



Digital Technologies @ School
Unplugged activities for students



Teachers

This activity is for: Years 5-10

Tech Trek

With thanks to David Schulz, year 10 student, for providing the inspiration for this content.

This activity teaches encryption and data representation

In this activity, students solve seven puzzles to navigate their way around the school to find a hidden treasure. Puzzles are solved by applying a range of data representation, binary number, pixel graphic, morse code and simple cryptography skills.



It is targeted towards **upper primary** and **secondary** students and is expected to take **15 to 45 minutes**.

Care has been taken to choose locations that are representative of typical Australian school, however, if your school is different, please be creative: you can amend the clues to reflect the locations at your school, or, for example, if you don't have a canteen, then designate an area in your school (for example a storeroom) and call it the canteen for the day. These clues can be presented in any order: plan ahead how you will organize teams, and which order you will ask each team to complete the clues in.

Encryption and data representation are important ideas in computing. Encryption allows computers to communicate securely with one another. We use secure ciphers (which are much harder to crack than the ones in this activity) 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.

Data Representation is an important part of communication. Many ideas can be communicated using symbols and conventions. In this activity, dots, dashes, pixel graphics and strings of 1s and 0s are all used to communicate important information. Computers also use conventions to store different kinds of data, including using binary numbers.



Teachers

You will need...

A treasure: treats, stickers, small items...

Hide the treasure in your homeroom (or another location linked to the last clue.)

Cut out the puzzles on pages 3 and 4 and hide them: we have suggested an order (Table to the right) but feel free to change it based on your needs.

Puzzle Number	Location to hide it
Puzzle 1	Hand it to the student
Puzzle 2	Canteen
Puzzle 3	Library
Puzzle 4	Hall
Puzzle 5	Main gate/entry
Puzzle 6	Office
Puzzle 7	Staff room

Note to teachers: Puzzle 6 contains a binary number. If you haven't covered binary with your students yet, please use this table to translate the binary numbers into decimal numbers to get started.

Value:	32	16	8	4	2	1	=
101010	1*32	0*16	1*8	0*4	1*2	0*1	42
100110	1*32	0*16	0*8	1*4	1*2	0*1	38

Getting started (read this with your students):

A treasure is hidden somewhere in the school. To solve this puzzle, you must solve the clues by correctly decoding/translating them. Each solution will lead you to the next room.

Sometimes, the solution to a problem is a single number, which maps to a room as shown in the following table:

1	Hall
2	Office
3	Canteen
4	Staff room
5	You homeroom
6	Main gate / entry
7	Library

When the solution to a problem is many numbers, use the numbers as positions in the alphabet. For example, 123 = ABC (Number decoding).

Remember! You **must** show your working, and the rooms which you travel through to successfully complete the challenge.



Tech Trek

A treasure is hidden somewhere at school. Solve the puzzles to find it!



Puzzle 1

Here is your first secret message:

dash-dot-dash-dot
dot-dash
dash-dot
dash
dot
dot
dash-dot

Solve it and go to the stated room.

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

Puzzle 2

These letters seem to make no sense at all. It must be a code. You figure it out and make your way to the answer.

WKH REMHFWLYH OLHV LQ WKH OLEUDUB...

Tip: A Caesar Cipher is a way of encrypting a message. To encrypt a message, letters are shifted to the right by a shift key. For example if the shift key is 1, the message ABC becomes BCD. To decrypt BCD we shift each letter one to the left, and it becomes ABC.

The shift key for this message is **3**.



Puzzle 3

Here is another message for you: **Here Assemblies Likely Linger**. This cryptic message not only tells you what happens in this location, but there is another subtle clue included.

Puzzle 4

Here is the fourth puzzle for you:

20-8-9-19
9-19
23-8-5-18-5
25-15-21
5-14-20-5-18
20-8-5
19-3-8-15-15-12

Each of the groups of numbers is a word. Solve the puzzle to continue your journey.

Puzzle 5

It's the place people drink 'coiffe'. That's not bad pronunciation, it's actually an anagram of your next location. Head there now!

Puzzle 6

What will you do with this puzzle?

101010 – 100110 = ? As the equation becomes clear, you hurry to the room.

Tip: If you need an extra hint to solve this, ask for a clue.

Puzzle 7

Make sense of this cryptic sequence of 1's and 0's: **11111100001000011111000010000111111**.

Use this 5 x 7 table to solve this puzzle. Tip: If you need an extra hint to solve this, ask for a clue.

You've arrived!

The treasure is here somewhere.



Answer key

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

Answers

Puzzle 1

CANTEEN

Puzzle 2

The shift is 3

By shifting the letters in **BRXU REMHFWLYH OLHV LQ WKH OLEUDUB** by three to the left (remember, we are uncoding), the message reads : **Your objective lies in the library**

Puzzle 3

Here Assemblies Likely Linger = the Hall (also the first letter of each word spells 'Hall')

Puzzle 4

Each number gets converted to its corresponding letter in the alphabet. For example, 123 = ABC. The resulting message is: **this is where you enter the school** = School gates / entry

Puzzle 5

Office, an anagram of Coiffe

Puzzle 6

The two strings of 1's and 0's represent binary numbers. If your students have not explored binary before, you can explain to the that each digit can be translated to a decimal value as follows:

Value:	32	16	8	4	2	1	=
101010	1*32	0*16	1*8	0*4	1*2	0*1	42
100110	1*32	0*16	0*8	1*4	1*2	0*1	38

42 - 38 = 4. Room 4 is the **Staff Room**



Answer key

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

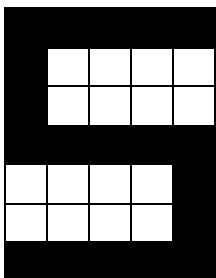
Puzzle 7

Pixel graphics.

Clue: If the student is stuck, suggest to Split the binary number into seven groups of five bits

11111
10000
10000
11111
00001
00001
11111

Enter them into the 5*7 matrix. A 1 corresponds to a black pixel. The resulting number is 5, which is the student's Homeroom.





Teachers

Want more?

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

Adapting this activity

This activity can be a springboard for students to create their own clues for students to continue the tech trek. It could also be used for a collaborative class activity where students can create clues to send a secret message around the class, translating it from a cipher to morse code, number translation, etc.

Older students may enjoy exploring more complex methods of encryption such as hashing algorithms: <https://brilliant.org/wiki/secure-hashing-algorithms/> (which wouldn't work well in this activity as they can't be decrypted.)

Keep learning

For High School students interested in learning more about how computers communicate with encrypted messages, try this course: cmp.ac/crypto.

For students who would like to explore data representation, and how computers store images, text and music using 1s and 0s, try this course: cmp.ac/pythondatarep

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

Ask students to create their own tech trek clues based on the activities in this worksheet.

Linking it back to the Australian Curriculum: Digital Technologies



Data representation

Investigate how digital systems represent text, image and audio data in binary (ACTDIK024 - see cmp.ac/datarep)

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