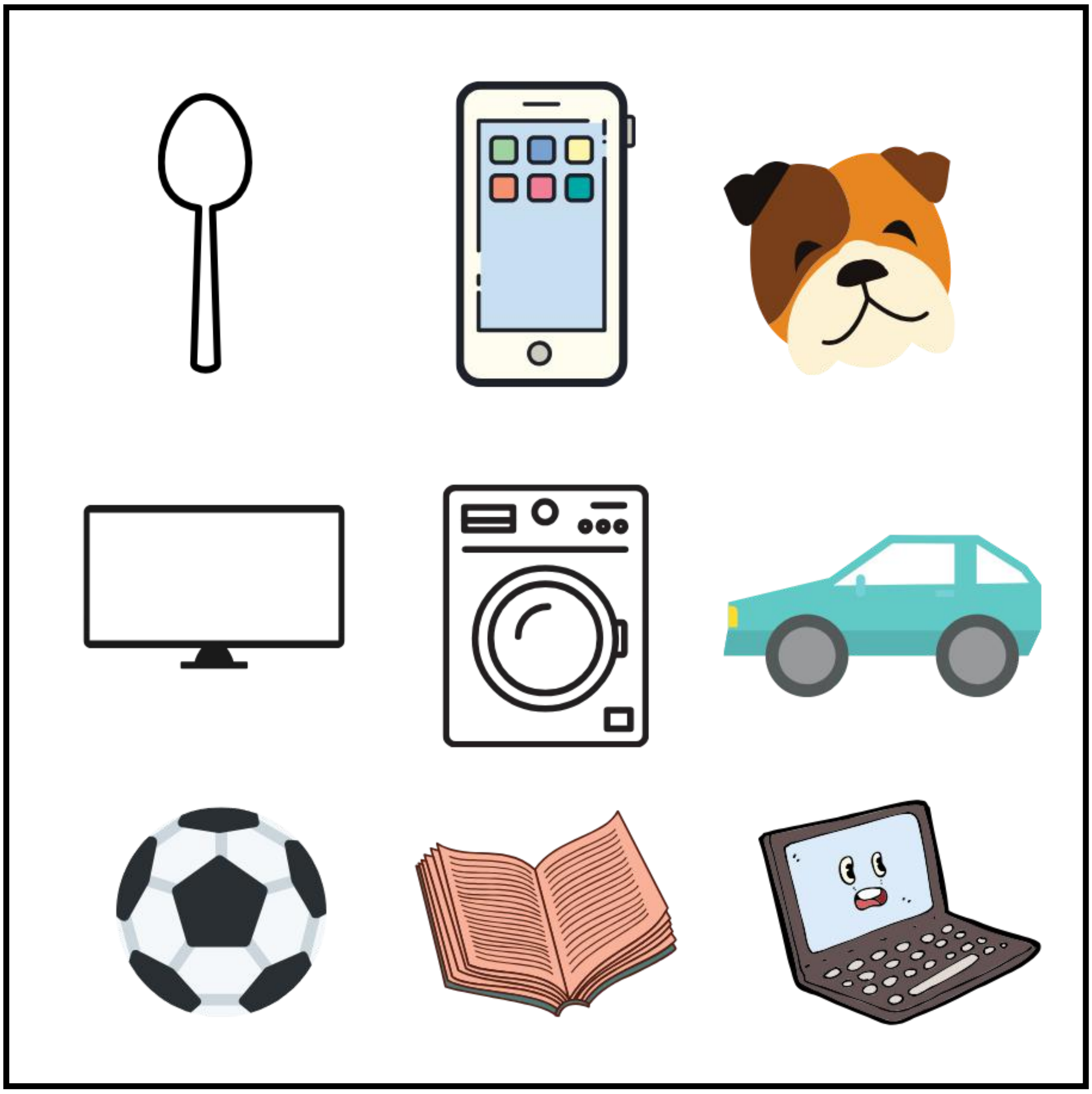
We’re going on a computer hunt

Step 1

How many digital systems do you think are in your classroom (or house?) Have a guess and write your answer here:

Step 2

Circle all the things which contain **digital systems** below.



We're going on a computer hunt

This page is for

Students

Step 3

Digital systems do important jobs for us.

For each thing you circled at step 2, finish this sentence (we've done one for you.)

A *car* helps us *get places*.

A________helps us____________________.

A________helps us____________________.

A________helps us____________________.

A________helps us____________________.

We're going on a computer hunt

This page is for

Students

Step 4

Walk around your classroom (or house) and see how many digital systems you can find. Make a list here:

1. ____.
2. ____.
3. ____.
4. ____.
5. ____.
6. ____.
7. ____.
8. ____.

This page is for

Students

We’re going on a computer hunt

Step 5:

In a group with other students, talk about what each digital system you have found does.

Step 6:

Match up the digital systems below with what they do - draw lines to connect words with pictures.

Clean clothes

Tell the time

Talk to people

Cool food

Research, make docs

Play games

This page is for

Teachers

Answer key

Step 1:

Most people will be surprised at the number of digital systems in their homes or classrooms. Homes are estimated to have around 15 connected devices each, and this doesn't include things like smart washing machines and other appliances. Devices that in the past were electrical but not digital systems are increasingly incorporating technology to allow them to adapt to what is happening around them. Things like kettles, heaters, watches and alarm clocks were once electrical but would not have been considered a digital system.

The hallmarks of a digital system are:

- A power source;
- A way to store data;
- A processor to process data;
- Taking inputs (such as pressing buttons, using a mouse, touching a screen); and
- Returning outputs (information on a screen, a change of temperature, sound from a speaker).

Step 2

Using the criteria above, we can determine that the telephone, laptop, washing machine, tv, and car are digital systems. The dog, despite containing a microchip, is not!

Step 3

A car helps us get places.

A washing machine helps us clean clothes.

A laptop helps us find and save information (there are many possible answers).

A tv helps us watch programs.

A telephone helps us contact people.

Step 6

Mobile phone: talk to people
Game controller: play games
Fridge: cool food
Washing machine: clean clothes
Smart watch: tell the time
Laptop: research, make docs

Want more?

Here are some further activities, online resources, assessment ideas and curriculum references.

This page is for

Teachers

Adapting this activity

For older students extend the discussion by identifying **components** of digital systems: ask students to identify inputs, outputs, power sources, storage and processing components as well as peripheral devices.

There is a useful video to watch here: https://www.youtube.com/watch?v=xfKn5OjHLqQ explaining the components of digital systems in an engaging way.

For greater curriculum coverage you could also include a discussion around exploring how people safely use common information systems to meet information, communication and recreation needs (ACTDIP005 - see cmp.ac/impact).

Keep learning

Students can complete a word search to build their vocabulary around digital systems: cmp.ac/techtalkSchool

Another unplugged activity this age group will enjoy is the messy drawer activity, where they explore and sort the contents of a drawer at home: cmp.ac/drawerSchool

For teachers creating a portfolio of learning or considering this task for assessment

Ask students to submit their completed worksheet.

Linking it back to the Australian Curriculum: Digital Technologies

Digital systems

Recognise and explore digital systems (hardware and software components) for a purpose (ACTDIK001: refer to cmp.ac/systems)

Refer to aca.edu.au/curriculum for more curriculum information.

Digital Technologies @ School
Unplugged activities for students

This activity is for: Years F-4

Is it a pig or a dog?

This activity is about how humans represent concepts using symbols

Data representation is the method of representing data. **Good** data representation presents information and ideas clearly and depends on the situation.

- This activity is designed to be done in **pairs**.
- It should take about **15 minutes**.

You will need:

- Each student will need **2 pieces of paper,** and a **pen/pencil.**
- To run as a worksheet, print pages 2-4 for each pair of students.

Getting started:

We're both going to draw a picture of a pig and a dog.

You should each have a piece of paper with two boxes.

In secret, draw a pig in one of them, a dog in the other, but **don't tell each other which is which!** Don't show each other what you're drawing either!

To make it even trickier, you're going to have just 30 seconds per drawing!

Find a timer, and get started.

Ready.... Set......

GO

This page is for

Students

Discuss

Pigs and dogs!

Times up!

Compare your pictures.

Swap worksheets and guess which one is a pig, and which one is a dog.

Student 1 first pic: ________________	Student 2 first pic: _________________
Student 1 second pic: _____________	Student 2 second pic: ______________

Did you guess right?

Did your picture look like a real life pig?

Probably not! There's no time to draw a realistic pig in 30 seconds. You would have drawn a **representation** of a pig and a dog.

There are lots of different ways to represent pigs and dogs depending on the situation!

This is a good way to draw a pig for a **cartoon**. 	This is a good pig symbol for a **game** 
This is a good dog for a **cartoon** 	This is a good dog for a **poop warning sign** 
This is a good dog for a **danger sign** 	This is a watch out for pigs **road sign** 

The way you choose to **represent** a pig and dog depends on the situation!

Make your own!

Draw a happy cartoon pig

Draw a wild pig

Draw a watch out for dog poo sign

Draw a sniffer dog

Draw a guide dog

Draw a don't feed the pig sign

This page is for

Teachers

Want more?

Here are some further activities, online resources, assessment ideas and curriculum references.

Adapting this activity

You can also use this activity with other animal pairs.

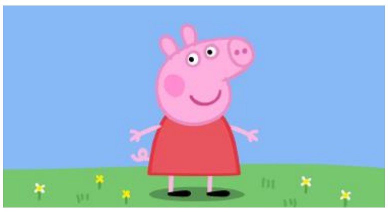
Eg:
Cat or Rat
Kangaroo or Dinosaur
Sheep or Goat

For older students you can add additional constraints, like trying to draw a giraffe, or a kangaroo in as few lines as possible.

Or make a challenge to express a different idea! How does a 'watch out for giraffes' road sign differ from a 'don't feed the giraffes' sign?

Keep the conversation going

- Can you represent other animals so they're not confused with pigs and dogs? Try drawing a Lion! Or a cat!
- Do you think people from the 1800s would recognise Peppa pig as a pig?



- What's the difference between what arabic numbers and roman numerals represent? When is it better to use arabic numbers?

Keep learning

For students interested in doing more offline data representation activities try DT Laundry: cmp.ac/laundrySchool

For online coding courses try Blockly Tree: cmp.ac/blocklytree

For teachers creating a portfolio of learning or considering this task for assessment

Ask students to come up with 5 different types of ball/seat/shoe, then draw a picture to represent each one.

Linking it back to the Australian Curriculum: Digital Technologies

Data representation
Recognise and explore patterns in data and represent data as pictures, symbols and diagrams. (ACTDIK008 - see cmp.ac/datarep).

Refer to aca.edu.au/curriculum for more curriculum information.

This page is for
Teachers

Digital Technologies @ School
Unplugged activities for students

This activity is for: Years 1-3

Tech talk find a word

A fun find-a-word activity to improve younger students' awareness of digital systems and their functions.

This activity is about recognising digital systems

Younger students in years 1 to 3 can improve their vocabulary and spelling as well as learning to identify basic digital systems by doing this word search.

This exercise improves students ability to scan for information, for example scanning search engine results for information or a piece of code.

They are written only downwards and across. There are no diagonal or backwards words.

- This activity will take about **20 minutes**

You will need...

- A printout of page 2 for each student
- A pencil

Getting started:

How many types of digital technology can you name? For example (point to if near) – computer, laptop etc.

Let's look at this list of words together and see which ones we already know, and which ones are new.

Keep the conversation going:

- Do students have these technologies in their home/school
- Can they name them?
- Do they know what each of them does? What purpose do they serve?
- How do these technologies make our lives easier?

Linking it back to the Australian Curriculum: Digital Technologies

Digital Systems
Recognise and explore digital systems (hardware and software components) for a purpose (ACTDIK001 - see cmp.ac/systems)

Refer to aca.edu.au/curriculum for more curriculum information.)

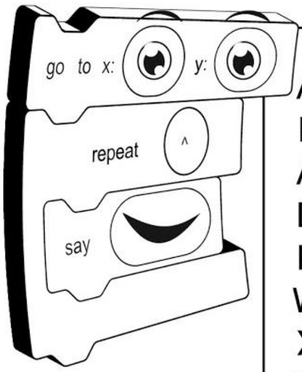
Keep learning

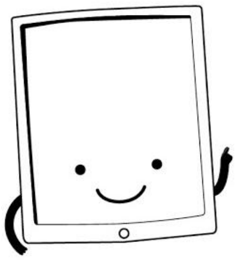
Learn about simple algorithms using Flatso the wom-bot!
Draw arrows on Flatso and test out simple sequences of instructions.
For more information head to cmp.ac/wombot

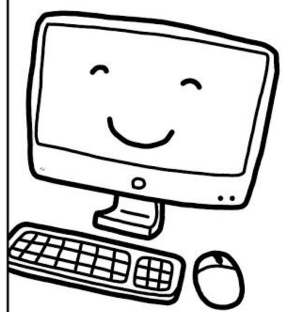
This page is for
Students

Tech talk

Can you find the 9 words hidden below?
Some words are down and some are across.
Circle them and colour in the pictures when you are done.







A	R	Q	I	W	O	F	M	O	U	S	E	W	U	D
F	R	M	P	Z	X	H	B	A	X	Y	Q	W	H	V
A	W	Z	N	B	E	F	E	B	F	H	Y	R	W	B
D	H	W	M	C	C	D	G	O	M	Y	I	H	S	Y
K	K	T	I	A	O	V	L	A	P	T	O	P	L	W
W	E	F	H	P	M	S	I	K	M	I	N	M	W	J
X	N	O	H	P	P	C	Y	O	C	T	G	K	D	V
Y	V	N	Z	C	U	R	P	L	X	D	M	E	A	I
P	F	A	I	N	T	E	R	N	E	T	G	Y	X	I
E	H	F	S	N	E	E	U	G	B	M	T	B	T	P
I	Z	J	P	C	R	N	Z	D	B	H	A	O	N	P
E	U	S	M	R	U	C	P	Q	G	L	B	A	R	A
V	H	A	E	P	O	L	H	P	K	P	L	R	G	G
U	P	Q	Q	J	R	Y	F	L	P	C	E	D	S	S
R	U	B	Q	A	U	S	B	V	O	K	T	Q	P	R

App
Computer
Internet
Keyboard
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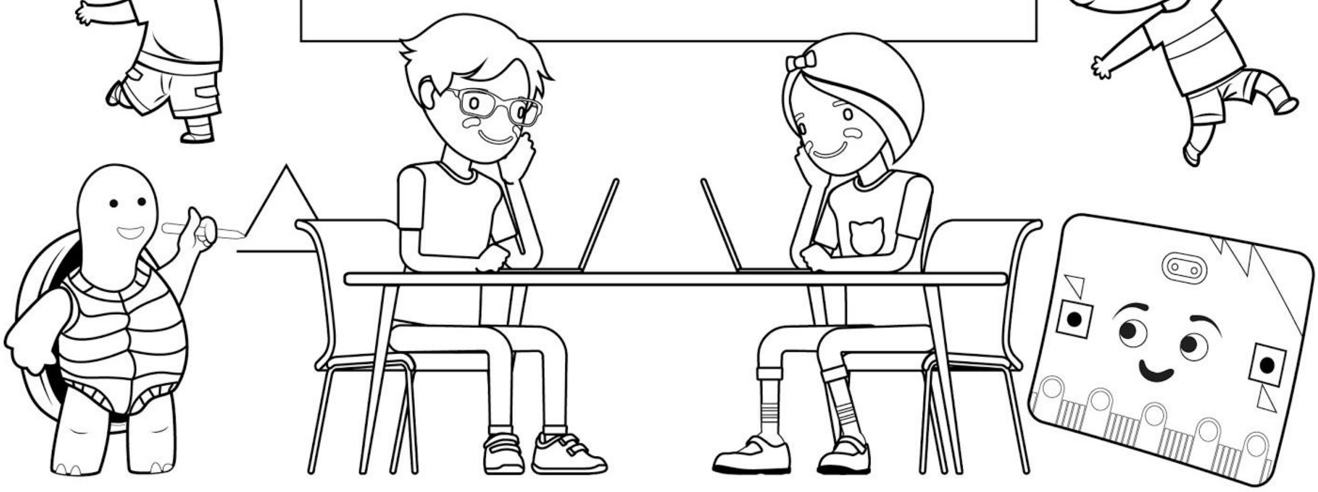

This page is for

Teachers

Answer key

A	R	Q	I	W	O	F	M	O	U	S	E	W	U	D
F	R	M	P	Z	X	H	B	A	X	Y	Q	W	H	V
A	W	Z	N	B	E	F	E	B	F	H	Y	R	W	B
D	H	W	M	C	C	D	G	O	M	Y	I	H	S	Y
K	K	T	I	A	O	V	L	A	P	T	O	P	L	W
W	E	F	H	P	M	S	I	K	M	I	N	M	W	J
X	N	O	H	P	P	C	Y	O	C	T	G	K	D	V
Y	V	N	Z	C	U	R	P	L	X	D	M	E	A	I
P	F	A	I	N	T	E	R	N	E	T	G	Y	X	I
E	H	F	S	N	E	E	U	G	B	M	T	B	T	P
I	Z	J	P	C	R	N	Z	D	B	H	A	O	N	P
E	U	S	M	R	U	C	P	Q	G	L	B	A	R	A
V	H	A	E	P	O	L	H	P	K	P	L	R	G	G
U	P	Q	Q	J	R	Y	F	L	P	C	E	D	S	S
R	U	B	Q	A	U	S	B	V	O	K	T	Q	P	R

App
Computer
Internet
Keyboard
Laptop
Mouse
Screen
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USB

"This page is for" Teachers

Digital Technologies @ School
Unplugged activities for students

This activity is for: Years F-4

DT Laundry

This activity teaches how we convey meaning through signs and symbols

We use conventions and shared context to understand the signs and symbols around us.
For example, we understand that a walking green person means it is safe to cross the street. But only because we all agree that is what it means! Many ideas can be communicated using symbols and conventions. Laundry symbols are an example of a convention that can be confusing even if you've been washing clothes for years!

Computers also use conventions to store different kinds of data using binary numbers. In this activity we teach students to recognise how to represent ideas (a.k.a data) using symbols in real life examples. In later years, students can transfer their understanding of symbols and abstraction in the real world to the world of digital technologies.

This activity will take up to **60 minutes**. Print pages 2 and 3 for students. If you are a teacher, read through page 6 for further information. (Answers are on pages 4 and 5.)

Getting started:

Did you know many of your items of clothing need to be washed in different ways?
Some items are delicate and need to be hand washed, some cannot be ironed.
How can we tell which is which? Clothing has writing and symbols on it that can tell us!

You will need…

Dirty Laundry (clean clothes are fine too). In a classroom setting you could ask students to bring an item of clothing in, they could look at the label in an item they are wearing or in lost property, or students could ask some teachers to photograph examples of clothing labels to share with the class.

Step by step

1. Guess what the example laundry symbols mean
2. Explore laundry symbols on your own clothing
3. Create your own laundry symbols
4. Discuss what makes a good or a bad laundry symbol

grok academy

This page is for

Students

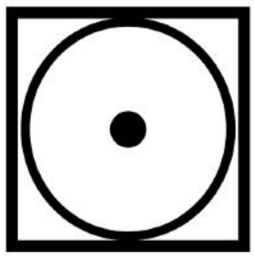
DT Laundry

Unlock the secret symbols hidden on your clothes

Guess the laundry symbol

Guess what instructions each symbol represents.
Write your guesses below.

______________________________ ______________________________



______________________________ ______________________________

Find symbols on your clothes

Look at your dirty laundry. What symbols are there?
Copy 2 of the symbols you saw below.

______________________________ ______________________________

Draw your own symbols

Draw your own symbols for the instructions below.

Cold wash only

Do not hang in sunlight

Iron on high heat

Wash with peanut butter

Invent your own instructions

Invent a new instruction and draw a symbol for it.
Ask another person if they can guess what it means.

____

This page is for

Teachers

Answer key

Guess the laundry symbol

1. Iron, steam or dry (any temperature)
2. Hand wash
3.Tumble dry with medium heat
4. Tumble dry with low heat

Have a discussion with your student.
Did you know about all of the symbols? Did you have to use the image below to understand them? What made them easy or hard to understand? Are there any repeated patterns in the symbols?

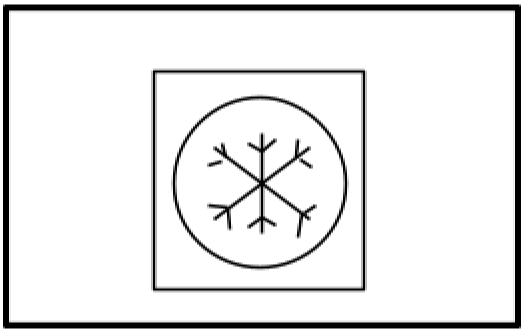
Find symbols on your own clothes

Here is a list of symbols you might find on your clothing.

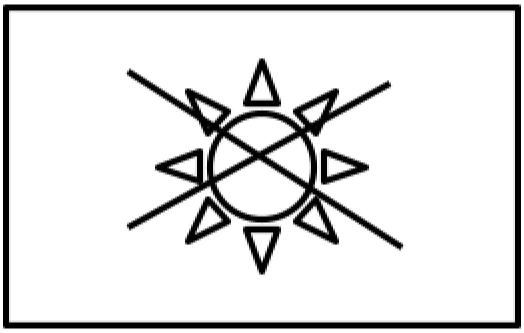
Source: https://laundrapp.com/guides/laundry-symbols/

Draw your own symbols

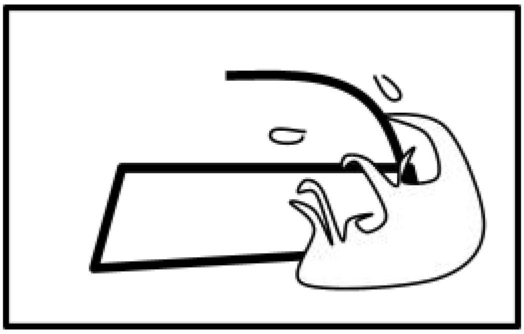
This is a creative task, so there are many correct answers. Here are some example symbols. What makes these symbols easy or hard to understand?



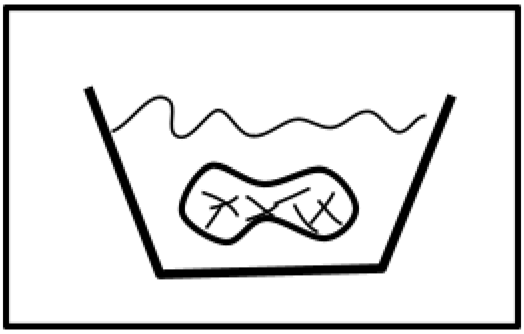
Cold wash only



Do not hang in sunlight



Iron on high heat



Wash with peanut butter

Invent your own instructions

This is also a creative task. For this task and the previous task you should discuss the answers to the following questions.

What would it look like on a tiny clothing tag?
Is it better than the existing symbols?
What other things could the new symbol accidentally represent?
Are the instructions sensible?

This page is for

Teachers

Want more?

Here are some further activities, online resources, assessment ideas and curriculum references.

Adapting this activity

This topic is interesting for people of all ages. For older students try engaging in a discussion about data representation appropriate for their year level.

Read more about data representation at cmp.ac/datarep

What do the number of dots in some of the laundry symbols mean? (● cold, ●● warm, ●●● hot)
Did you know this before? Would using numbers or letters make it easier or harder?

What are some other places we see symbols? (e.g. road signs, buttons in apps, bathroom signs, food packaging)

What are the benefits of using symbols instead of words and numbers? (e.g., readable in any language)
What are the benefits of using words and numbers instead of symbols? (e.g., you don't have to be a laundry expert to understand them)

How could you represent the data in these symbols with a computer? (e.g., using pictures, words, numbers, binary, objects)

Discuss how efficiently each of the above representations can be stored. (e.g, compare bitmap and vector images, compare words vs number representations)

Discuss the difference between what a symbol looks like and what the symbol represents. (e.g., an emoji can be a symbol that represents a hamburger, for example, but it looks different on different devices)

Keep learning

For students of all ages you can try the Lego Algorithmics DT Mini Challenge where students learn about representing and following instructions.
cmp.ac/algorithmics

Or you can print out animal trading cards and use symbols and simple decisions to classify living things
cmp.ac/animalcards
cmp.ac/classifying

For teachers creating a portfolio of learning or considering this task for assessment

Ask students to submit the second page of their worksheet with their invented laundry symbols.

Linking it back to the Australian Curriculum:Digital Technologies

Data representation

Recognise and explore patterns in data and represent data as pictures, symbols and diagrams (ACTDIK002 - see cmp.ac/datarep) (Years F-2)

Recognise different types of data and explore how the same data can be represented in different ways. (ACTDIK008 - see cmp.ac/datarep) (Years 3-4)

Refer to aca.edu.au/curriculum for more curriculum information.

grok academy

This page is for
Teachers

Digital Technologies @ School
Unplugged activities for students

This activity is for: Years 5-6

Race Up If Mountain!

This activity introduces decision making in programming

This activity is designed to teach decision making in programming as well as starting to teach students about variables. The game is based on a path up a mountain blocked with a number of smaller 'if mountains' that must be passed to reach the finish. The students must roll the dice and follow the flowchart at each mountain, trying to roll a number that will allow them to pass. The statements have been written in flowcharts that mimic the decision making of computers.

It is targeted towards primary students in years 5-6 and can be expected to take between 1 and 1.5 hours to complete.

An extension for students familiar with Python syntax has been included but is by no means expected. In the extension the flowcharts have been translated into Python coded 'If statements' (the name for decision making statements in code). The Python statements are logically identical to the flowcharts and can be used concurrently for students that are keen but inexperienced.

Getting started:

This is a board game where players race up the mountain, it's a game of luck and climbing! First we will build up the board, then we will race to reach the top of the mountain, stopping at smaller mountains along the way. The flowcharts on those mountains will help you decide if you can pass, they are similar to how computers make decisions.

You will need...

- Scissors
- Glue
- A six-sided die (if you don't have one, there is one you can make on the board).
- A playing piece for as many players as you have, for example, 2 bottle caps for 2 players.
- Coloured pencils to colour in your board.

Print pages 2 to 5 for your students.

Step by step instructions are on the next page

Race up If Mountain!

Build your board and race up the mountain!
Climbing over If Statements flowcharts along the way!

This page is for

Students

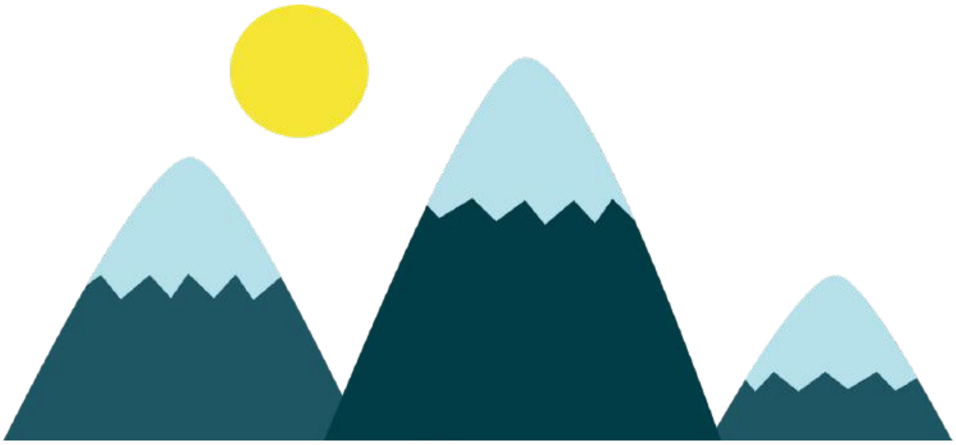


Image originally created by Nicole Turner on [Pixabay]

Step 1

Colour in your board and your dice. You can colour in the mountains as well, but make sure you can still read what they say.

Step 2

Cut out your mountains. Make sure you also cut around the tabs with letters on! This is important! You need them to stick your mountains to the board. Fold your mountains in half. Then you can cut out your die if you need to.

Step 3

Stick your mountains to your board, make sure you stick the mountain with 'A' to the 'A' squares on the board. Once you've built your mountains, you can fold and stick your die.

Step 3

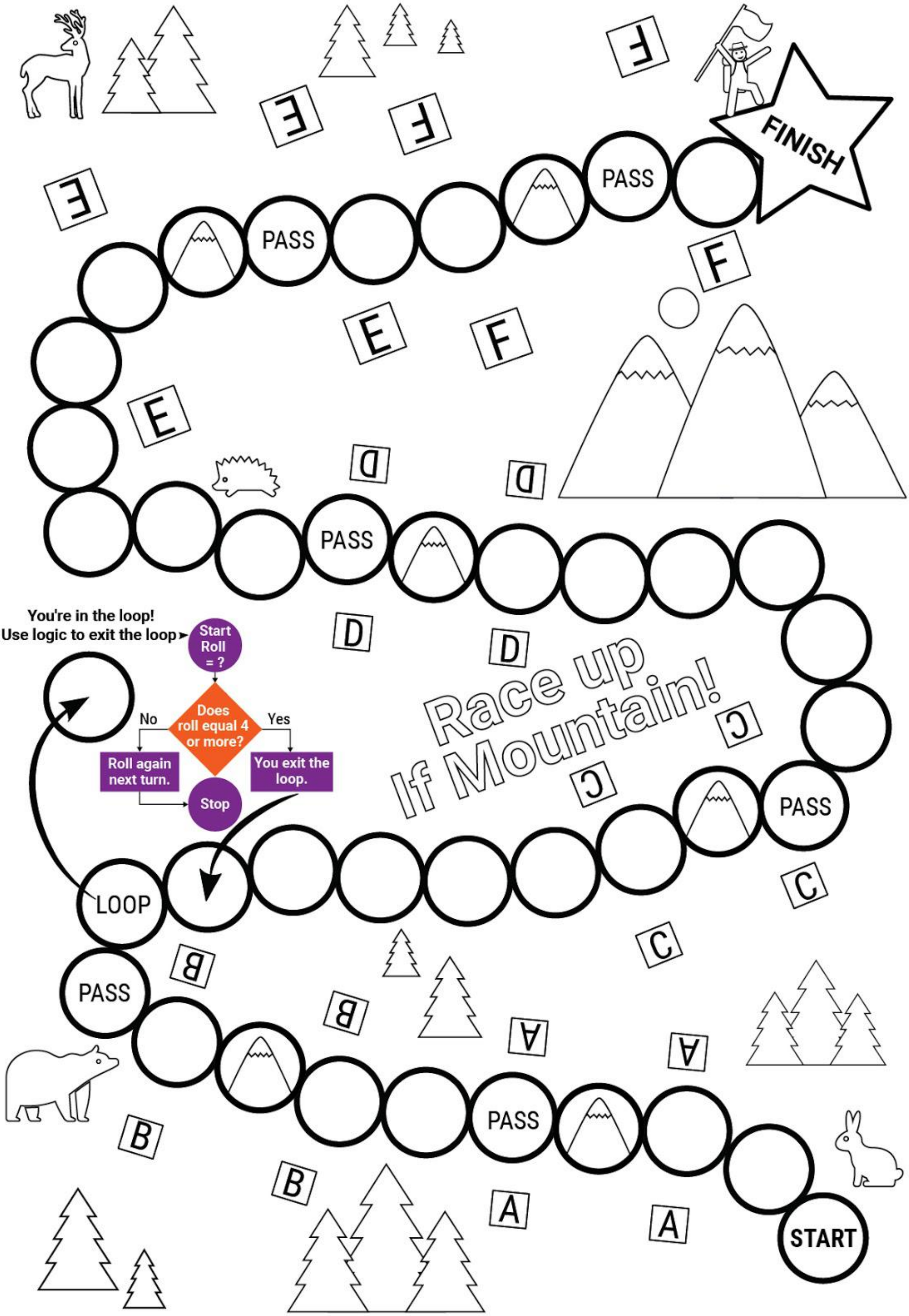
Find players and find a token for each of them.
Once there are at least 2 players, you're ready to go!

Step 4

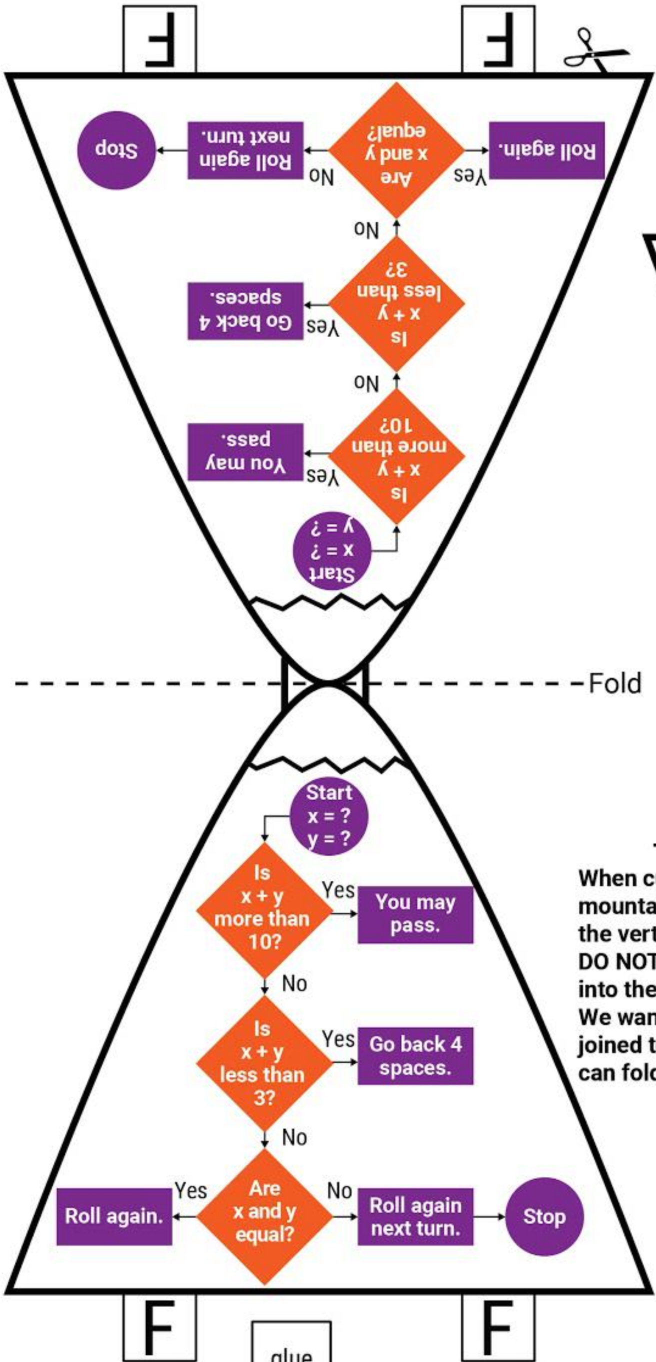
Read the rules of the game so you know how to play and start your race!

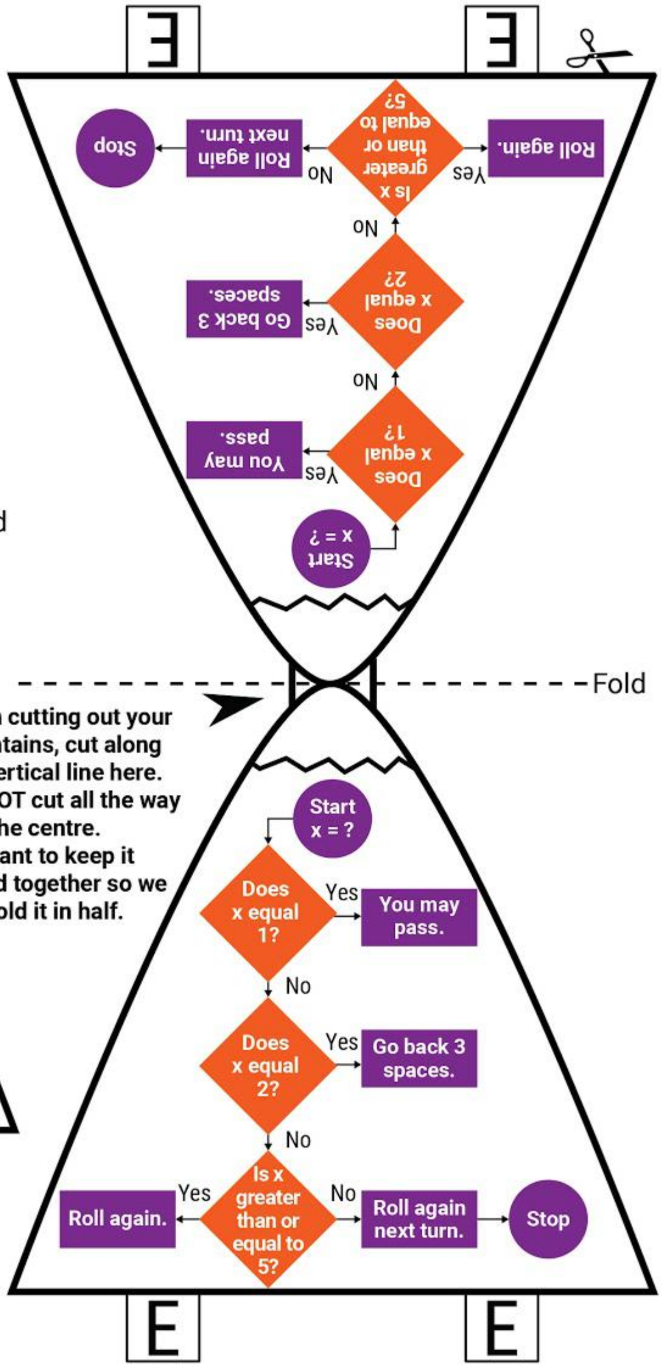
The Rules

- Every player starts at START.
- Take turns to roll the die. Whoever rolls the highest number goes first, then take take turns in a clockwise direction.
- Move your token as many places as you rolled, rolling a 3 means you move forward 3 places.
- When you land on a mountain you must play the mountain. Roll the die and follow the flowchart. If you pass the mountain, you move to the 'PASS' circle.
- The Loop! If you land on the 'LOOP' circle, you're stuck in a loop! You have to roll a 4 or more to escape!
- The final two mountains use variables. If there is an x variable, roll the die and that number becomes x. If there is a y variable, roll the die again, that roll becomes y. Use those for x and y on the flowchart.
- You must re-roll each variable every turn.
- To win the game, be the first to reach FINISH!

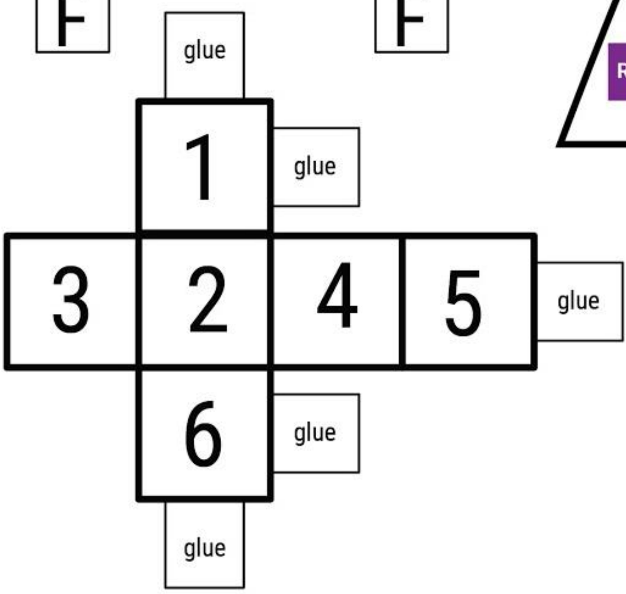


FINISH
PASS
PASS
PASS
You're in the loop!
Use logic to exit the loop
Start
Roll
= ?
Does
roll equal 4
or more?
No
Yes
Roll again
next turn.
You exit the
loop.
Stop
Race up
If Mountain!
PASS
LOOP
PASS
PASS
START
A
A
B
B
C
C
D
D
E
E
F
F

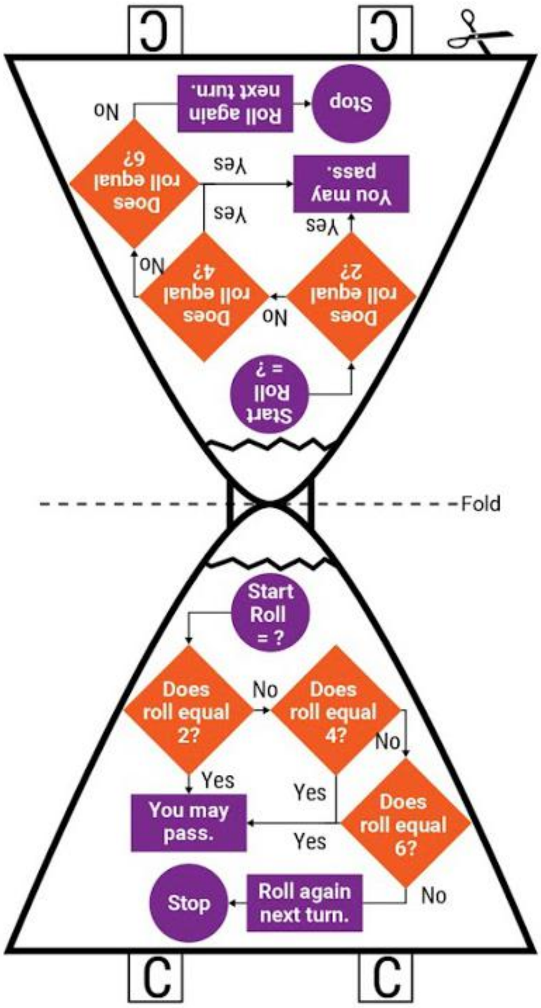


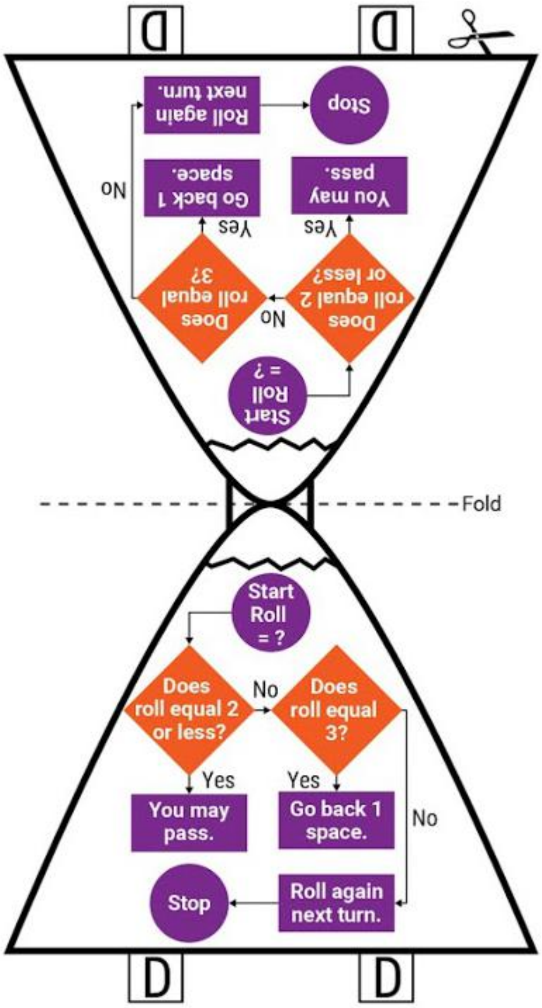


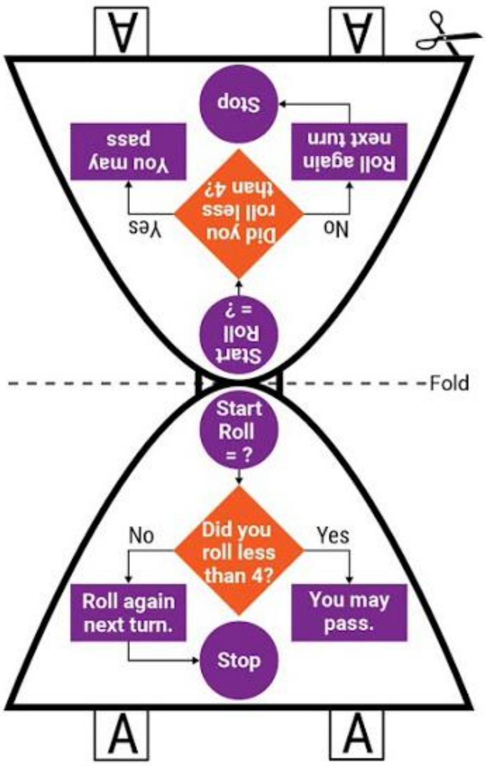
When cutting out your mountains, cut along the vertical line here. DO NOT cut all the way into the centre. We want to keep it joined together so we can fold it in half.

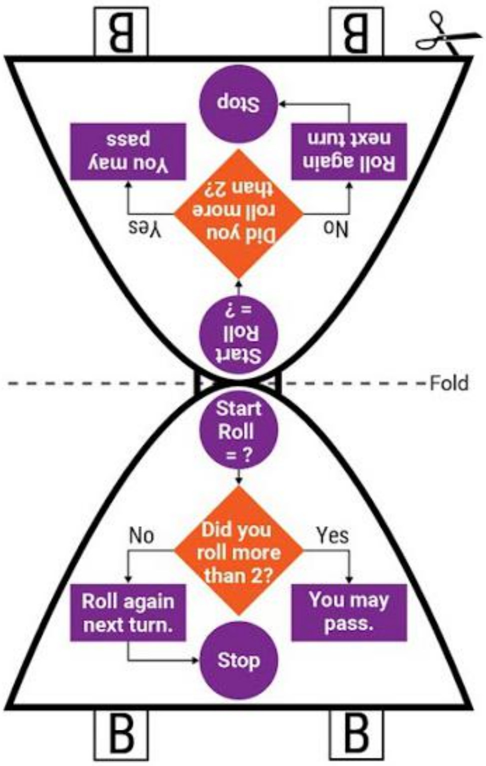


Make sure you keep your tabs when cutting out your mountain! Then dab some glue on each tab and glue them to the board where you see the same letter so they form an arch over the game path.


C
Start Roll = ?
Does roll equal 2?
No
Does roll equal 4?
No
Does roll equal 6?
Yes
Yes
Yes
You may pass.
No
Roll again next turn.
Stop
Fold
C


D
Start Roll = ?
Does roll equal 2 or less?
No
Does roll equal 3?
Yes
You may pass.
Yes
Go back 1 space.
No
Roll again next turn.
Stop
Fold
D


A
Start Roll = ?
Did you roll less than 4?
No
Yes
Roll again next turn.
You may pass.
Stop
Fold
A


B
Start Roll = ?
Did you roll more than 2?
No
Yes
Roll again next turn.
You may pass.
Stop
Fold
B

This page is for

Teachers

More information for teachers

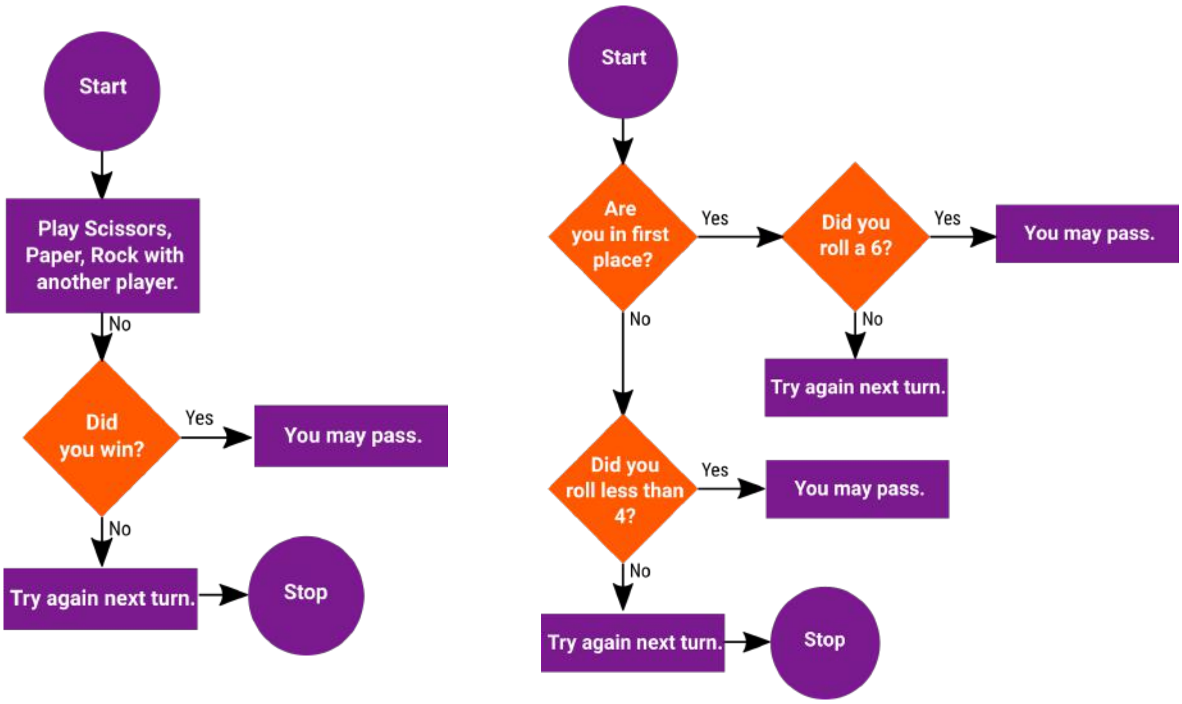
Here are some further activities, online resources, assessment ideas and curriculum references.

Keep the conversation going:

Making your own flowcharts.

Encourage students to come up with their own mountain flowcharts using die rolls as the deciding factor.

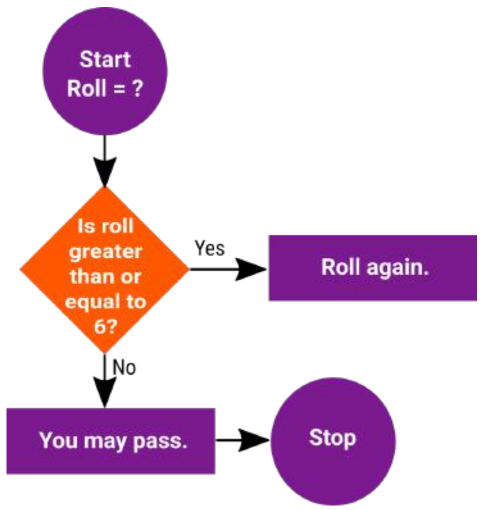
What are other things that your flowcharts can check, aside from the number rolled on the die? For example:



What happens if we accidentally write a flowchart that never lets us pass the mountain?

This is called an ‘infinite loop’ because you are stuck in the loop for infinity and can’t get out.

Ask the student how they would fix it to show that they understand.

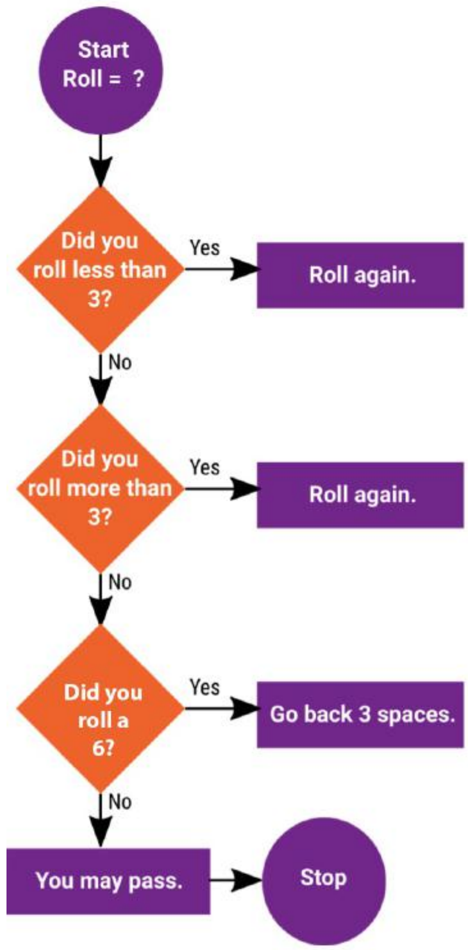


Sometimes they are harder to see.

This infinite loop will never let you pass.

This is because every possible outcome from the dice rolls is caught in a “yes” flow. Since you are always caught by a “yes” flow, you will never follow the “no”s all the way to the “pass” block.

You will also never be able to go back 3 spaces. This is because you will follow the “greater than 3 → yes” flow to roll again every time you roll a 6. This means you will not be able to reach the “equal 6 → yes” flow.



Thinking about mountain flowcharts and difficulty
How might we make the flowcharts of the last 2 mountains easier or harder to pass? Think about how much more likely it is to roll a number greater than 3 than it is to roll a 6.

For teachers creating a portfolio or learning or considering this task for assessment:

Ask students to design their own mountains.
The first mountains should be small flowcharts with easy odds to pass. They should get progressively trickier to pass. You can decide if they must include variables.

- Make sure the flowcharts are logically exhaustive (expanded below).
- Ask the students to explain why their last mountain is harder to pass than their first. This should demonstrate an understanding that the odds of rolling any number higher than 3 is higher than the odds of rolling a single number.

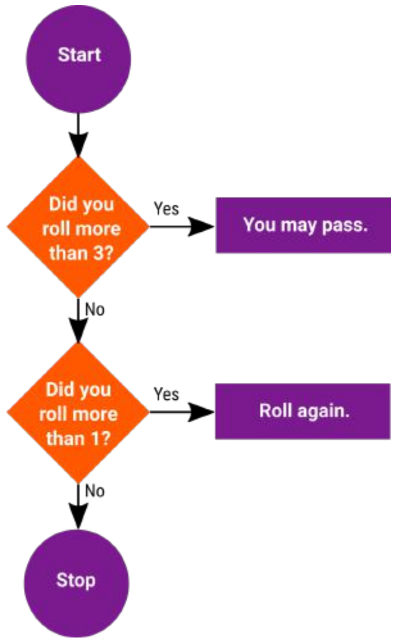
Watch out! Common if statement pitfalls

It is important to make the if statement logic *exhaustive*. Don't miss any of the possible outcomes (dice numbers). For example:

If we roll 1 in the above example then neither of the conditions apply.

What is the player meant to do? They can't roll again or pass, so they are stuck!

The solution is to add a final instruction block before the stop circle that gives an instruction to a player that they should follow if no other flows apply to them.



This page is for

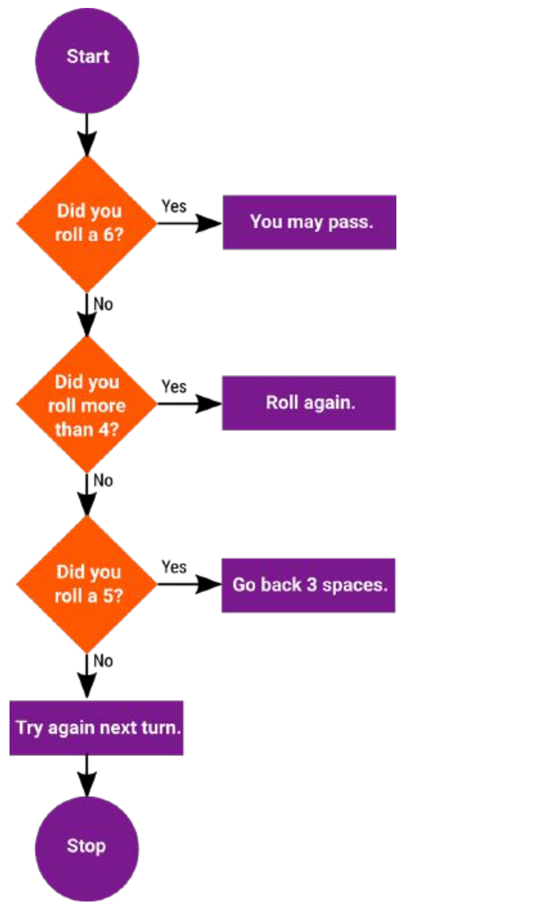
Teachers

It is important that students also understand the *sequential* nature of the flow charts, that they work from top to bottom and that you cannot jump to different diamonds.

In this example, if a player rolls a 5, they will never actually go back 3 spaces.

This is because they would follow the "more than 4 → yes" flow and roll again every time.

To fix this, you would need to swap the "more than 4" and "roll a 5" diamonds.



Helping to Understand Variables

A table is also a good way to keep track of the variables in the last 2 mountains. The last 2 ask you to "*roll for x*" and "*roll for x and y*". Here is an example table you can use to keep track of the variables. You can use this table as a reference when following the flowcharts, for example to work out (x+y).

	What did you roll?	Fill in the number
Variable x		x =
Variable y		y =

Linking it back to the Australian Curriculum:Digital Technologies

Algorithms - Design, modify and follow simple algorithms involving sequences of steps, branching, and iteration (repetition) (ACTDIP019 - see cmp.ac/algorithms) (5-6).
Refer to aca.edu.au/curriculum for more curriculum information.

This page is for

Extension

Choose if you want to print this for your kids or keep it to yourself!

Teachers

The flow charts can all be translated into Python Syntax if statements. We have provided these at the very end of the activity. A key component of the Python version is ***comparison operators***, a table below can be provided to help them master these.

Comparison operators conversion table

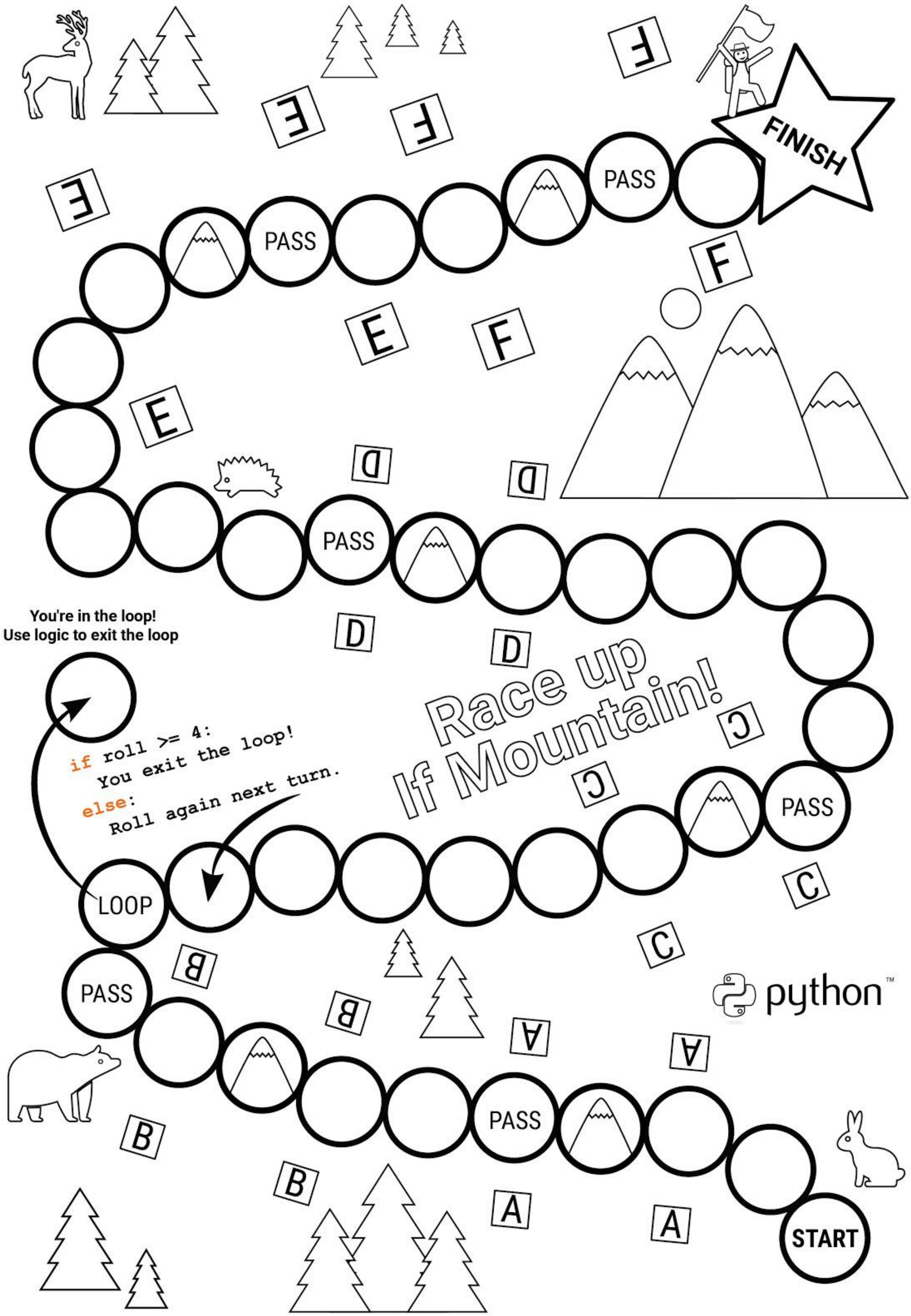
Operator	In a sentence
a < b	a is **less than** b
a <= b	a is **less than or equal to** b
a > b	a is **more than** b
a >= b	a is **more than or equal to** b
a == b	a is **equal to** b

If your child has not learned about if statements and variables before,a good introduction to teaching if statements can be found at:
https://medium.com/groklearning/programming-in-primary-school-introducing-if-statements-64875db05614

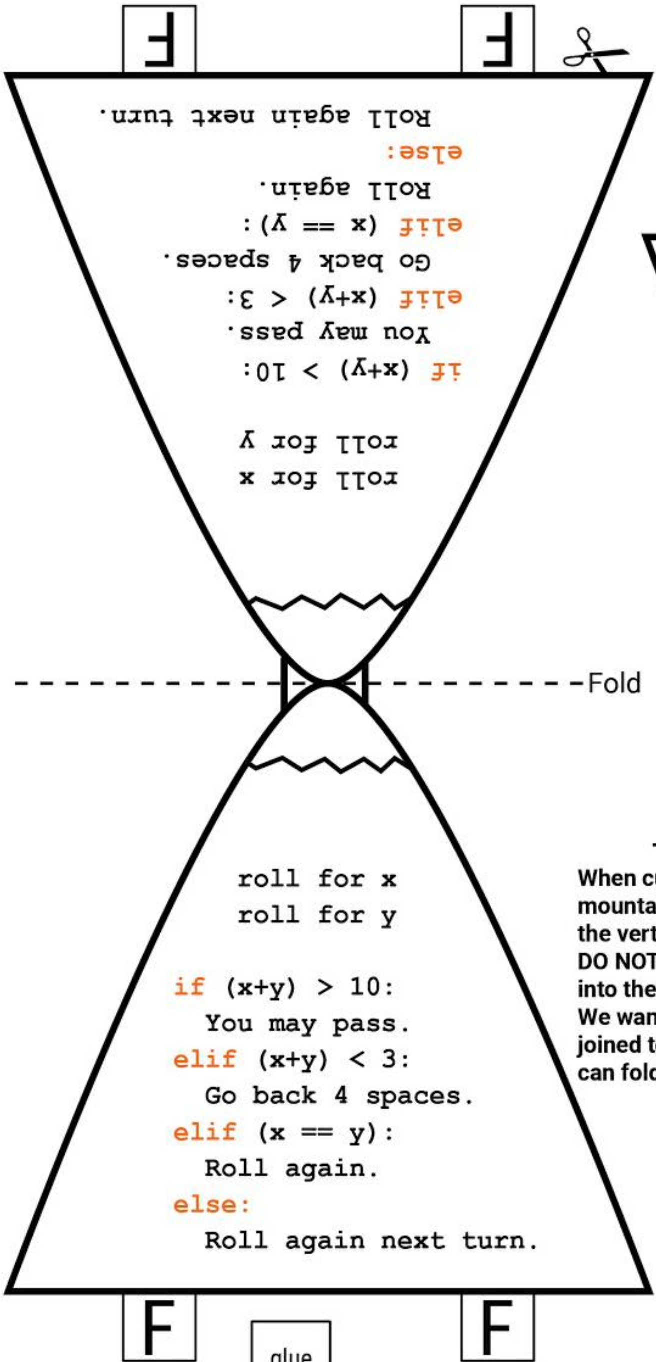
Is it also worth making sure the students can understand what the if statement conditions mean. Have them use the syntax and flow charts to write out sentences for the conditions, to help with their understanding.

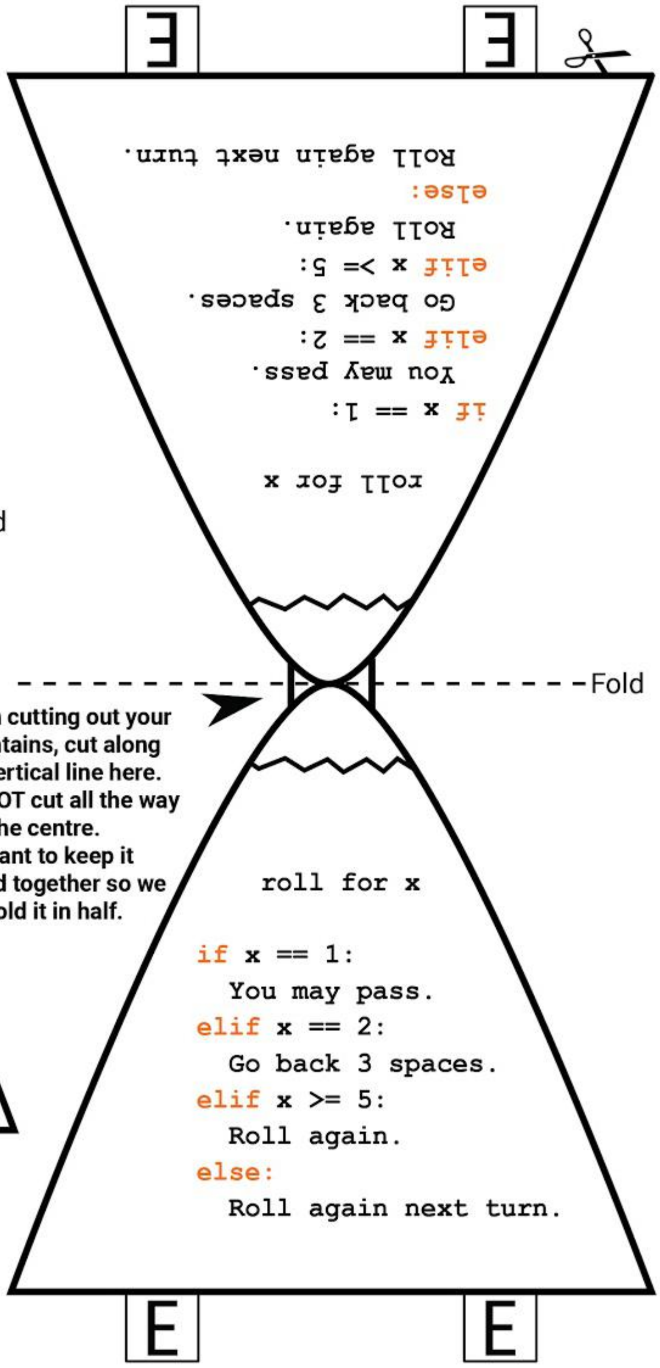
If Statement	What does it mean in a sentence?	What numbers will work?
If roll > 3 You may pass	If you roll a number that is greater than 3, you can pass.	4, 5, 6
Else: Roll again	If you **do not** roll a number that is greater than 3, you have to roll again.	1, 2, 3

You should encourage them to create a table each time then get stuck with a mountain written in syntax. Using the tables can help students to understand the options available at each mountain and can be phased out as their confidence improves.

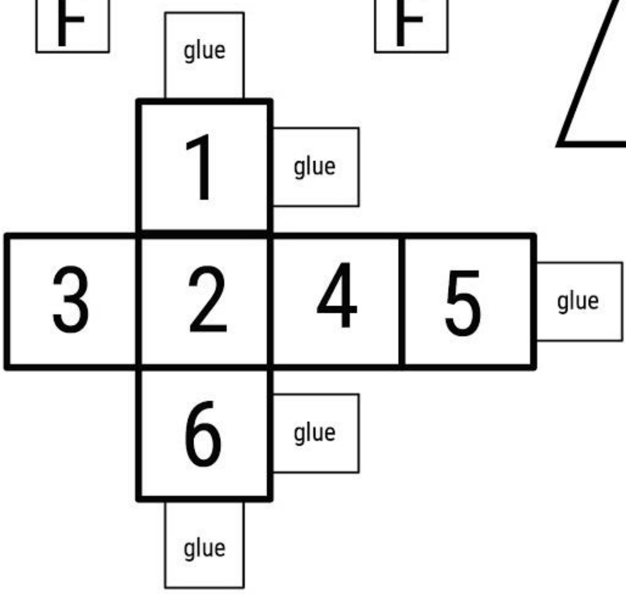


FINISH
PASS
PASS
PASS
PASS
PASS
PASS
You're in the loop!
Use logic to exit the loop
if roll >= 4:
You exit the loop!
else:
Roll again next turn.
LOOP
Race up
If Mountain!
python™
START
A
B
C
D
E
F





When cutting out your mountains, cut along the vertical line here. DO NOT cut all the way into the centre. We want to keep it joined together so we can fold it in half.



Make sure you keep your tabs when cutting out your mountain! Then dab some glue on each tab and glue them to the board where you see the same letter so they form an arch over the game path.

C C


```
if roll == 2 or
if roll == 4 or
if roll == 6:
  You may pass.
else:
  Roll again next
  turn.
```


Fold

```
if roll == 2 or
if roll == 4 or
if roll == 6:
  You may pass.
else:
  Roll again next
  turn.
```

C C

D D


```
if roll <= 2
  You may pass.
elif roll ==3:
  Go back 1 space.
else:
  Roll again next
  turn.
```


Fold

```
if roll <= 2
  You may pass.
elif roll ==3:
  Go back 1 space.
else:
  Roll again next
  turn.
```

D D

A A


```
if roll < 4:
  You may pass.
else:
  Roll again next turn.
```


Fold

```
if roll < 4:
  You may pass.
else:
  Roll again next turn.
```

A A

B B


```
if roll >= 3:
  You may pass.
else:
  Roll again next turn.
```


Fold

```
if roll >= 3:
  You may pass.
else:
  Roll again next turn.
```

B B

Digital Technologies @ School
Unplugged activities for students

This activity is for: Years 3-6

Number Guessing Algorithm

This activity teaches algorithms

Computers follow instructions to solve problems. It's our job, as humans, to decide on the best set of instructions to give to computers to solve problems. There are often lots of ways to solve the same problem. How do you know which is best?

- This activity will take up to **60 minutes**.
- It's designed for students to works in **pairs**

You will need:

- Print pages 2 and 3 for each pair of students.
- They'll need a pen/pencil

Getting started:

I'm thinking of a number between 1 and 100. Can you guess it?

We're going to experiment with different ways to guess a number, and come up with the best way.

Step by step

WIth a partner, one person thinks of a number between 1 and 100 (person A), while the other one guesses it (person B). Person A can only say 'higher' or 'lower' after Person B gusses.

Follow the steps on the worksheet to create an algorithm to win the game by guessing the other person's number in the least number of guesses.

This page is for

Students

Number Guessing

I'm thinking of a number between 1 and 100 … can you guess it?

Step 1

With a partner, take turns thinking of a number from 1 to 100. One person thinks of the number, and the other person has to guess the number. (The first person has to tell you if the number they are thinking of his higher or lower than your guess.)

Record the results in the table on the right (the first line is an example). Play as many rounds as you like, and keep practicing to see how good you can get at this game.

Round	The number was..	I guessed it in __ guesses
1	74	12
2		
3		
4		
5		

Step 2

Have you figured out the best way to play this game?
How can you guess the number with the smallest number of guesses? Write step by step instructions here:

Step 1	
Step 2	
Step 3	

Hint: Will your instructions work for every game, or just one?
Try to come up with a general set of instructions that will always work.
Try using words like 'if', 'then' and 'repeat'

This page is for

Students

Step 3

Play the game again, following the instructions you just made EXACTLY and record your results on the table on the right.

Round	The number was..	I guessed it in __ guesses
1		
2		
3		
4		

Step 4

Do you need to change the instructions? If so, go back and change them.

Step 5

Now think of a number between 1 and 1,000. Before you start guessing, how many total guesses do you think it will take to guess the number? Write your guess here: ________________

Step 6

Play four rounds and record your results here.

Round	The number was	I guessed it in _ guesses
1		
2		
3		
4		

You've created an **algorithm** to find a number out of a big collection of numbers. If your algorithm is to do with splitting the group of numbers in half over and over, you're thinking like a computer scientist!

When computers have to search through lots and lots of information it's really helpful to have a set of instructions, or algorithm, that can do it the quickest way possible. Splitting sets of ordered numbers in half, over and over, is called **binary search.**

Step 7

Are you surprised with how quickly you can guess a number between 1 and 1,000?

This page is for

Want more?

Here are some further activities, online resources, assessment ideas and curriculum references.

For teachers

Adapting this activity

For younger students, you can start this activity guessing a number between 1 and 10.

For older students, ask them to create a flowchart as well as a written set of instructions. This flowchart should show both **decisions** and **repetition.**

Ask students what they found hardest about this activity? It's quite intuitive to apply **binary search** when playing this game, but coming up with a general set of written instructions can be challenging - doing the activity with a partner ensures you follow the instructions precisely and see where they may need a tweak.

Keep learning

Searching and sorting algorithms are crucial in computing. With datasets containing billions of items, finding the most efficient way to search or sort can save huge amounts of money and resources, not to mention customers - people will click away from shopping or entertainment websites if results take too long to show.

You can explore how more of these algorithms work at www.sorting.at.

For more lesson plans and ideas for teaching sorting and searching algorithms look at the CS Unplugged website:
csunplugged.org/en/topics/ - there is a collection of resources specifically on sorting algorithms.

For teachers creating a portfolio of learning or considering this task for assessment

Ask students to submit the worksheet with their record of rounds played, results, and algorithm (and in the case of older students, flowchart).

Linking it back to the Australian Curriculum: Digital Technologies

Algorithms

Define simple problems, and describe and follow a sequence of steps and decisions (algorithms) needed to solve them (ACTDIP010 - see cmp.ac/algorithms) (Years 3-4)

Design, modify and follow simple algorithms involving sequences of steps, branching, and iteration (repetition) (ACTDIP019 - see cmp.ac/algorithms) (Years 5-6)

Refer to aca.edu.au/curriculum for more curriculum information.

This page is for

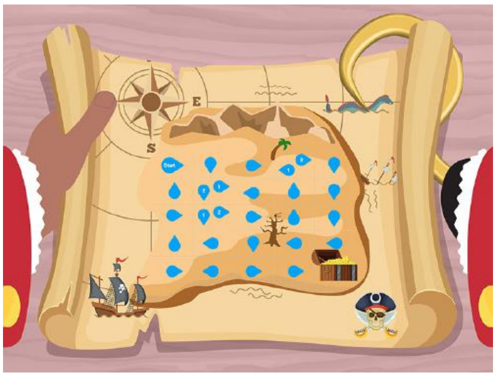
Teachers

Digital Technologies @ School

Unplugged activities for students

This activity is for: Years 3-4, 5-6

Pirate Treasure Hunt



This activity introduces students to following algorithms with decisions and repetition.

This activity is a non-programming activity which introduces the key concepts of making decisions (using the IF...THEN...ELSE construct) and iteration (with simple loops).

We use algorithms to solve all sorts of problems around us. Algorithms are sequences of steps, or procedures, that lead us from a starting position to a goal. The data in the map represents instructions that students need to understand and interpret correctly in order to move to the correct next field.

This activity will take between **15-30 minutes**.

The activity is targeted towards primary school students. It consists of two parts. The first map is for students to get acquainted with the concept of the activity. The second map is an extension activity for students that have mastered the first activity and who are eager for a greater challenge.

Getting started:

Your fellow pirates have found a map but can't quite figure out what it means. All they see are strange shapes that look like drops of water. You are the smartest pirate on the ship, so they come to you for help. Can you solve the puzzle and show them the way to the treasure?

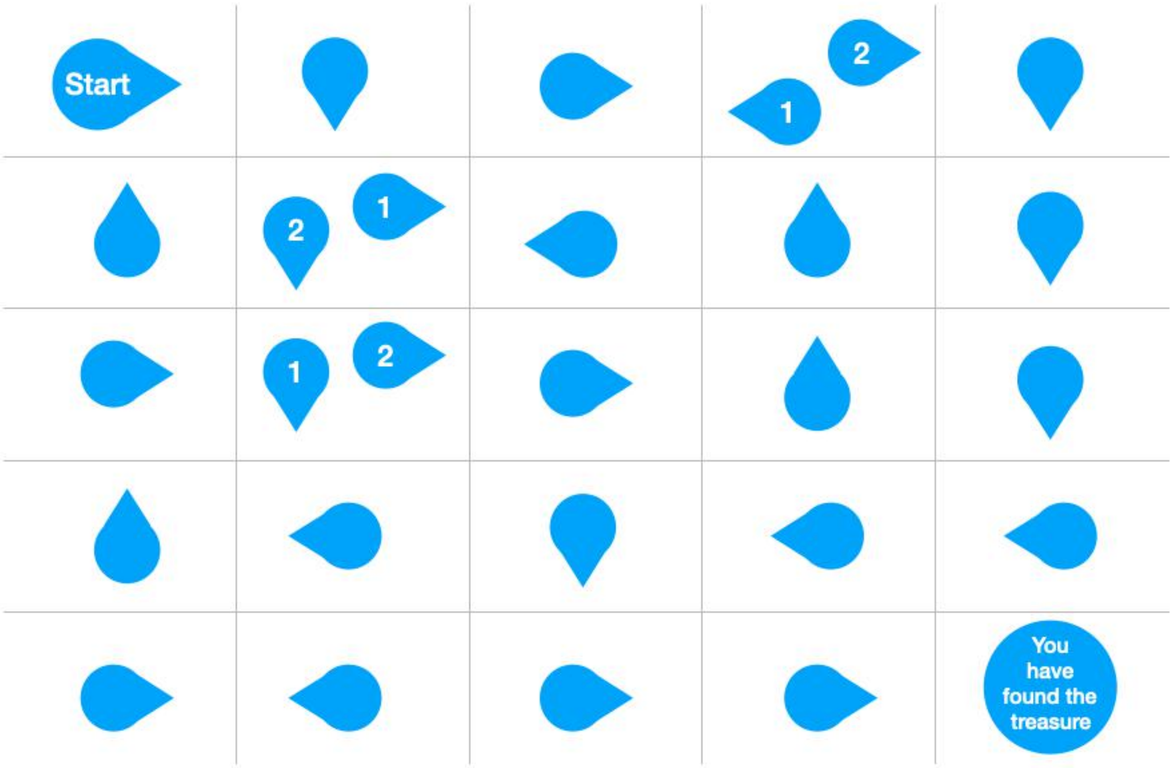
Analysing the map very carefully, you found these instructions on the back of the map.

Symbol	Meaning
Start	Start here and follow the pointed end of the drop to the next square.
	Continue to the next square in the direction of the pointed end of the drop.
1	When you reach this square the first time, follow the direction of the pointed end of the drop.
2	When you reach this square for the second time, follow the direction of the pointed end of the drop.

This page is for
Students

Pirate Treasure Hunt

Solve the maze to get to the treasure.



Step 1

Start at the Start drop and move to the next square in the direction of the point.

Step 2

Use a pen to show your path from drop to drop.

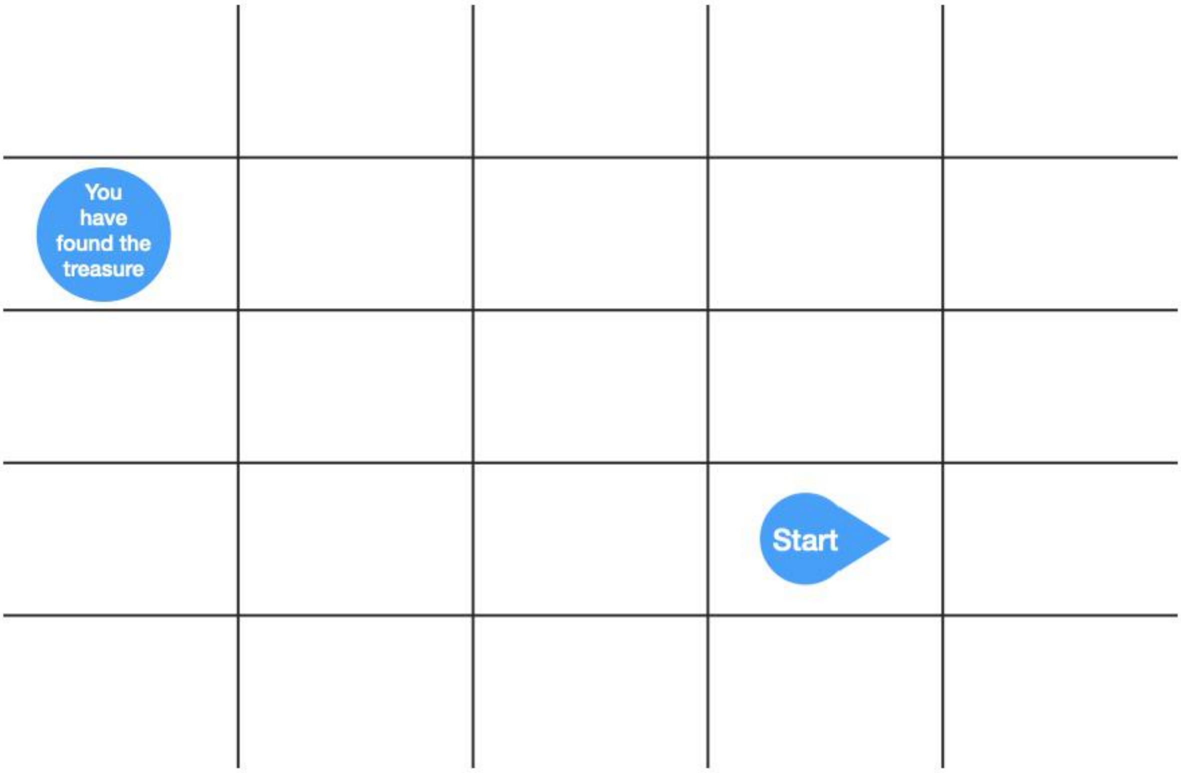
Step 3

When a square contains more than one drop, you need to decide if you have entered the square for the first or second time.

- If you enter the square the very first time, follow the pointed end of the drop with a 1.
- If you enter the same square a second time, follow the pointed end of the drop with a 2.

Step 4
The game is finished when your path has led you to the treasure.

Step 5
Create your own set of instructions to get from start to the treasure on the map below.
Draw the drops. Include at least two squares that have more than one drop in them.
Ask a friend or family member to follow your instructions. Did they arrive at the treasure? If not, have another go.



Pirate Treasure Hunt

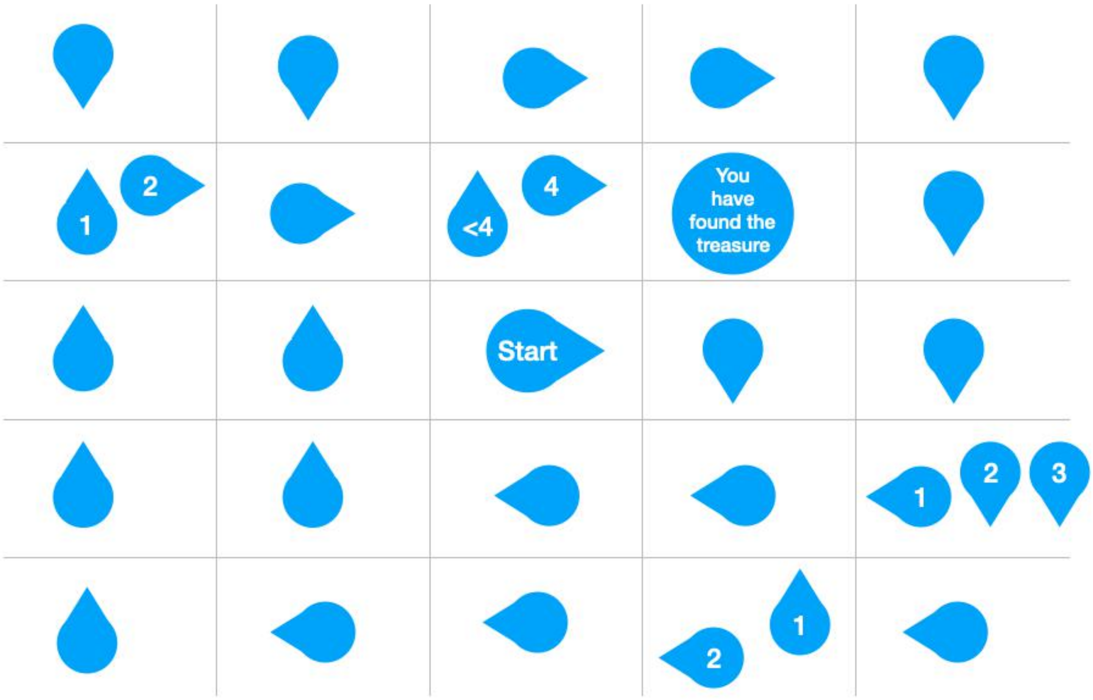
Map 2 - extension activity

This page is for

Students

The pirates are super-impressed with your problem-solving skills and ask you to solve another map for them. The same rules apply.

Hint: ‘<’ means less than

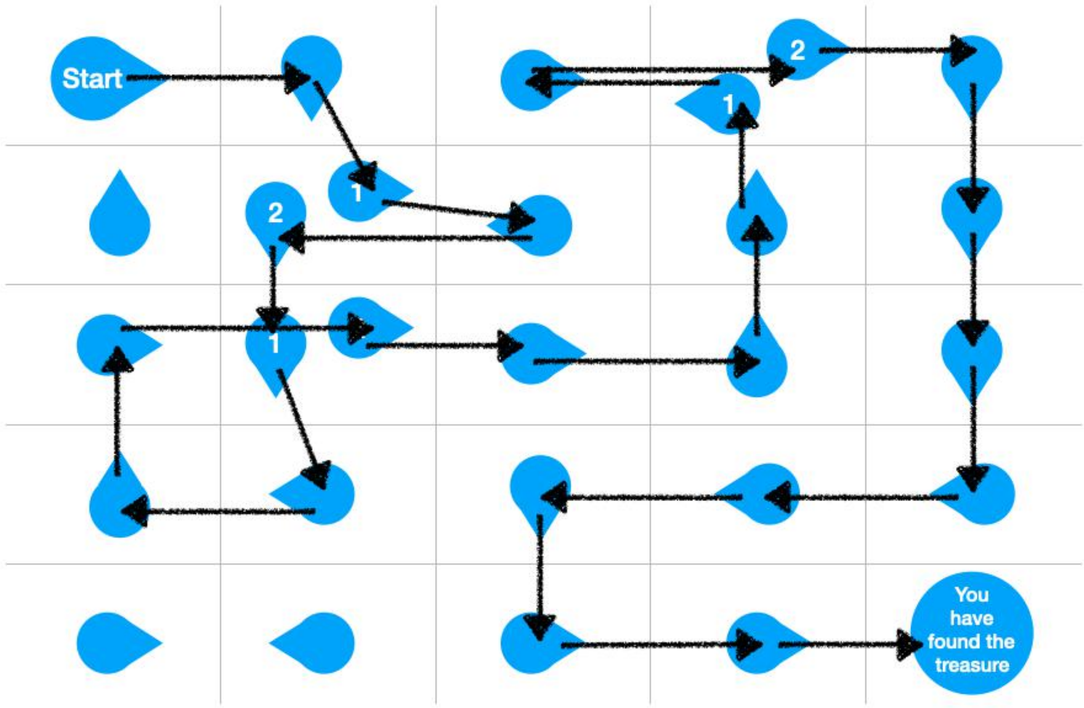


Answer key

Choose if you want to print this for your students
or keep it to yourself!

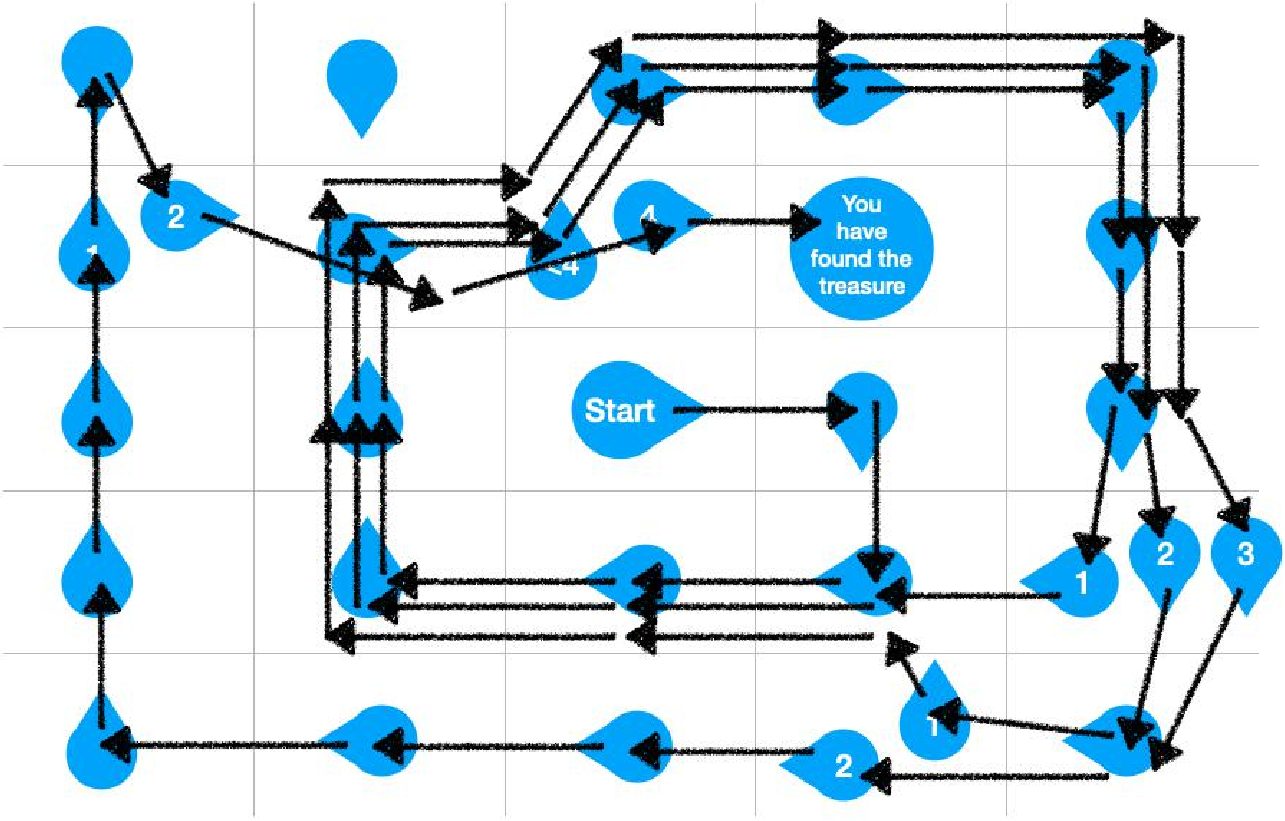
Map 1

Here is the solution to this game. The main challenge is for students to decide which of the dots they should connect to first and second when they enter a square. To keep track, students can count the arrows that go into a square, or add a tally in the corner of the square.



Answer key for map 2

Choose if you want to print this for your students or keep it to yourself!



This page is for

Teachers

Want more?

Here are some further activities, online resources, assessment ideas and curriculum references.

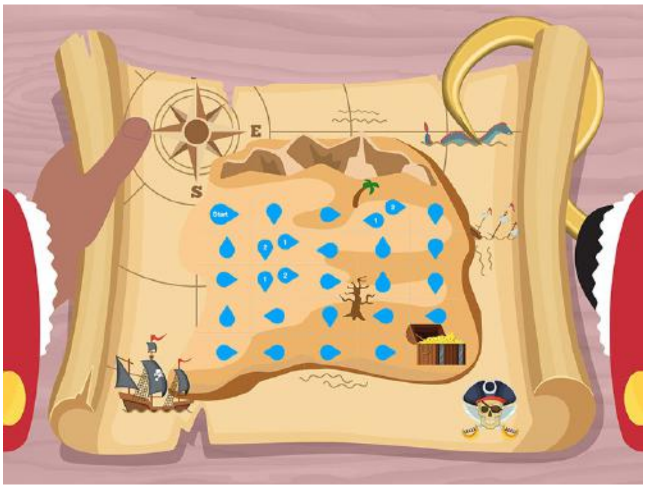
Adapting this activity

If your students are keen to keep going with this activity, you could draw more drops and use them in an open space: perhaps draw a grid with chalk on the ground, or use masking tape.
Ask students to create some more symbols to create another treasure map: how would you tell the hunter to move two squares?

Keep learning

Students can continue to learn about iteration and loops by learning to program using our DT Challenges - we suggest the chatbot activity cmp.ac/chatbot for students in year 5 and 6.

For year 3 and 4 students we recommend the wombot activity: cmp.ac/blockly-wombot



For teachers creating a portfolio of learning or considering this task for assessment

Ask students to submit their completed treasure maps and the additional map they have created.

Linking it back to the Australian Curriculum: Digital Technologies

Algorithms
Define simple problems, and describe and follow a sequence of steps and decisions (algorithms) needed to solve them. (ACTDIP010 - see cmp.ac/algorithms)

Design, modify and follow simple algorithms involving sequences of steps, branching, and iteration (repetition). (ACTDIP019 - see cmp.ac/algorithms)

Refer to aca.edu.au/curriculum for more curriculum information.

Digital Technologies @ School
Unplugged activities for students

This page is for Teachers

This activity is for: Years 3-6

Tech Collect

A fun find-a-word activity to improve students awareness of digital systems and their function

This activity is about recognising digital systems

Students in years 3 to 6 can improve their vocabulary and spelling as well as identifying digital systems.

This exercise improves students ability to scan for information, for example scanning a search engine or a piece of code.

- This activity will take about **20 minutes**

You will need…

- A printout of page 2 for each student/pair
- A pen/pencil

Keep the conversation going

- Do you have these technologies in your school?
- Can you point them out? Can you already name these devices on sight?
- Do you know what each of them does? What purpose do they serve?
- How do these technologies make our lives easier?
- Digital systems are made up of parts - how many parts can you name?
- Not all the items on the list are physical objects! Can you sort them into hardware and software?

Linking it back to the Australian Curriculum: Digital Technologies

Digital Systems

- Recognise and explore digital systems (hardware and software components) for a purpose (ACTDIK001 - see cmp.ac/systems)

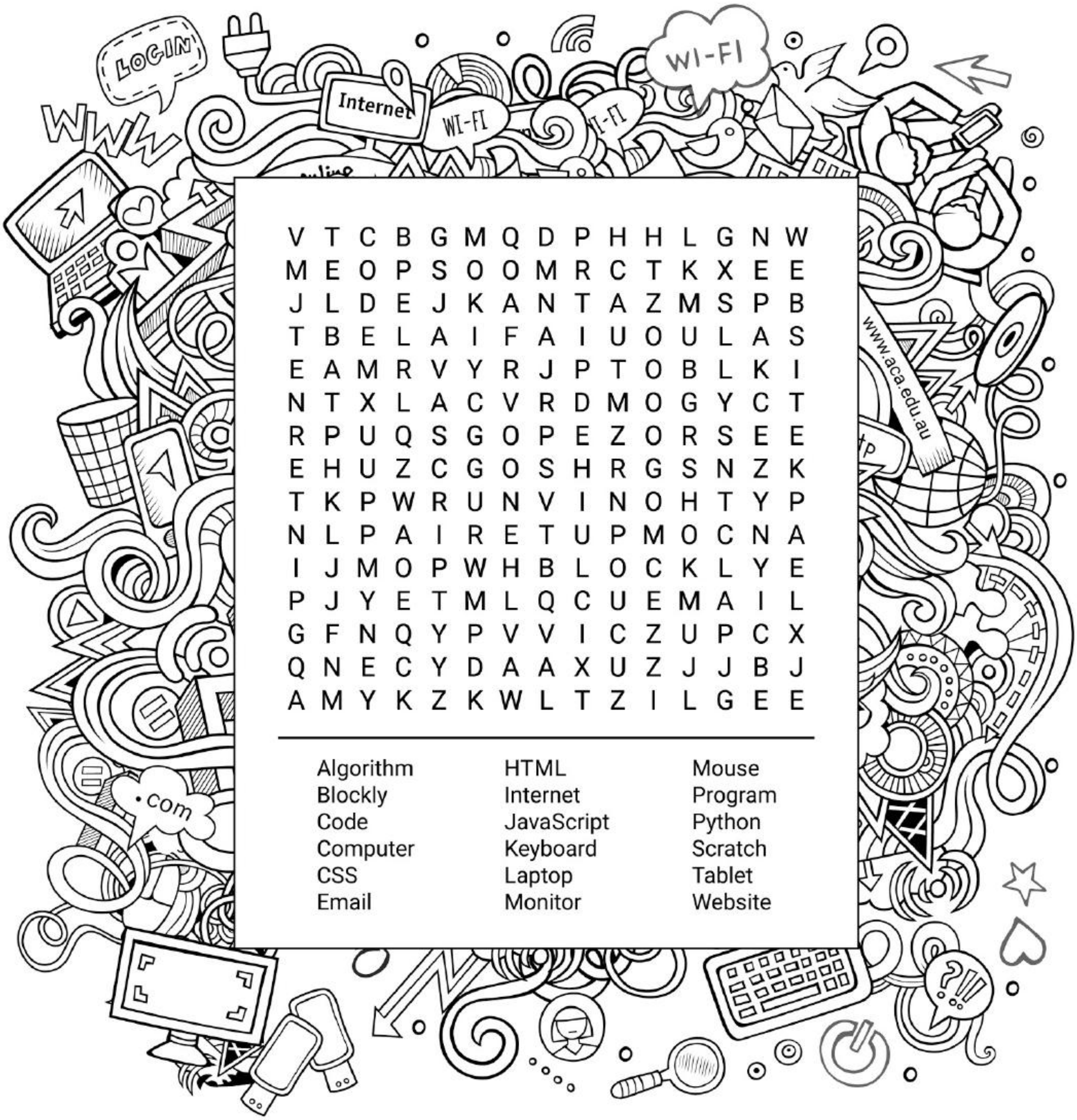
- Identify and explore a range of digital systems with peripheral devices for different purposes, and transmit different types of data (ACTDIK007 - see cmp.ac/systems)

Refer to aca.edu.au/curriculum for more curriculum information.)

Keep learning: Classify animals using a decision tree algorithm
This lesson teaches students to use physical characteristics of different animals to develop an algorithm that allows you to easily group and identify each animal based on a series of simple questions.
For more information head to cmp.ac/classifying

Tech talk

Can you find the 18 technology words hidden below? Some are written backwards! Circle them and colour in the background when done.



V	T	C	B	G	M	Q	D	P	H	H	L	G	N	W
M	E	O	P	S	O	O	M	R	C	T	K	X	E	E
J	L	D	E	J	K	A	N	T	A	Z	M	S	P	B
T	B	E	L	A	I	F	A	I	U	O	U	L	A	S
E	A	M	R	V	Y	R	J	P	T	O	B	L	K	I
N	T	X	L	A	C	V	R	D	M	O	G	Y	C	T
R	P	U	Q	S	G	O	P	E	Z	O	R	S	E	E
E	H	U	Z	C	G	O	S	H	R	G	S	N	Z	K
T	K	P	W	R	U	N	V	I	N	O	H	T	Y	P
N	L	P	A	I	R	E	T	U	P	M	O	C	N	A
I	J	M	O	P	W	H	B	L	O	C	K	L	Y	E
P	J	Y	E	T	M	L	Q	C	U	E	M	A	I	L
G	F	N	Q	Y	P	V	V	I	C	Z	U	P	C	X
Q	N	E	C	Y	D	A	A	X	U	Z	J	J	B	J
A	M	Y	K	Z	K	W	L	T	Z	I	L	G	E	E

Algorithm	HTML	Mouse
Blockly	Internet	Program
Code	JavaScript	Python
Computer	Keyboard	Scratch
CSS	Laptop	Tablet
Email	Monitor	Website

kostenkodesign/iStock.com

This page is for

Teachers

Answer key

V	T	C	B	G	M	Q	D	P	H	H	L	G	N	W
M	E	O	P	S	O	O	M	R	C	T	K	X	E	E
J	L	D	E	J	K	A	N	T	A	Z	M	S	P	B
T	B	E	L	A	I	F	A	I	U	O	U	L	A	S
E	A	M	R	V	Y	R	J	P	T	O	B	L	K	I
N	T	X	L	A	C	V	R	D	M	O	G	Y	C	T
R	P	U	Q	S	G	O	P	E	Z	O	R	S	E	E
E	H	U	Z	C	G	O	S	H	R	G	S	N	Z	K
T	K	P	W	R	U	N	V	I	N	O	H	T	Y	P
N	L	P	A	I	R	E	T	U	P	M	O	C	N	A
I	J	M	O	P	W	H	B	L	O	C	K	L	Y	E
P	J	Y	E	T	M	L	Q	C	U	E	M	A	I	L
G	F	N	Q	Y	P	V	V	I	C	Z	U	P	C	X
Q	N	E	C	Y	D	A	A	X	U	Z	J	J	B	J
A	M	Y	K	Z	K	W	L	T	Z	I	L	G	E	E

Algorithm	HTML	Mouse
Blockly	Internet	Program
Code	JavaScript	Python
Computer	Keyboard	Scratch
CSS	Laptop	Tablet
Email	Monitor	Website

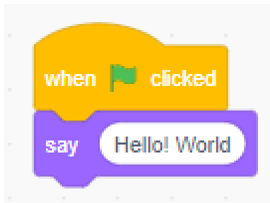
This page is for

Students Teachers

Glossary

Something unfamiliar? Find it below for some more information.

Word	Simple Category*	Definition
Algorithm		An algorithm is a sequence of steps that you follow to solve a problem. When you cook using a recipe, do long division in maths, or put on your uniform in the morning you are following an algorithm!
Blockly	Programming Language	Blockly is a visual programming language. That means it is a ‘drag and drop’ style of programming with minimal typing. Here are some example blocks:  You can program in Blockly in some of the ACA Digital Technologies Challenges. Have a look here: https://aca.edu.au/resources/#blockly
Code	Software	Code is what is used to give computers instructions. Computers can’t understand English or any other human language! When you write code for computers, you write it in a programming language.
Computer		A computer is a machine that works with data. It can take data in as input, work with it and send back changed data as output. For example, a calculator is a computer. You give it a maths question as input data, it calculates it and it gives you the answer as output.
CSS	Programming Language	CSS is a text based programming language. CSS stands for "Cascading Style Sheet", it is a language specifically for programming how websites look. Without it, websites would look a lot more flat and boring.
Email	Software	Email is software that runs on a computer. It helps you to send a message by saving your message, transmitting it across the internet to a mail server (like a digital mailbox) of the person it is for.
HTML	Programming Language	HTML is a text based programming language. It is one of many languages used to program websites. If a website was a house, HTML would be the basic walls, doors and windows that make it work. Languages like CSS and Javascript add the furniture, paint and pictures that make it comfortable and nice to live in.
Internet		The internet is a connected network of computers. It is made up of millions and millions of them that can all talk to each other. It’s a way of sharing information because you don’t have to keep everything on your computer, you can ask others to show you information they are saving.

JavaScript	Programming Language	Javascript is a text based programming language. It is used to program interactivity on websites.
Keyboard	Hardware	A keyboard is a piece of hardware that helps you to interact with a computer. It has keys for all the letters of the alphabet as well as different punctuation marks and maths symbols.
Monitor	Hardware	A monitor is a piece of hardware that helps you interact with a computer. It is a screen that displays images. The computer has to run software to translate the data from 1's and 0's to images on the monitor that are easy for people to understand.
Mouse	Hardware	A mouse is a piece of hardware that helps you interact with a computer. It moves a mouse icon across a monitor screen so that you can interact with the computer without having to type.
Program	Software	A program is a collection of code that are instructions for a computer. When a program is run, the instructions are carried out by the computer. Programs can do all sorts of things!
Python	Programming Language	Python is a text based programming language. You can use it to program computers. Unlike HTML, it is not just for one thing, it can be used for mathematics, websites, video editing, data processing, games… So much more! You can program in Scratch in some of the ACA Digital Technologies Challenges. Have a look here:https://aca.edu.au/resources/#python
Scratch	Programming Language	Scratch is a visual programming language. That means it is a 'drag and drop' style of programming with minimal typing. Here are some example blocks: You can program in Scratch in some of the ACA Digital Technologies Challenges. Have a look here: https://aca.edu.au/resources/#scratch 
Tablet	Hardware	A tablet is a type of computer that has a touch screen as the primary way to interact with it. It can sometimes have a keyboard and mouse attached too.
Website		A website is a collection of files that are saved on a computer connected to the internet. When you visit a website with **your** device, it runs a program that can read those files and show you what is saved on that computer.
	***categories**	Some of the words above don't fit easily into one category like 'Hardware' or 'Software'. Is it because they are both? What do you think they could be? Talk with your teacher about what you think could be added as a category.

This page is for

Digital Technologies @ School
Unplugged activities for students

Teachers

This activity is for: Years 3-6

Marble Run

This activity teaches decision making (branching)

In computing, branching is making a decision that changes the flow, or outcome, of the program. A home computer makes decisions like this all the time, for example, *if a usb is plugged in, then it shows up in the file explorer*. These decisions don't just exist in computers, they are in the physical world too. Trains switch to a different track *if a lever is pulled*, electricity flows to your lights *if the switch is turned on*.

In this activity the decision will take place in a marble run, where changing a small element in the run, or flipping a switch, causes the marbles to change track.

This is a creative activity, designed to be made from simple materials, it can be as complex, or as simple as you like.

- This activity will take up to **60 minutes**, depending on the complexity of the marble run.
- This activity is designed to be done **solo** or **in pairs**

You will need...

At least one marble and supplies to build the run. You could probably make this with just a wall, sticky tape, and paper - but it's more fun to get creative with materials.

Some useful materials are:

- Toilet paper rolls
- Sticky tape
- Paper
- Scissors
- Buckets/cups for marbles to fall into
- A wall or door that you can stick things too
- Floor space
- Lego
- A large tilted board to stick things to
- Hot wheels track

Each student/pair will need a print out of pages 2-3.

Marble Run

Make your own marble run!

This page is for

Students

Step 1: Simple marble run

Make a marble run.

Your marble run should be long enough that the marble travels for at least one second, and lands safely in a bucket at the end!

Don't make it too complicated just yet, we'll add extra stuff later.

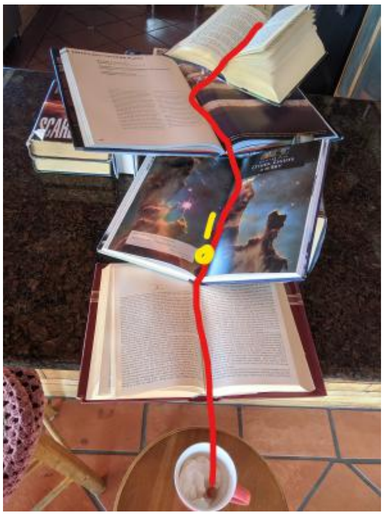
Some example marble runs:

Lego Marble Run!

Broken Guitar!

Paper and tape only!

Books!



This page is for

Students

Step 2: Add a decision

Add a *decision*, or *branch* to your marble run.

It should be something like a switch on a train track, where you can quickly change it back and forth.

It could be:

- A toilet paper roll with hole cut in it, and paper to easily put on top and seal it back up again
- A lego brick that can be added and removed
- An extra wall that diverts it off the track

Step 3: A bigger marble run!

Make a new track that your marble takes if it branches off, so it ends up in a different bucket!

1. Paper run with two tracks!

There's a hole in one of the paper tubes that can be covered over - switching the marble to the new track.

2. Broken Guitar with an extra branch

A small cable twist tie diverts the marble off to the side.

Step 4: If it's ok with your teacher, take a video of your marble run and ask them to share it on Twitter, Instagram or Facebook, tagging us (@grokacademy)

See what other people have made!

This page is for

Teachers

Want more?

Here are some further activities, online resources, assessment ideas and curriculum references.

Adapting this activity

The basic concept of a marble run with decisions can be extended in a number of ways.

Self sorting

If students have different sized marbles they could make a self sorting run. For example smaller marbles might fall through a hole, while larger marbles don't.

Count the marbles

If you have access to a microcontroller, like a micro:bit or arduino, you could use a sensor to keep track of the number of marbles coming through. Is there an alternative way to do it without a digital system? What's the advantage of each?

Keep the conversation going

- How is the branching decision that we make with marbles like computer branches?
- How is it different?

Keep learning

For year 5/6 students interested in learning more about how computers make decisions, try our blockly Smart Garden online course: cmp.ac/garden

For teachers creating a portfolio of learning or considering this task for assessment

Ask students to take a video of their marble run, making sure they are demonstrating the branching element.

Linking it back to the Australian Curriculum: Digital Technologies

Algorithms

Design, modify and follow simple algorithms involving sequences of steps, branching, and iteration (repetition) (ACTDIP019 - see cmp.ac/algorithms)

Refer to aca.edu.au/curriculum for more curriculum information.

Digital Technologies @ School
Unplugged activities for students

This activity is for: Years 5-6

Wombot: Carrot Hunt

This activity teaches algorithmic thinking

We use algorithms to solve all sorts of problems around us. Algorithms are sequences of steps, or procedures, that lead us from a starting position to a goal. Some algorithms can be described easily (think about the recipe for making a cake), whilst others are harder to describe (think about a Sudoku puzzle).

The algorithm in this activity is somewhere between a cake recipe and a Sudoku puzzle: there are some procedural steps, and a bit of trial and error.

- This activity may take up to **60 minutes**.
- It is designed for students working in **pairs**

You will need…

- A printout of pages 2-3 for each **pair**
- Scissors for each pair **or** a pencil/rubber
- To run as a worksheet print pages 4-5 for each **pair**

Getting started:

Wombot is very upset: **five delicious carrots have gone missing!**
A bunch of Wombot's friends have joined in the carrot hunt — can you help?

Each Wombot is looking forwards and to each side to look for the carrots, and each of them can see some of the carrots, or none. Your job is to work out where the five carrots are!

See a demonstration

cmp.ac/carrothuntvid

This page is for
Students

Wombot: Carrot Hunt

Oh no! Wombot has lost five delicious carrots!
Wombot's friends have joined in the hunt, and they need help!

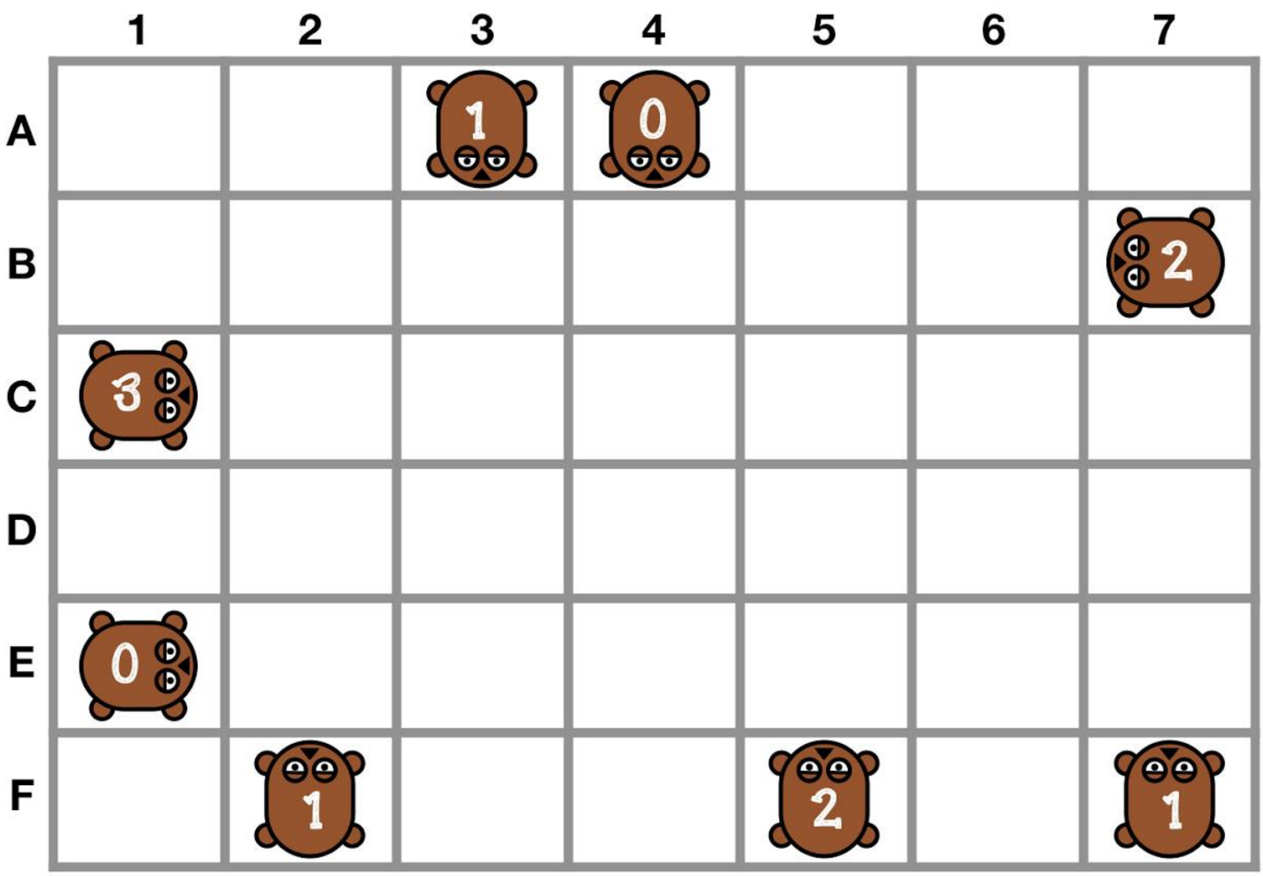


Image: Credit Grok Academy Limited (formerly the Australian Computing Academy, the University of Sydney)

This page is for

Students

Wombot: Carrot Hunt

Oh no! Wombot has lost five delicious carrots!
Wombot's friends have joined in the hunt, and they need your help!

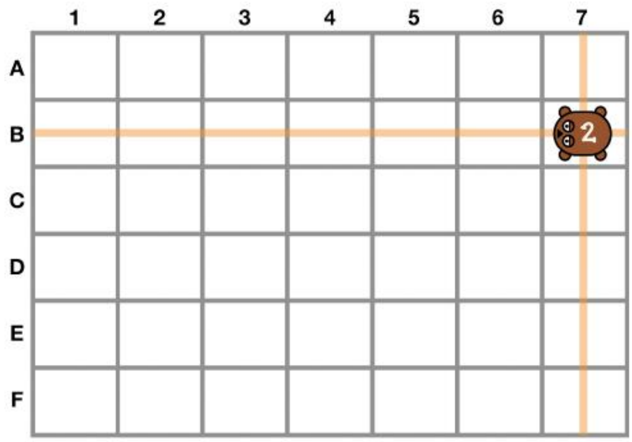
Preparation:
Cut out the five carrot markers and 30 no-carrot markers.
(You could also use a pencil to record whether or not there are carrots in squares on the grid.)

Carrot markers

No carrot markers

Step 1

All the Wombots are gathered around the garden looking for carrots.
Each Wombot has a **number** showing how many carrots it can see — in front, or to its left, or to its right.



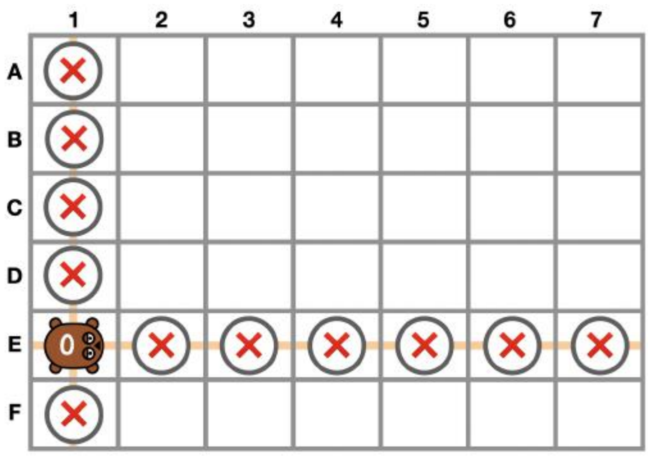
Here is an example.

The Wombot at B7 has the number **2** on its back — so it can see two carrots.

The carrots must be *somewhere* on the orange lines.

Step 2

If a wombot has zero on its back, then it doesn't see any carrots along its connected lines. Mark the places that are definitely free of carrots with an **X**.

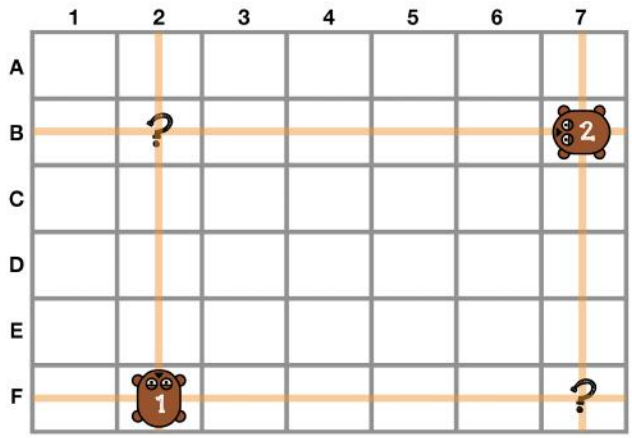


This page is for

Students

Step 3

When two Wombots get together you can see clues to find the carrots. One place the carrots **could** be found is where the lines from the Wombots cross.



The Wombot at B7 can see **two** carrots, and the Wombot at F2 can see **one** carrot — maybe they are seeing one carrot together!

It could be that there is a carrot where the lines cross — **where the "?" is at B2 and F7!**
Now, a carrot might **not** be there — but it's a clue!

By looking at the numbers on the other Wombots you can combine the clues and work out where the carrots are hiding.

Step 4

Follow the lines from each of the Wombots, and work out where the carrots must be!
Remember, each Wombot's number is the total number of carrots it can see, not more or less.

When you think you're sure of where a carrot is, mark the location with a **carrot marker**.
Mark all the places that you're sure **don't have carrots** with the **X** markers.
(Some of the Wombots **can't see any carrots** — that's a hint!)

When you have placed **all 5 carrot markers**, check if the numbers on each Wombot matches the number of carrots it can see. If you have made a mistake, place the carrot marker somewhere else — keep trying!

When you think you have it right, check the answers with your teacher.

Answer key

Choose if you want to print this for your kids or keep it to yourself!

This page is for

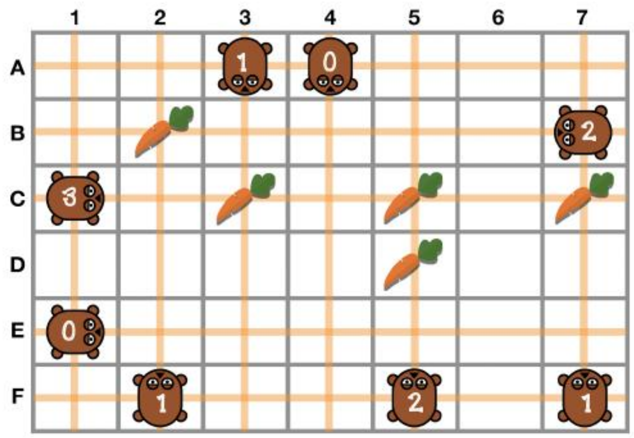
Teachers

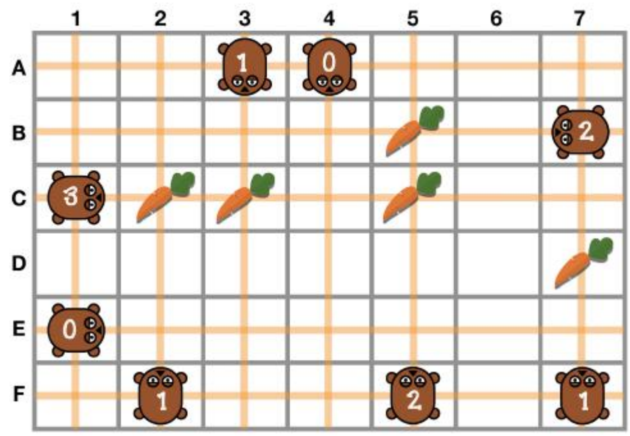
A good place to start is with the Wombots that **can't see any carrots**.
You know that none of the carrots are on the lines drawn from those Wombots — so that's easy!
Put **X** markers on all of those spaces.

Then, you can start working out where the carrots might be. One Wombot can see three carrots — **and they all have to be across row C** (can you see why?). So you can try putting three carrots along row C, and then look at the other Wombots — do they see enough carrots? Or too many? Or too few?

Some hints:
Some carrots can be seen by more than one Wombot.
One carrot can only be seen by one Wombot.

Here are two possible solutions:





Your students may have found another valid solution — there are at least three others!

This page is for

Teachers

Want more?

Here are some further activities, online resources, assessment ideas and curriculum references.

Keep learning

Continue learning about algorithms with our friendly wombot by completing the Blockly Wombot DT Challenge: cmp.ac/blockly-wombot

For a more challenging version of this activity take a look at Spaceship Rescue: cmp.ac/spaceshipSchool

For teachers creating a portfolio of learning or considering this task for assessment:

Ask students to submit their solution recorded with a pen or pencil rather than markers.
Students can design their own version of this activity by placing carrots and recording how many carrots each wombot can see, then asking a friend or family member to solve the new challenge.

Linking it back to the Australian Curriculum: Digital Technologies

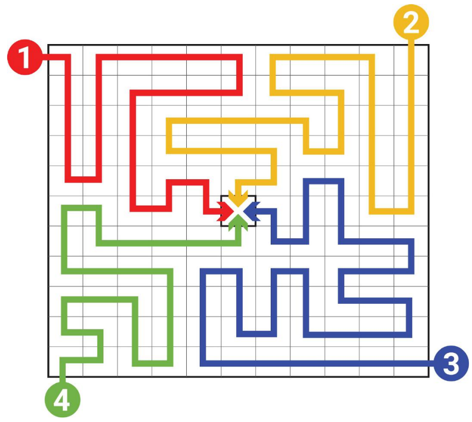
Algorithms
Design, modify and follow simple algorithms involving sequences of steps, branching, and iteration (repetition) (ACTDIP019 - see cmp.ac/algorithms)

Refer to aca.edu.au/curriculum for more curriculum information.

Digital Technologies @ Home
Unplugged activities for students

This activity is for: Years 5-8

Maze escape!



Many thanks to the Girls Programming Network who created this activity.

This activity teaches…

This activity teaches students to create an efficient algorithm, to navigate through a maze. This activity will take **1 to 2 hours**.

Students choose from a finite set of commands trying to build the **best** (most efficient) maze navigation algorithm. In this activity 'best' means the fewest number of instructions.

Creating algorithms that are accurate and efficient is an important concept in computing. Solving problems takes a computer's time and energy: as we ask computers to solve bigger and bigger problems (like climate modelling and searching for life beyond earth) it becomes more and more important to find the most efficient solution available.

The commands students will use to get through the maze include two key programming ideas:
branching: ie IF something is true THEN do something)
iteration: keep doing something a fixed number of times or until a specified condition is no longer true.
They will need to understand these concepts to complete this activity effectively.

Getting started:

This activity can be delivered as a workbook by printing pages 2-9 or you can just print pages 4-9 (the maze instructions) for students to cut out. You could also have students write the instructions out on a piece of paper.

For the maze, you can use a printed copy of the maze, or you can use masking tape (if you have space and time) on the floor, creating a room-sized maze following the picture shown.

Students can work alone or in pairs taking turns coming up with instructions and then following them.

See a demonstration

cmp.ac/mazevid

Maze escape!

Can you get to the centre of the maze with the fewest instructions?

Step 1

Cut out the commands on pages 4-9.

Step 2

Using only the cut out commands, create an algorithm to get to the centre of the maze.
Your algorithm should follow one line colour. So, if you want to follow the red line to the center, you cannot touch yellow or green lines.

Step 3

Now follow the instructions you built exactly (or ask your partner to follow them), starting from the number at the beginning of the coloured line. For example, if you wanted to follow the blue line, you would start on the blue number 3.

Do your instructions work? Do you need to change them a bit? Can you improve them at all?

Step 4

If your instructions get you to the middle, work out how many points you earn (see below).

Now see if you can make a better set of instructions that earns you as many points as possible.

Step 5

Repeat steps 1-4 for all the maze paths.

Points

You earn points for each set of instructions. The less commands you use the more points you get.
There are 4 paths to the centre of the maze.

- You get 10 points per path if your instructions have less than 12 commands.
- You get 8 points per path if your instructions have between 12 and 20 commands.
- You get 5 points per path if your code has more than 20 commands.

If you write a program that works on any of the paths and will get to the centre, you get a **bonus 10 points**.

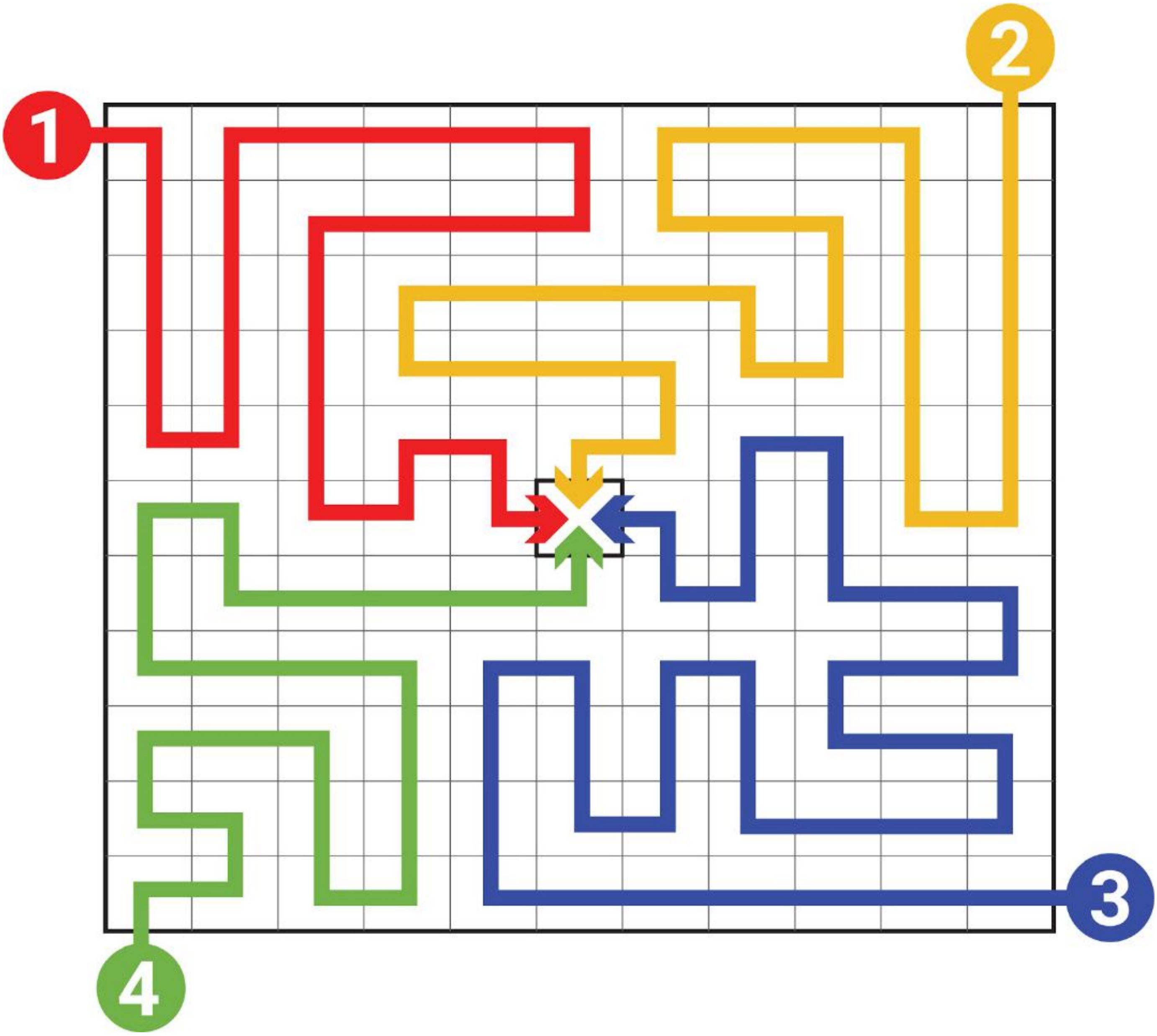
Get **another bonus 10 points** if your instructions solve all the paths in **less than 7 lines**.

This page is for

Students

Maze escape!

Can you get to the centre of the maze with the fewest instructions?



Maze escape!

Can you get to the centre of the maze with the fewest instructions?

Print off these commands

For ____ counts: →
For ____ counts: →
For ____ counts: →
For ____ counts: →

Maze escape!

Can you get to the centre of the maze with the fewest instructions?

Code snippets - while loop

While not at the end of maze: →
While not at the end of maze: →
While not at the end of maze: →
While not at the end of maze: →

Maze escape!

Can you get to the centre of the maze with the fewest instructions?

Code snippets - while loop

While there is path ahead: →
While there is path ahead: →
While there is path ahead: →
While there is path ahead: →

Maze escape!

Can you get to the centre of the maze with the fewest instructions?

Code snippets - if

If there is a path to the left: ⟶
If there is a path to the left: ⟶
If there is a path to the right: ⟶
If there is a path to the right: ⟶

Maze escape!

Can you get to the centre of the maze with the fewest instructions?

Code snippets

If there is a path in front: →
If there is a path in front: →
If there is a path in front: →
If there is a path in front: →

Maze escape!

Can you get to the centre of the maze with the fewest instructions?

Turn to the right	Turn to the left
Turn to the right	Turn to the left
Turn to the right	Turn to the left
Turn to the right	Turn to the left
Turn to the right	Turn to the left
Step forward	Step forward
Step forward	Step forward
Step forward	Step forward
Step forward	Step forward

This page is for

Teachers

Answer key

Choose if you want to print this for your kids or keep it to yourself!

There are many possible answers to this activity. The best, most efficient solution uses **6 commands** that work on **all** the paths:

While not at the end of maze:
→ If there is a path to the left:
  → Turn to the left
  If there is a path to the right:
  → Turn to the right
  Step forward

The reason we don't need the "If there is a path in front" before stepping forward - is because we've checked if the line turns already, it will *always* be forward.

Here is an example to follow line 1 that is the **least efficient** and would only earn 5 points:

Step forward
Turn to the right
For 4 counts:
→ Step forward
Turn to the left
Step forward
Turn to the left
For 4 counts:
→ Step forward
Turn to the right
For 4 counts:
→ Step forward
Turn to the right
Step forward
Turn to the right

(continued):
For 3 counts:
→ Step forward
Turn to the left
For 4 counts:
→ Step forward
Turn to the left
Step forward
Turn to the left
Step forward
Turn to the right
Step forward
Turn to the right
Step forward
Turn to the left
Step forward

Want more?

Here are some further activities, online resources, assessment ideas and curriculum references.

Adapting this activity

Once students understand how to complete this activity, ask them to write efficient instructions to help navigate the world around them. For example using a map, or the steps to get to their bedroom. Or an algorithm that puts a pencil on every desk in the classroom in the most efficient way.

Keep the conversation going

- What were some strategies that you used to solve the problem?
- How does it relate to other types of instructions like directions or navigation?
- Did you see any repeated patterns within the solution? Could you turn them into a **function**?

Keep learning

To move this type of thinking into the computer, we recommend trying the Blockly Turtle course. Students can write their own programs that follow these types of steps!

cmp.ac/blocklyturtle

For younger students who would like to create a maze using the Scratch programming language, there is a printable step by step guide available here:

cmp.ac/scratchmaze

For teachers creating a portfolio of learning or considering this task for assessment

Ask students to submit their best algorithm for the 4 paths in this worksheet.

You could also ask them to design their own maze and accompanying efficient algorithm.

Linking it back to the Australian Curriculum: Digital Technologies

Algorithms
Design, modify and follow simple algorithms involving sequences of steps, branching, and iteration (repetition) (ACTDIP019 - see cmp.ac/algorithms)

For a band level specific curriculum linking, see https://aca.edu.au/resources/maze-escape/#linking

Refer to aca.edu.au/curriculum for more curriculum information.

Digital Technologies @ School
Unplugged activities for students

This activity is for: Years 4-6

Cracking a code — give your passwords superpowers

This activity teaches students about how to create secure passwords

How many guesses will it take to crack the code set by your partner?

Students do this activity with a partner. Player 1 chooses a three digit code using only numbers between 1 and 6 (for example 235 or 532 or 625 but not 743). Player 2 has 10 chances to guess the number.
After each guess Player 1 gives Player 2 information to help them make a better next guess.

Students and their families use passwords every day to secure information as basic as their order for a favourite pizza or as important as their bank account or school exam results. It's really important to keep this information secure.

It's fairly simple to guess a 3 digit code created using 6 numbers within 10 guesses. Short passwords can be easily cracked too. Maths tells us that in our game there are 6 x 6 x 6, or 216 possible combinations. Adding an extra digit to the code would make it **much** harder to guess: there would now be 1,296 combinations. If we used eight digits in our password there would be 1,679,616 possible passwords (sticking to six numbers only). If we include all 10 digits and twenty six letters in the alphabet (upper case or lower case), we also make passwords much harder to crack: a 3 digit or letter password now has 238,328 combinations. Length matters with passwords, and at the end of the activity students will have a strategy to choose their own strong passwords.

This activity is expected to take 30 to 60 minutes. Print pages 2 and 3 for students to use, and read through the information on pages 1 and 4 before you get underway.

Getting started:

Can you crack the code? Imagine that all that stands between you and a vault full of cash is a combination lock with 3 digits. Each digit can only be a number between 1 and 6. Use your logic powers to crack the code! Once you have cracked the code, use your new skills to create passwords with super powers!

See a demonstration

cmp.ac/codecrackervid

Crack the code

How many guesses do you need to crack open the vault?

This page is for Students

Step 1

Player 1: choose a 3 digit number using only numbers between 1 and 6. Write it down to remember it, but keep it secret from player 2. You can use the same number more than once in your 3 digit number.

Step 2

Player 2: write your first guess in line 1 of the table.

Step 3

Player 1: in the smaller boxes on line 1, let Player 2 know how good their guess was:
If they have a number that's the right number in the right place, draw a ☑.
If they have the right number in the wrong place, draw a ?
If they guess a number that isn't in your number at all, draw a ✕

For example: If Player 1 is thinking of 653 and Player guesses 321, they would get a result of ? ✕ ✕ : one number (3) is the right number in the wrong place, and two numbers (2 and 1) aren't in the code at all.

1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Step 4

Repeat steps 2 and 3 in the next rows of the table as many times as you need until Player 2 guesses Player 1's number.

Code:	6	5	3			
1	3	2	1	?	✕	✕
2	4	5	6	✕	☑	?
3	6	2	4	☑	✕	✕
4	6	5	1	☑	☑	✕
5	6	5	2	☑	☑	✕
6	6	5	3	☑	☑	☑

Here's how a game looks if the code is '653'

This page is for

Students

Step 5

Play the game again but instead of **numbers** this time agree with your partner on six items in a group: say, favourite foods (chocolate, donut, apple, cherry, salami, tomato) or superheros (Spiderman, Iron Man, Black Widow, Black Panther, Captain Marvel, Thor). Write the list down so you can both see it.

Play the game again - so Player 1 might choose **Thor - Iron Man - Spiderman**. If Player 2 guesses **Black Panther-Iron Man-Thor** - the feedback would be ✕ ☑ ?.

Step 6

You can use this game to make really strong passwords. If your password is only 3 characters long, computers can guess your password **almost instantly**. If you use a password with 20 characters it will take much longer. So next time you need to choose a password think about your three favourite things in a group - foods, superheros, TV shows. This will make a nice long password that you can remember easily but computers can't crack easily. For example the password **ThorIronManSpiderMan** would take ***607 million years*** for a computer to guess with today's technology! Always remember to use long passwords. You can check your password here: www.howsecureismypassword.net

1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Write down the six item here (eg Spiderman, Iron Man, Black Widow, Black Panther, Captain Marvel, Thor):

This page is for

Teachers

Want more?

Here are some further activities, online resources, assessment ideas and curriculum references.

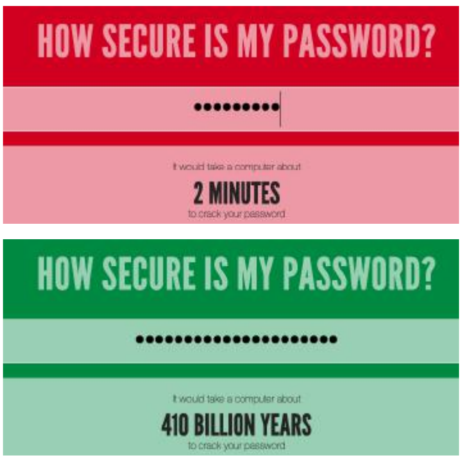
Adapting this activity

This activity could be adapted for learners of many ages by: using colours instead of numbers (for example, guess a three colour code made of green, red, blue and yellow), using all digits between 0 and 9 in the first game, or beginning with a four digit code.

Keep learning

To explore password security, and other key issues around information privacy, enrol students in the Information Privacy and Security Schools Cyber Security Challenge: cmp.ac/infosec or the Information and Privacy Security Challenge for primary students: cmp.ac/primaryinfosec

To see in real time how secure different lengths of passwords are, look at: www.howsecureismypassword.net (also good to view on a mobile device.)



For teachers creating a portfolio of learning or considering this task for assessment

Ask students to suggest tips for creating a secure password.

Students can create their own code-cracking game using the principles in this game.

Linking it back to the Australian Curriculum: General ICT Capabilities

Apply personal security protocols

Identify and value the rights to identity, privacy and emotional safety for themselves and others when using ICT and apply generally accepted social protocols when using ICT to collaborate with local and global communities.

Refer to aca.edu.au/curriculum for more curriculum information.

This page is for

Digital Technologies @ School
Unplugged activities for students

Teachers

This activity is for: Years 5-8

Unscrambling a secret message

This activity teaches how we can send a receive scrambled messages

We can make a message secret by changing the letters to create an *encrypted message*. This change process is called a *cipher*. Anyone who knows the cipher can reverse it, *decrypting* the secret message to get the original back. The message is still there, but hidden, because we've changed how we *represent* it.

Simple ciphers, such as Pig Latin[1] or Caesar Cipher[2], can be *cracked* to find the original message and the cipher.

We use *secure* ciphers (that are extremely hard to crack) to protect communication on the Internet, e.g. to stop hackers getting our credit card details when we shop online. Without encryption, every message we send is at risk.

In this activity, the message is encrypted by swapping letters (a *substitution cipher*). There is no pattern to how they are swapped, except that each letter always swaps to the same one. Here, the cipher encrypts every *G* by swapping it to an *A*, so to decrypt the message, we must swap every *A* back to an *G*.

You can crack the substitution cipher to find the original message by looking for familiar words and letter patterns in the encrypted message. Good luck!

This activity will take up to **60 minutes** . Print pages **2** for students. The answer appears on page **3**. Page **4** contains further curriculum information and teaching ideas.

Getting started:

We're going to unscramble a hidden message, using our understanding of English and commonly used words, and learn about one way to send hidden messages. We're going to crack a cipher!

[1] https://en.wikipedia.org/wiki/Pig_Latin
[2] https://cryptii.com/pipes/caesar-cipher

This page is for Students

Can you unscramble the message?

The letters have been jumbled up. Use the grid at the bottom to write down your answer for each letter. Use your knowledge of words to figure out what the message says.

The first word has only one letter. How many one letter words do you know? It can't be **A** because the answer grid shows us that when you see a **G** in the scrambled message, this becomes **A** in the unscrambled message (the top line). So it must be **I**. Go ahead and find all the other letters **Y** in the scrambled message and write **I** above them. Also write **I** above **Y** in the answer grid at the bottom of the page.

Look for other parts of words that you recognize. On the third line the letters **BCGJ** are unscrambled to be **_HAT.** Think of a word that ends in **HAT.** It might be **THAT,** but we already know that **J** in the scrambled message becomes **T,** and this scrambled word starts with **B.** Once you have figured out what to change letter **B** to, write it above **B** everywhere you see it in the message and also in the answer grid, then look for other parts of words you recognise.

Unscramble this message

							T				A	T		M	Y
Y		Z	Y	P	W		J	H		W	G	J		A	L

				T	B						T	H	
	B	W	W	J	R	Y	N		B	Y	J	C	

	H					.			H	A	T			
E	C	W	W	V	W	.		B	C	G	J		Y	V

T	H			B			T		B			A		-
J	C	W		R	W	V	J		R	D	W	G	P	-

	A		T								U	?	
I	G	V	J		I	H	D		L	H	M	?	

Write your answers here

M		H				A			T			U
A	B	C	D	E	F	G	H	I	J	K	L	M

				B								
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Answer key

This page is for

Teachers

The unscrambled message

I		L	I	K	E		T	O		E	A	T		M	Y
Y		Z	Y	P	W		J	H		W	G	J		A	L

	W	E	E	T	B	I	X		W	I	T	H	
	B	W	W	J	R	Y	N		B	Y	J	C	

C	H	E	E	S	E	.		W	H	A	T		I	S
E	C	W	W	V	W	.		B	C	G	J		Y	V

T	H	E		B	E	S	T		B	R	E	A	K	-
J	C	W		R	W	V	J		R	D	W	G	P	-

F	A	S	T		F	O	R		Y	O	U	?	
I	G	V	J		I	H	D		L	H	M	?	

The completed answer key

M	W	H	R	C	J	A	N	F	T	P	Y	U
A	B	C	D	E	F	G	H	I	J	K	L	M

X	Q	K	D	B	Z	O	G	S	E	V	I	L
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

This page is for

Teachers

More information

Here are some further activities, online resources, assessment ideas and curriculum references.

Adapting this activity

Once students understand how to complete this activity, ask them to prepare a hidden message for a classmate.
It helps to have short words in the message if you want to crack them.

Keep learning

For year 7 to 10 students interested in learning more about how computers communicate with encrypted messages, try this course:
cmp.ac/crypto

An additional hands-on lesson plan further exploring cryptography is available to download at
cmp.ac/cipherwheels

For teachers creating a portfolio of learning or considering this task for assessment

Ask students to create their own scrambled message using a substitution cipher that they create.

Students could also explore when cryptography is necessary for securing data by making a list of data they frequently send online: examples include messages, searches eg, for netflix, bus timetables, recipes, banking transactions, purchase of movie tickets, submitting school work. Students can then sort these transmissions into activities where encryption is (i) necessary (ii) a good idea (iii) unnecessary.

Linking it back to the Australian Curriculum: Digital Technologies

Digital systems
Investigate how data is transmitted and secured in wired, wireless and mobile networks, and how the specifications affect performance (ACTDIK023 - see cmp.ac/systems)

Cryptography is an important part of investigating the transmission of data.

Cryptography

Cryptography allows a message to be securely stored and transmitted.

Students explain why cryptography is necessary for securing data (e.g. transmitting credit card details over the web) and explore simple encryption and decryption algorithms (e.g. rot13 and XOR).

Refer to aca.edu.au/curriculum for more curriculum information.

This page is for

Digital Technologies @ School
Unplugged activities for students

Teachers

This activity is for: Years 3-4

Flat Pack LEGO LEGO is a trademark of the LEGO Group

This activity teaches algorithms

This activity introduces algorithms using LEGO construction bricks. Students will be required to represent different blocks using words and deliver explicit instructions to another student to help them to build a LEGO figure.

- This activity should take **between 30 minutes and 1 hour**.
- Students should work **in pairs**

You will need…

- Assorted LEGO blocks
- Pen and paper
- Print page 2 for each pair of students

See a demonstration

cmp.ac/legovid

Getting started

Students will make something out of lego, then describe it sufficiently for another student to follow. This is similar to the instructions in flat pack furniture, or LEGO.

Flat Pack LEGO

This page is for

Students

Help someone else to recreate your LEGO creations by writing the best instructions possible!

LEGO is a trademark of the LEGO group

Step 1

Build a LEGO creation in 10 pieces or less. It can be an animal, a person or an object. Whatever you can build in 10 pieces is great! Keep the finished creation a secret for now. (15 minutes)

Step 2

Once you have designed and built your creation, write instructions on how to build it. Words only! They can be as long or as short as you like, but try to make them as clear and easy to follow as possible. (10 minutes)

Step 3

Break your creation back into pieces. Now, swap pieces and instructions with your partner and build the other person's creation! (10 minutes)

Step 4

When they are finished or time is up, check and see. How did you both do? Did your partner make your creation correctly?

If they didn't, discuss any confusing bits in your instructions. How can you make them clearer?

Step 5

Try this activity again with a new creation! What else can you add to your instructions to make it easier to understand?

This page is for

Teachers

Answer key

Choose if you want to print this for your kids or keep it to yourself!

The ideal instructions
The overall solution to this activity are instructions that provide enough information for the builder so that they can successfully build your creation. The instructions can take many forms but they key factors are:

- Clear definitions
- Clear context

Let's unpack those a bit more.

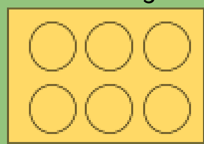
Clear definitions

Ideal instructions will define a few things before you get started. You need to make sure that the builder knows without a doubt which blocks are which, or they're going to build off the plan.

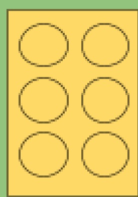
You should also define your rotations, this is important for terms like "left, right top" etc. Should left mean 30 degrees left? 90 degrees? Starting from where? This brings us to the second major part, context.

Clear context

The position of the pieces needs to be contextualised so that you know what edge is the left, the top etc. Consider a block that is 2x3 circles big. Which is the left hand edge?



This is the same block, which is the left hand edge now?



It all depends on the context which you can give your builder by having a chat beforehand, or by including extra details about how to place pieces when they are setting up to build.

There's no official LEGO terminology for parts (aside from their part numbers) so it's completely up to you! Just make sure that you give the names clear context and definition.

This page is for

Teachers

Diagrammatic or Photographic Instructions
Visual instructions can be just as good, if not better. But why?

If your student has struggled to contextualise spatial instructions (e.g. ‘up, down, the top, turn left, rotate upward’), they’re not alone! It’s really hard to define all the spatial aspects necessary for clear 3D instruction.

A photo or diagram has a lot of this information implicitly* present. The spatial position of the block is
already communicated so instructions to “flip it over” can be taken in the content of that image and interpreted more easily.

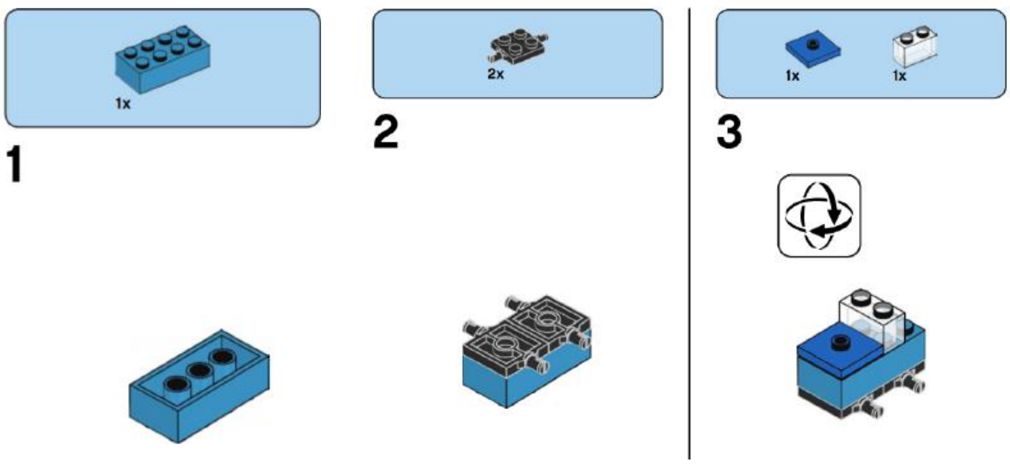
*implicitly: in a way that is suggested but not communicated directly (Cambridge Dictionary)

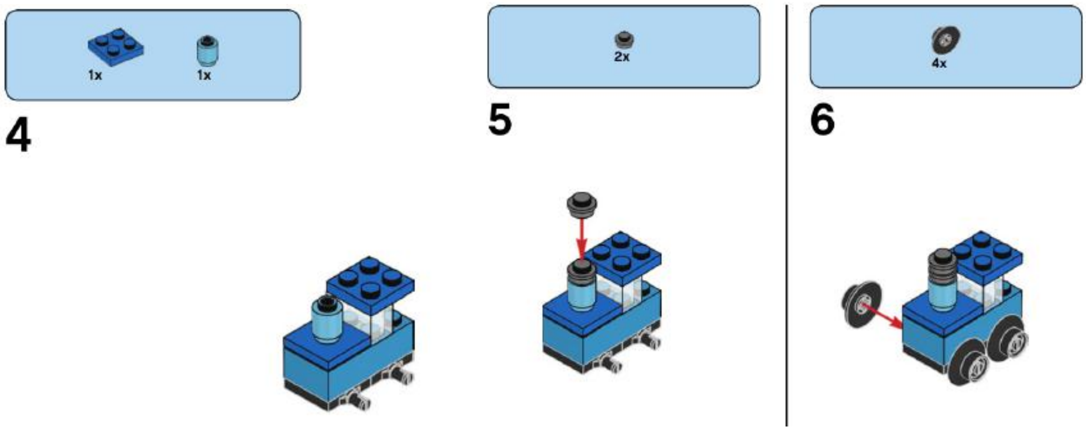
This is why so many building instructions contain very few words but many images.

The LEGO website has all of its kits instructions available for download, the link is here:
https://www.lego.com/en-us/service/buildinginstructions

They have helped people build creations for decades and most of that is done with pictures (though partly because they are catering to children who may not be able to read yet).
Another alternative is IKEA building instructions which are also primarily visual.

Here’s an example from LEGO kit number 11006.





Copyright LEGO, LEGO is a trademark of the LEGO Group

There's still some **context** and **definition** needed, even with these instructions. Can you see the symbols that need defining? The arrow and the 'rotate' symbol. Both of these are contextualised by the images before and after them. Before the rotate symbol, the LEGO in 2 is upside down, in 3 the rotate symbol is present and the image of the piece is flipped.

Similarly, the image where the arrow first appears and the one after it show that the piece has started at the blunt end of the arrow and been places where the point is. It's telling your brain where to put the block without you even knowing it!

This page is for

Want more?

Here are some further activities, online resources, assessment ideas and curriculum references.

Adapting this activity

If students really want a challenge, they can sit back to back with each other. The student that designed the creation has to explain how to build it to the other student. They are not allowed to look at what the other student is doing. It adds complexity but also increases the obviousness of where language might fail in their instructions.

With some careful planning, this activity can be run over a video conferencing setup. However you must make sure that students have access to the same LEGO pieces.

Keep the conversation going

- Is it easier to build the creation if you know what it is supposed to be?
- Is it easier to write instructions in words or in pictures?
- Is it easier to read instructions in words or in pictures?
- What if the person who was building your creation was colourblind? How could you help them find the right blocks? How important are colours to your creation?
- What were some strategies that you used?
- What do you need to tell the person building your LEGO so that the instructions work?
- If you could design your own LEGO piece, what would it look like? Where could you use it?

Keep learning

Try drawing using Blockly code blocks here: cmp.ac/blocklytree

For teachers creating a portfolio of learning or considering this task for assessment

Students could conduct research on building instructions (e.g. LEGO, IKEA) and write what findings they draw from the examples.

Linking it back to the Australian Curriculum: Digital Technologies

Algorithms
Define simple problems, and describe and follow a sequence of steps and decisions (algorithms) needed to solve them (ACTDIP010 - see cmp.ac/algorithms) (3-4)

Specification
Define problems in terms of data and functional requirements drawing on previously solved problems (ACTDIP017 - see cmp.ac/specification) (5-6)

Refer to aca.edu.au/curriculum for more curriculum information.