Caterpillar Coding

Living things and their habitats: butterflies and moths

Scientific researchers use computers on a daily basis to help them to solve complex problems, generate hypotheses, store large volumes of data, and analyse datasets that are too large and/or complex too do by hand.

Some scientific researchers develop software programmes that can be installed and used on mobile computer devices or smartphones. These programmes are called Apps, which is short for "application". For example, ''What's flying tonight?' and iRecord Butterflies are Apps that have been developed by scientists at the UK Centre for Ecology & Hydrology and Butterfly Conservation to help volunteer scientists to identify moths and butterflies, and collect data about the moths and butterflies that are living near them. These volunteers are 'Citizen Scientists'.

Binary code is a language used by computers and Apps that uses two digits (called bits): 0 and 1. Binary code allows computers and Apps to send and receive information to each other (letters, symbols, sounds, videos). Each letter of the alphabet has a specific combination of eight 0 and 1 digits. A combination of 8 digits (bits) is called a byte. Each letter of the alphabet has one byte for uppercase, and one byte for lowercase. For example, an uppercase 'C' is written with the binary code 01000011, but a lower case 'c' is written 01100011. The binary codes for each uppercase letter of the alphabet is given below:

A	01000001		N	01001110
B	01000010		O	01001111
C	01000011		P	01010000
D	01000100		Q	01010001
E	01000101		R	01010010
F	01000110		S	01010011
G	01000111		T	01010100
H	01001000		U	01010101
I	01001001		V	01010110
J	01001010		W	01010111
K	01001011		X	01011000
L	01001100		Y	01011001
M	01001101		Z	01011010

How did scientists solve complicated mathematical problems before there were computers?

Before there were computers, people, who are nowadays called 'Human Computers', were employed to do complex mathematical problems by hand. Calculations were broken down into smaller, more basic math problems, and each problem was then given to a person to solve. Human computers would sit at tables with pen and paper and work for many long hours to carefully solve the math problem they were given. Human computers solved math problems that helped to build space rockets, calculate artillery trajectories during World War 2, and to build the first machine computers!

Annie Easley was an American computer scientist, mathematician, and rocket scientist. Easley applied for a job as a 'human computer' at the National Aeronautics and Space Administration (NASA). She was one of the first African-Americans to work at NASA. When machine computers were invented, Easley became a computer programmer. She had a long and very successful career, working on many complex projects developing alternative power technology. Most famously, she worked on the Centaur rocket.

Activity 1: Create a paper chain caterpillar using binary code

Equipment list

- 2 different coloured papers
- Scissors
- Selloptape (or glue)

Instructions

- See the video: 'How to_caterpillar coding'.
- Use the binary code alphabet and the 'Activity 1 translation sheet' to translate either the word 'caterpillar' or the word 'larva' into binary code.
- Optional: On the 'translation sheet' work out the number of bits, and the number of bytes that make up your word. Write the answer in the Table.
- Choose one colour paper to represent the '0' and a different colour paper to represent the '1'
- Cut strips of each colour paper approximately 1cm wide and 10 cm long
- Start with the first letter of your word. For the first binary number make a circle with the coloured strip using sellotape.

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- Continue to the next letter of your word, make a circle with the coloured strip (using the correct colour for that binary digit) and using selloptape, join it to the first circle to make a paper chain.
- Repeat for each of the letters in your word to create a paper chain of your word in binary code.
- On a coloured piece of paper, draw a face for your caterpillar. Cut the face out, and stick it to the front of your paper chain (on the first circle of your binary code), so that you know which is the front of your paper chain 'caterpillar' or 'larva'.
- For longer words, it may be easier to work in groups and work together to make the paper chain caterpillar.

Activity 2: Translate binary codes

- Use the binary code alphabet and the 'Activity 2 translation sheet' to translate each of the 3 binary codes to reveal the name of 3 types of butterfly commonly found living in farmland habitats.
- Use the internet and/or a selection of relevant nature books from the library to find pictures of each type of butterfly. Draw a colourful picture of each type of butterfly (use a separate piece of paper if you need some more space).

Please provide us with some feedback about the [Caterpillar coding activity](). Thank you!

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Activity 1 translation sheet

Binary code alphabet

A	01000001		N	01001110
B	01000010		O	01001111
C	01000011		P	01010000
D	01000100		Q	01010001
E	01000101		R	01010010
F	01000110		S	01010011
G	01000111		T	01010100
H	01001000		U	01010101
I	01001001		V	01010110
J	01001010		W	01010111
K	01001011		X	01011000
L	01001100		Y	01011001
M	01001101		Z	01011010

Translation sheet

	Binary code	Number of 'bits' (paper circles)
C		8
A		8
T		8
E		8
R		8
P		8
I		8
L		8
L		8
A		8
R		8
	Total number of bits	
	Total number of bytes	

	Binary code	Number of 'bits' (paper circles)
L		8
A		8
R		8
V		8
A		8
	Total number of bits	
	Total number of bytes	

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Activity 2 translation sheet

Binary code alphabet

A	01000001		N	01001110
B	01000010		O	01001111
C	01000011		P	01010000
D	01000100		Q	01010001
E	01000101		R	01010010
F	01000110		S	01010011
G	01000111		T	01010100
H	01001000		U	01010101
I	01001001		V	01010110
J	01001010		W	01010111
K	01001011		X	01011000
L	01001100		Y	01011001
M	01001101		Z	01011010

Activity 2: Translation sheet

	Butterfly 1
Binary code	Your letter
01000011	
01001111	
01001101	
01001101	
01000001	

	Butterfly 2
Binary code	Your letter
01010000	
01000101	
01000001	
01000011	
01001111	
01000011	
01001011	

	Butterfly 3
Binary code	Your letter
01010010	
01001001	
01001110	
01000111	
01001100	
01000101	
01010100	

Draw pictures of each type of butterfly below (there is more space available on the next page):

Activity 1: Translation sheet answers

	Binary code
C	01000011
A	01000001
T	01010100
E	01000101
R	01010010
P	01010000
I	01001001
L	01001100
L	01001100
A	01000001
R	01010010

	Binary code
L	01001100
A	01000001
R	01010010
V	01010110
A	01000001

Activity 2: Translation sheet answers

	Butterfly 1		Butterfly 2		Butterfly 3
Binary code	Your letter	Binary code	Your letter	Binary code	Your letter
01000011	C	01010000	P	01010010	R
01001111	O	01000101	E	01001001	I
01001101	M	01000001	A	01001110	N
01001101	M	01000011	C	01000111	G
01000001	A	01001111	O	01001100	L
		01000011	C	01000101	E
		01001011	K	01010100	T

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