Christmas puzzles with CS4FN

A4

Version for School Teachers

CS4FN
Computer Science For Fun

UKRI Engineering and Physical Sciences Research Council

Queen Mary University of London

Table of Contents

These word puzzles are a way to have fun while developing the **logical / computational thinking** and **pattern-matching** skills needed to enjoy computing (and maths). There are two versions: red for home educators and green for school teachers. The packs are the same but the home ed versions have some puzzles with the solution at the bottom (for parents to fold over or cut off before giving to their child). The school version has the solutions on separate pages (to save teachers having to fold 30 bits of paper!).

Red: for home educators

Green: for school teachers

The pixel puzzles should be filled in with coloured pens or pencils following the colour guide.

Bonus Christmas Computing Zine – your child can fill this in themselves, or fold it following the instructions (see https://**bit**.ly/**CS4FN**mini**Zine**Christmas) and send to a friend to complete.

More info at https://**cs4fn**.blog/**christmas**2024
https://**teaching**london**computing**.org/kriss-kross-puzzles/ and https://**teaching**london**computing**.org/pixel-puzzles/

Christmas Pixel Puzzles: Computational Thinking

Pixel puzzles turn the ways images are represented (as a series of numbers representing pixels) into puzzles. They come in various forms from a simple variant of colour-by-numbers to more complex puzzles based on compression where images are represented by fewer numbers so take up less storage – but can you get them back! Each representation needs its own algorithm to follow to get the image back.

Use them to learn about algorithms, representation of images, pixels and raster graphics, compression algorithms, run length encoding, data representation, logical thinking, computational thinking. Also for younger children practice and explore numeracy, counting, colours, symmetry.

One way images are represented and so stored in a computer or digital camera is as a grid of numbers. This way of representing an image is called a **bitmap image** or a **raster image**. Each image is split in to a grid of squares. Each number gives the colour of that square of the image. Each square is called a pixel. The more pixels making up the image the **higher the resolution** it has. Higher-resolution pictures have more detail and in particular lines are smoother. The image is less pixelated – you see the squares less. It also means you can see more fine detail – smaller things may disappear in a **low resolution** image.

Each image has to also come with (or have pre-agreed) a key indicating which number corresponds to which colour. The number of colours allowed is called the **colour depth**. The more colours, the more bits are needed to store each pixels colours. With two colours you need a single bit for each pixel, with 4 colours you need 2 bits, with 8 colours you need 3 bits, and so on. Each bit pattern represents a different number and so a different colour.

Computational Thinking

An important part of computational thinking involves being able to choose an appropriate **representation** of data. It is important to know about different representations already used. Choosing representations is a part of **abstraction**: choosing what matters to represent about data and what can be ignored. With bitmap images, part of that is in choosing the resolution. By splitting the image in to small squares and ignoring finer detail, we get an easy way to store, manipulate and transmit images. Once the image is a list of numbers we can explore variations of the representation that allow us to compress the image – store it using fewer numbers.

This is also an example of decomposition with respect to data. The image is decomposed in to small squares. A different way to decompose an image, so a different representation is by the lines and shapes within it. This **decomposition** instead leads instead to vector images.

Every image is unique, but by choosing a representation of bitmap images we get a **generalised** way to represent an image. Any image can be represented this way.

Instructions: Simple Colour-by-number Puzzles

Each square holds a number that tells you the colour to colour in that square. Look up the colours in the key.

Explore different algorithms for colouring them in. For example:

1.Work along the rows colouring each pixel in turn before moving to the next row.

2.Pick a colour then work along the rows, colouring pixels of only that colour. When you get to the end of the grid, pick the next colour and start again. Repeat this until you run out of colours.

3.Pick an uncoloured square and colour it, then colour all pixels around it that are the same number, moving outwards until their are no more adjacent pixels with that number. Then pick a new uncoloured square and repeat until the whole picture is done.

Christmas Kriss Kross Puzzles

These word puzzles are a way to have fun while developing the **logical / computational thinking** and **pattern-matching** skills needed to enjoy computing (and maths).

These are our Christmas-themed kriss kross puzzles, we also have puzzles themed around Spring and Hallowe'en as well as subject-specific ones such as history, minibeasts and Egypt. For much younger children we have a range of puzzles that can also help them practise reading, writing, spelling (and phonics) and counting.
Find them all at https://**teaching**london**computing**.org/kriss-kross-puzzles/

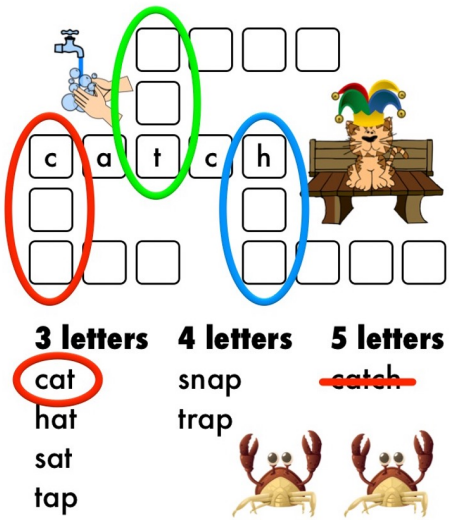
How to solve a Kriss-Kross: an introduction to logical thinking
- Logical thinking is just about thinking clearly and being careful.
- Look for clues that are useful *now*.
- Some clues won't be useful *yet*. Just be patient! You just need other clues first.
- Check and double check.

Starting Strategies
A good clue to look for first: If there is only one word of any length left then find the blank space in the grid of the same length - that's the only place that word can fit.

Make sure to cross the word off so you know which you have used!

Now look for more clues. Which words in the grid have letters that mean only one word fits? If you know some letters of a word in the grid then count how many letters long it is and compare the unused words of that length with the pattern of known letters. If only one matches you have found where it goes. Otherwise you need more information so try another word in the grid.

- Lots end in **t** so that is no help
- but only one 3-letter word starts with **c**
- (only one starts with **h** so that's possible too)



Three of the words with 3 letters *could* fit in the green oval (CAT, HAT and SAT) as they all end with the letter T – but CAT can only go in the space that starts with the letter C (red oval) as none of the other words could fit there, and HAT can only fit in the three-letter space starting with H (blue oval).

Christmas Pixel Puzzle 1: A very welcome visitor

Pictures can be stored in a computer as a grid of numbers. Each number gives the colour of that small area or **pixel**. This is also the way digital images are stored and represented on a screen.

Recreate the picture by colouring each **pixel** as given by its number. Look up the colour for each number in the key. For example, colour pixels marked 0 in black, and pixels marked 1 in red.

6	6	6	6	6	6	6	6	1	8	6	6	6	6	6	3
6	6	6	6	6	6	6	1	1	1	6	6	6	6	3	3
6	5	5	5	5	6	1	1	1	1	1	6	6	6	6	3
6	3	3	3	5	6	8	8	8	8	8	6	6	6	6	4
1	3	3	2	2	5	8	9	9	9	8	6	6	6	6	4
7	7	7	7	7	7	8	8	1	8	8	6	6	6	2	4
7	7	7	9	9	7	1	8	8	8	1	6	6	4	4	4
7	7	7	8	8	7	1	1	8	1	1	6	6	4	5	4
7	7	7	1	1	1	1	1	1	1	1	1	9	4	4	4
7	7	7	7	1	1	1	1	1	1	1	1	1	4	4	5
7	7	7	7	7	7	8	8	8	8	8	4	8	4	4	4
7	7	7	7	7	6	1	1	1	1	1	4	9	5	4	2
7	7	7	7	7	3	1	1	3	1	1	4	4	4	4	4
7	5	2	5	3	3	1	1	3	1	1	3	2	3	3	4
3	2	2	2	3	3	0	0	3	0	0	3	3	3	1	1
3	5	2	5	3	0	0	0	3	0	0	0	3	3	1	1

KEY

0 Black
1 Red
2 Orange
3 Yellow
4 Green
5 Blue
6 Purple
7 Brown
8 White
9 Pink

Puzzle created by Paul Curzon

The Computing

One way images are represented and so stored in a computer or digital camera is as a grid of numbers. This way of representing an image is called a bitmap image or a raster image.

Find out more at https://**teaching**london**computing**.org/pixel-puzzles/

Christmas Pixel Puzzle 2: Leading the way

Pictures can be stored in a computer as a grid of numbers. Each number gives the colour of that small area or **pixel**. This is also the way digital images are stored and represented on a screen.

Recreate the picture by colouring each **pixel** as given by its number. Look up the colour for each number in the key. For example, colour pixels marked 0 in black, and pixels marked 1 in red.

7	3	3	3	3	5	4	4	3	3	7	3	3	3	3	3
7	7	3	3	5	5	5	4	4	7	7	3	3	3	3	3
7	7	7	3	3	5	3	3	7	7	7	7	3	3	5	3
3	7	7	7	3	3	3	7	7	7	4	3	3	5	5	5
3	3	3	7	3	3	3	7	3	3	4	4	3	3	5	3
3	3	3	6	6	6	6	6	3	3	3	4	4	4	3	3
5	3	3	6	0	6	0	6	3	3	3	3	3	4	4	3
5	5	3	6	6	6	6	6	7	7	7	7	7	7	4	4
5	3	3	6	6	1	6	6	7	6	1	6	6	7	3	3
3	3	3	6	6	6	6	6	7	6	6	2	1	7	6	6
3	3	3	3	3	3	7	7	7	7	7	7	7	7	3	6
3	3	3	3	3	3	6	3	6	3	3	6	3	6	3	3
3	3	3	3	3	3	6	3	6	3	3	6	3	6	3	3
3	5	5	5	5	3	6	3	6	3	3	6	3	6	3	5
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

KEY

0	Black
1	Red
2	Green
3	Blue
4	Magenta
5	White
6	Grey
7	Brown

Puzzle created by Elaine Huen

The Computing

Each image is split in to a grid of squares. Each number gives the colour of that square of the image. Each square is called a pixel. The more pixels making up the image the higher the resolution it has.

Find out more at https://**teaching**london**computing**.org/pixel-puzzles/

Christmas Pixel Puzzle 3: Ice cold circuits

Pictures can be stored in a computer as a grid of numbers. Each number gives the colour of that small area or **pixel**. This is also the way digital images are stored and represented on a screen.

Recreate the picture by colouring each **pixel** as given by its number. Look up the colour for each number in the key. For example, colour pixels marked 2 in black, and pixels marked 4 in red.

8	8	8	8	8	8	4	4	4	4	4	4	8	8	8	1
8	1	8	8	8	4	4	4	4	4	4	4	4	8	8	8
8	8	8	8	4	4	4	4	4	4	4	4	8	1	8	8
8	8	8	8	1	1	1	1	1	1	1	1	8	8	8	8
8	8	8	8	3	5	5	3	3	5	5	3	8	8	8	8
8	8	8	1	3	5	5	3	3	5	5	3	8	8	8	8
8	8	8	8	3	3	3	3	3	3	3	3	8	8	8	8
8	1	8	8	3	3	2	2	2	2	3	3	8	8	1	8
8	8	8	3	3	3	3	3	3	3	3	3	3	8	8	8
8	8	3	3	3	5	5	5	5	8	8	3	3	3	8	8
8	3	3	3	3	5	6	5	5	5	5	3	3	3	3	1
3	3	3	3	3	5	5	5	9	5	5	3	3	3	3	3
3	3	1	3	3	5	5	9	9	9	5	3	3	8	3	3
3	8	8	3	3	7	5	5	5	5	5	3	3	1	8	5
1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1
1	1	1	3	3	3	3	3	3	3	3	3	3	1	1	1

KEY

1	White
2	Black
3	Grey
4	Red
5	Orange
6	Yellow
7	Green
8	Blue
9	Purple

Puzzle created by Elisa Huen

The Computing

Higher-resolution pictures have more detail and in particular lines are smoother. The image is less pixelated – you see the squares less. It also means you can see more fine detail – smaller things may disappear in a low resolution image.

Find out more at https://**teaching**london**computing**.org/pixel-puzzles/

Christmas Pixel Puzzle 4: Something delicious

Pictures can be stored in a computer as a grid of numbers. Each number gives the colour of that small area or **pixel**. This is also the way digital images are stored and represented on a screen.

Recreate the picture by colouring each **pixel** as given by its number. Look up the colour for each number in the key. For example, colour pixels marked 2 in red, and pixels marked 4 in (dark) green.

5	5	5	5	5	6	5	5	5	6	5	5	5	5	5
5	5	5	6	5	6	5	5	5	6	5	6	5	5	5
5	5	5	6	5	6	5	5	6	6	5	6	6	5	5
5	5	5	6	5	6	6	5	6	5	5	5	6	5	5
5	5	6	6	5	5	6	5	5	4	4	5	6	5	5
5	5	6	5	5	5	5	5	4	4	4	5	6	5	5
5	5	6	5	5	5	5	2	4	4	5	5	6	5	5
5	5	6	5	5	3	3	2	2	3	5	5	6	5	5
5	5	5	5	3	3	3	3	3	3	3	5	5	5	5
5	5	5	3	3	3	3	3	3	3	3	3	5	5	5
5	5	5	1	3	3	1	3	3	3	3	1	5	5	5
5	5	1	1	1	1	1	1	1	1	1	1	1	5	5
5	5	1	1	1	1	1	1	1	1	1	1	1	5	5
5	5	1	1	1	1	1	1	1	1	1	1	1	5	5
5	3	3	3	3	3	3	3	3	3	3	3	3	3	5

KEY

1	Deep Red
2	Red
3	White
4	Dark Green
5	Dark Blue
6	Grey

Puzzle created by Elaine Huen

The Computing

One way images are represented and so stored in a computer or digital camera is as a grid of numbers. This way of representing an image is called a bitmap image or a raster image.

Find out more at https://**teaching**london**computing**.org/pixel-puzzles/

Christmas Pixel Puzzle 5: North Pole helper

Pictures can be stored in a computer as a grid of numbers. Each number gives the colour of that small area or **pixel**. This is also the way digital images are stored and represented on a screen.

Recreate the picture by colouring each **pixel** as given by its number. Look up the colour for each number in the key. For example, colour pixels marked 2 in orange, and pixels marked 4 in green.

5	5	5	5	5	5	5	5	1	1	1	1	7	7	5	5
5	5	2	5	5	5	5	1	1	1	1	1	7	7	5	5
5	5	0	5	5	5	1	1	1	1	1	1	5	5	5	5
5	5	3	5	5	7	7	7	1	1	1	1	1	5	5	5
5	5	0	3	3	3	3	7	7	7	7	1	1	5	5	5
5	3	3	3	3	3	3	3	3	3	7	7	7	5	5	5
5	3	0	3	3	6	3	3	6	3	3	0	3	5	5	5
5	3	0	3	3	3	3	3	3	3	3	0	3	5	5	5
5	3	3	3	3	3	3	3	3	3	3	3	3	5	5	5
5	5	5	3	3	3	2	2	3	3	3	5	5	5	5	5
5	5	5	3	3	3	3	3	3	3	3	5	5	3	5	3
5	5	5	5	5	0	0	0	0	5	5	5	5	3	3	3
4	4	4	4	4	0	7	7	0	4	4	4	4	4	7	7
4	1	1	1	1	1	7	7	1	1	1	1	1	4	1	1
4	1	1	1	1	1	1	1	1	1	1	1	1	4	1	1
4	1	1	0	1	1	7	7	1	1	0	1	1	1	1	1

KEY

0	Black
1	Red
2	Orange
3	Yellow
4	Green
5	Blue
6	Purple
7	White

Puzzle created by Paul Curzon

The Computing

Each image has to also come with (or have pre-agreed) a key indicating which number corresponds to which colour. The number of colours allowed is called the **colour depth**.

Find out more at https://**teaching**london**computing**.org/pixel-puzzles/

Christmas Pixel Puzzle 6: A symmetrical someone

Pictures can be stored in a computer as a grid of numbers. Each number gives the colour of that small area or **pixel**. This is also the way digital images are stored and represented on a screen.

This picture has been compressed - we only need half the data - half the numbers to complete it. Colour the squares (pixels) with numbers in by using the colour key. For the squares with no number work out what colour they are by symmetry.

9	9	9	9	9	9	2	5								
9	9	9	9	9	1	2	4								
9	9	9	9	9	0	0	8								
9	9	9	9	9	0	0	8								
9	7	9	9	9	8	8	2								
9	7	7	9	9	8	8	2								
9	9	7	7	5	6	3	5								
9	9	9	7	6	8	8	0								
9	9	9	9	3	8	8	0								
9	9	9	8	8	8	8	8								
9	9	9	8	8	8	8	8								
9	9	9	8	8	8	8	0								
9	9	9	8	8	8	8	0								
9	9	9	8	8	8	8	8								
8	8	8	8	8	8	8	8								
8	8	8	8	8	8	8	8								

KEY

0	Black
1	Red
2	Orange
3	Yellow
4	Green
5	Blue
6	Purple
7	Brown
8	White
9	Grey

Puzzle created by Elisa Huen

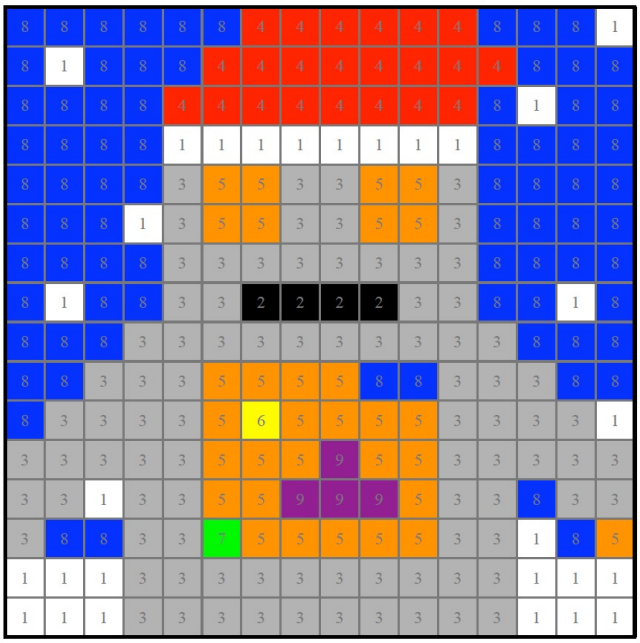
The Computing

The more colours, the more bits are needed to store each pixels colours. With two colours you need a single bit for each pixel, with 4 colours you need 2 bits, with 8 colours you need 3 bits, and so on. Each bit pattern represents a different number and so a different colour.

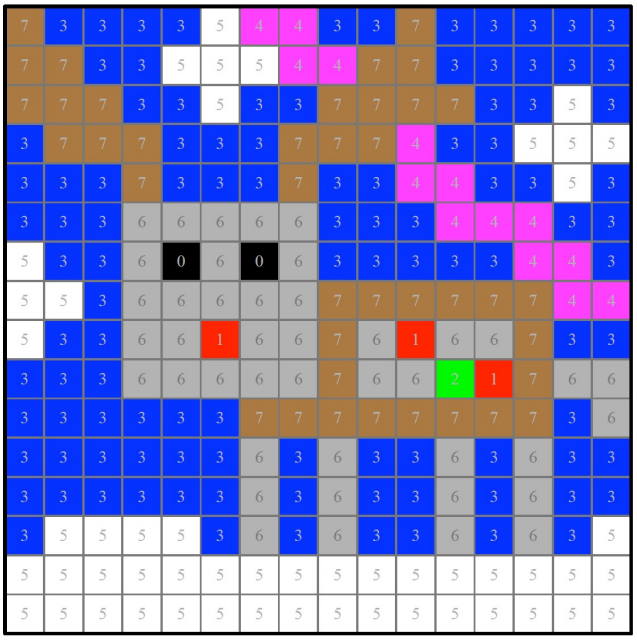
Find out more at https://**teaching**london**computing**.org/pixel-puzzles/
& https://**teaching**london**computing**.org/pixel-puzzles/symmetrical-pixel-puzzles/

Christmas Pixel Puzzles: SOLUTIONS

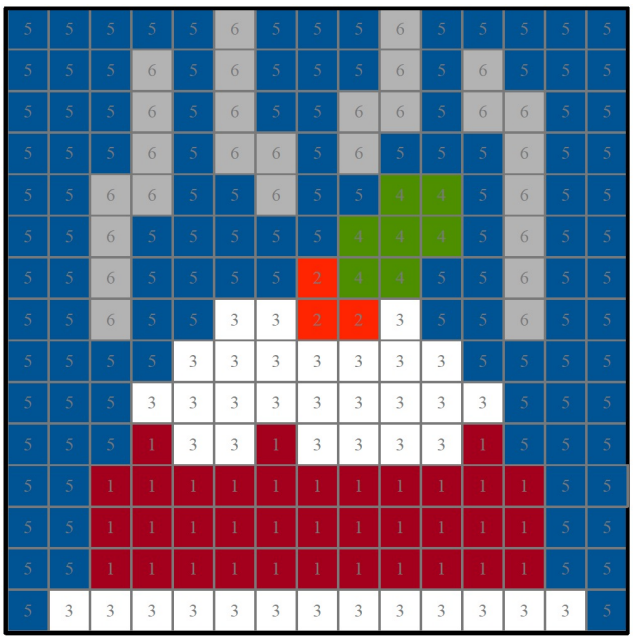
Father Christmas by Paul Curzon



Robot Snowman by Elaine Huen



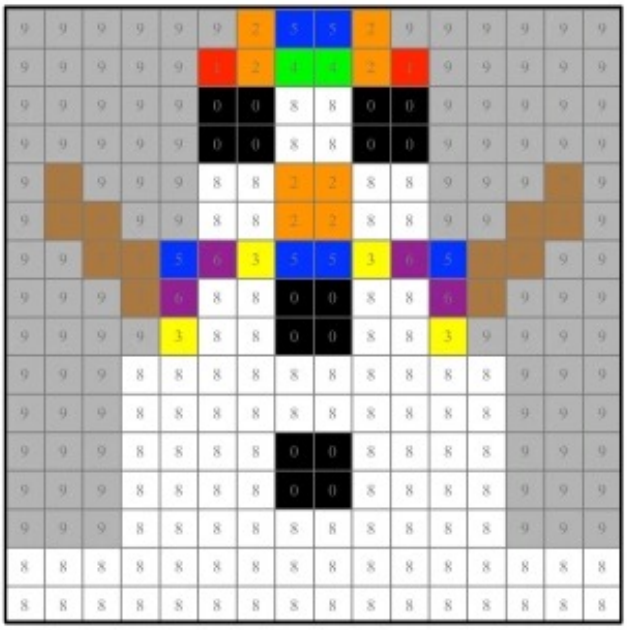
Robot Rudolph by Elisa Huen



Christmas Pudding by Elaine Huen

Christmas Pixel Puzzles: SOLUTIONS

Robot Christmas Elf by Paul Curzon

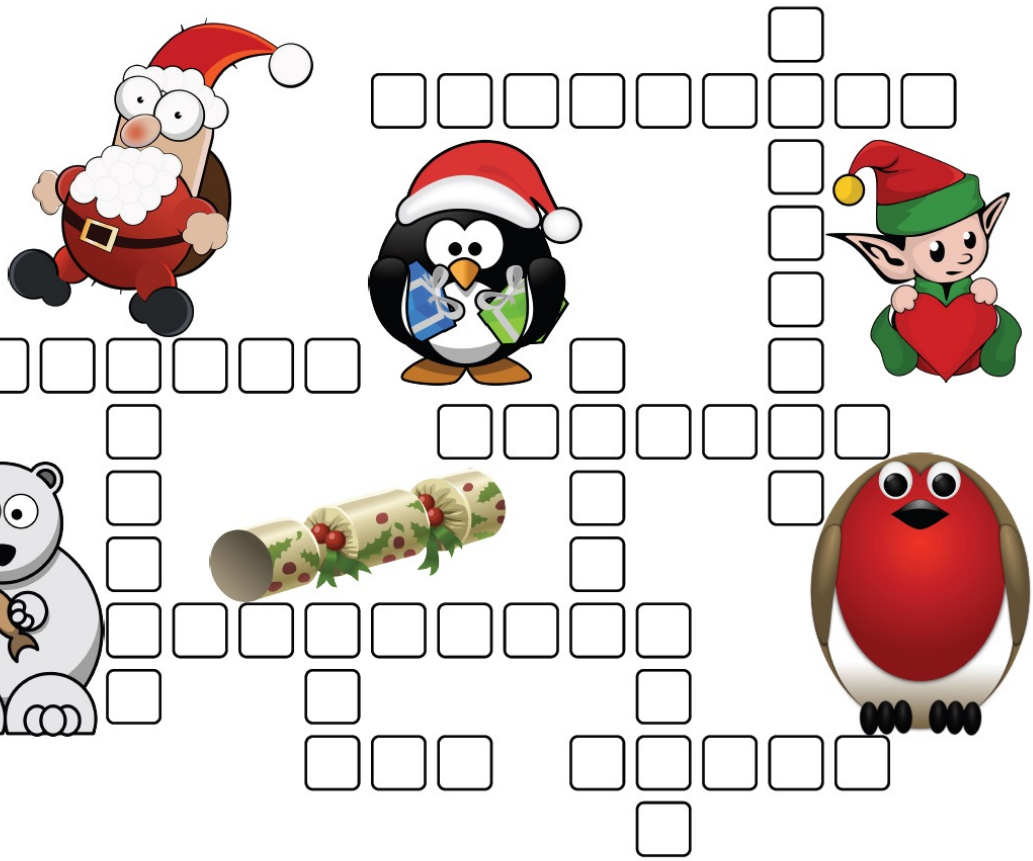


Symmetrical Snowman by Elisa Huen

Christmas Kriss Kross 1

If there is only one word of any length left then find the blank word in the grid of that length and the word goes there.

If you know some letters of a word in the grid then count how many letters long it is and compare the unused words of that length with the pattern of known letters. If only one matches you have found where it goes. Otherwise you need more information so try another word in the grid.



Puzzle created by Paul Curzon

3 letters	4 letters	5 letters	6 letters	7 letters	8 letters	9 letters
elf	snow	santa	grinch	penguin	december	christmas
ice		robin		cracker		polarbear

The Computing

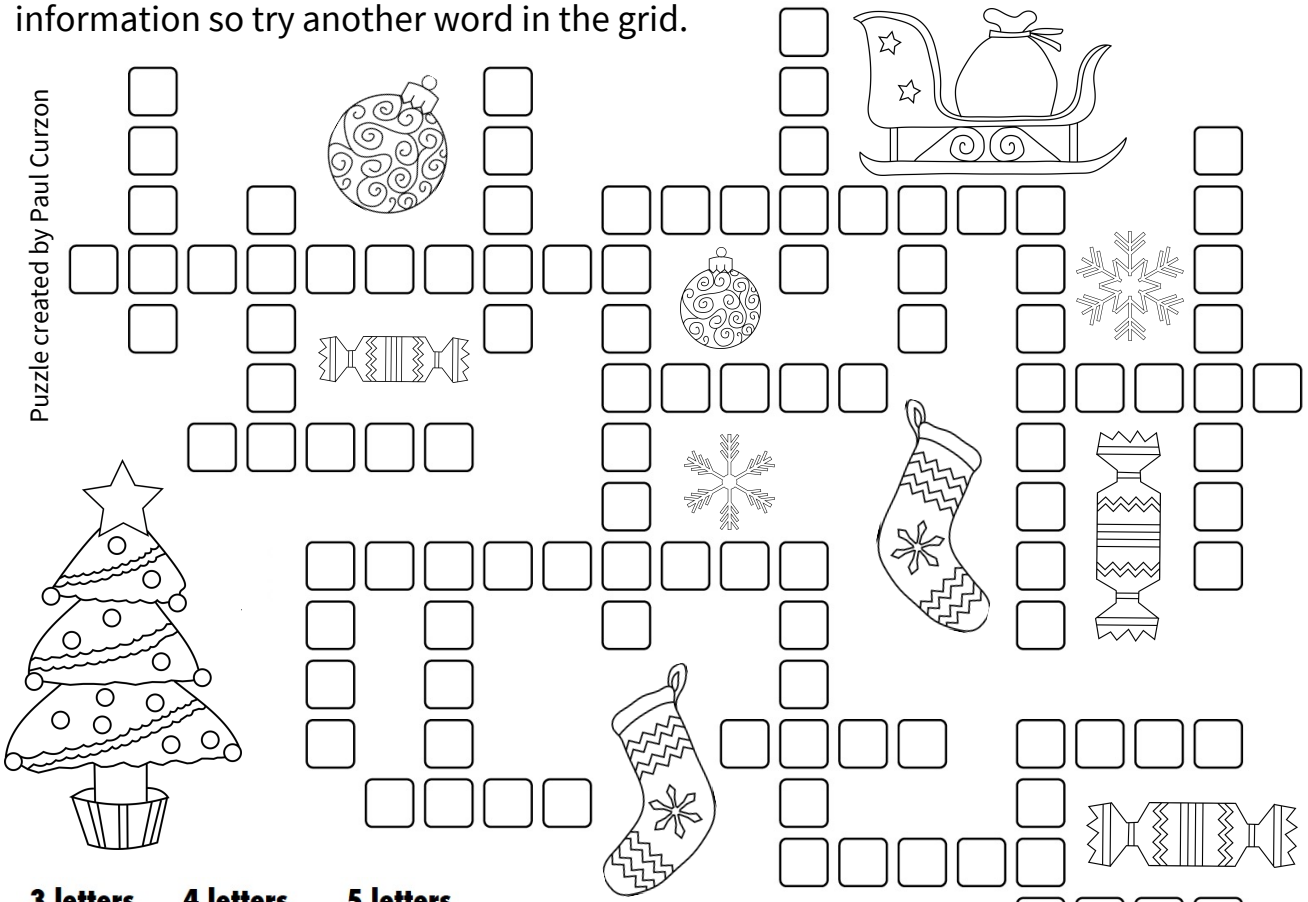
Solve these word puzzles as a way to develop the logical thinking and pattern matching skills needed to enjoy both computing and maths. Logical thinking is just about thinking clearly and being careful. Look for clues that are useful now. Some clues won't be useful yet. Just be patient! You just need other clues first.

Find out more at:
https://**teaching**london**computing**.org/kriss-kross-puzzles/

Christmas Kriss Kross 2

If there is only one word of any length left then find the blank word in the grid of that length and the word goes there.

If you know some letters of a word in the grid then count how many letters long it is and compare the unused words of that length with the pattern of known letters. If only one matches you have found where it goes. Otherwise you need more information so try another word in the grid.



3 letters
ice

4 letters
crib
mice
snow
star
toys
tree

5 letters
angel
cards
fairy
holly
igloo
kings
myrrh
robin
santa

6 letters
sleigh

8 letters
penguins
presents
reindeer
stocking

9 letters
christmas

10 letters
polar bear

The Computing

Solve these word puzzles as a way to develop the logical thinking and pattern matching skills needed to enjoy both computing and maths. Logical thinking is just about thinking clearly and being careful. Look for clues that are useful now. Some clues won't be useful yet. Just be patient! You just need other clues first.

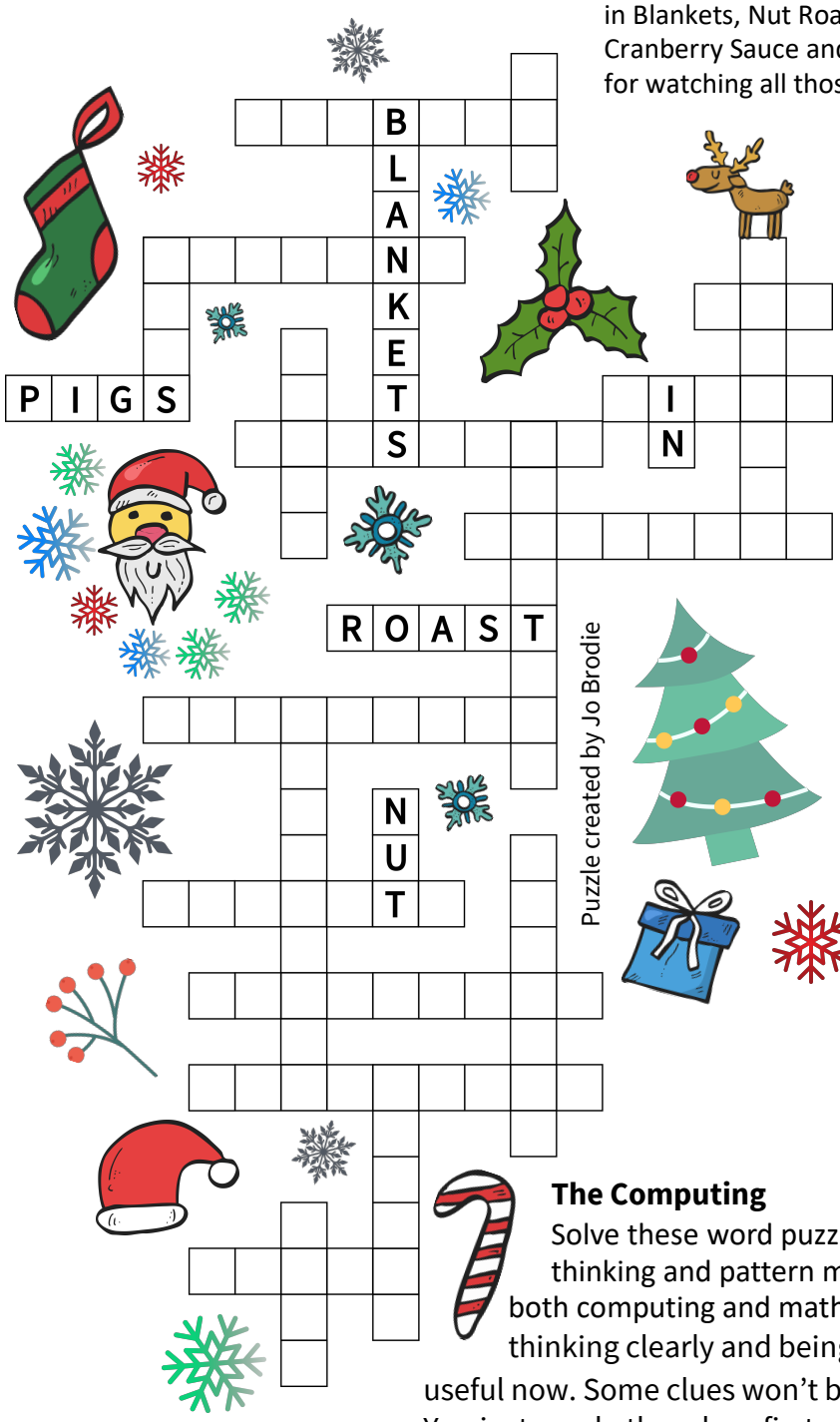
Find out more at:
https://**teaching**london**computing**.org/kriss-kross-puzzles/

Christmas Kriss Kross 3 *(with some filled in)*

If there is only one word of any length left then find the blank word in the grid of that length and the word goes there.

If you know some letters of a word in the grid then count how many letters long it is and compare the unused words of that length with the pattern of known letters. If only one matches you have found where it goes. Otherwise you need more information so try another word in the grid.

This puzzle is full of delicious festive food like Pigs in Blankets, Nut Roast, Chocolate Log, Mince Pies, Cranberry Sauce and Red Cabbage. The popcorn's for watching all those Christmas films!



Puzzle created by Jo Brodie

2 Letters
in

3 letters
log, nut, red

4 letters
nuts, pigs, pies

5 letters
gravy, mince, roast, sauce

6 letters
turkey

7 letters
cabbage, carrots, popcorn
pudding, sprouts

8 letters
blankets, parsnips, potatoes
stuffing

9 letters
chestnuts, chocolate
chocolate (yes, twice!)
cranberry

The Computing

Solve these word puzzles as a way to develop the logical thinking and pattern matching skills needed to enjoy both computing and maths. Logical thinking is just about thinking clearly and being careful. Look for clues that are useful now. Some clues won't be useful yet. Just be patient! You just need other clues first.

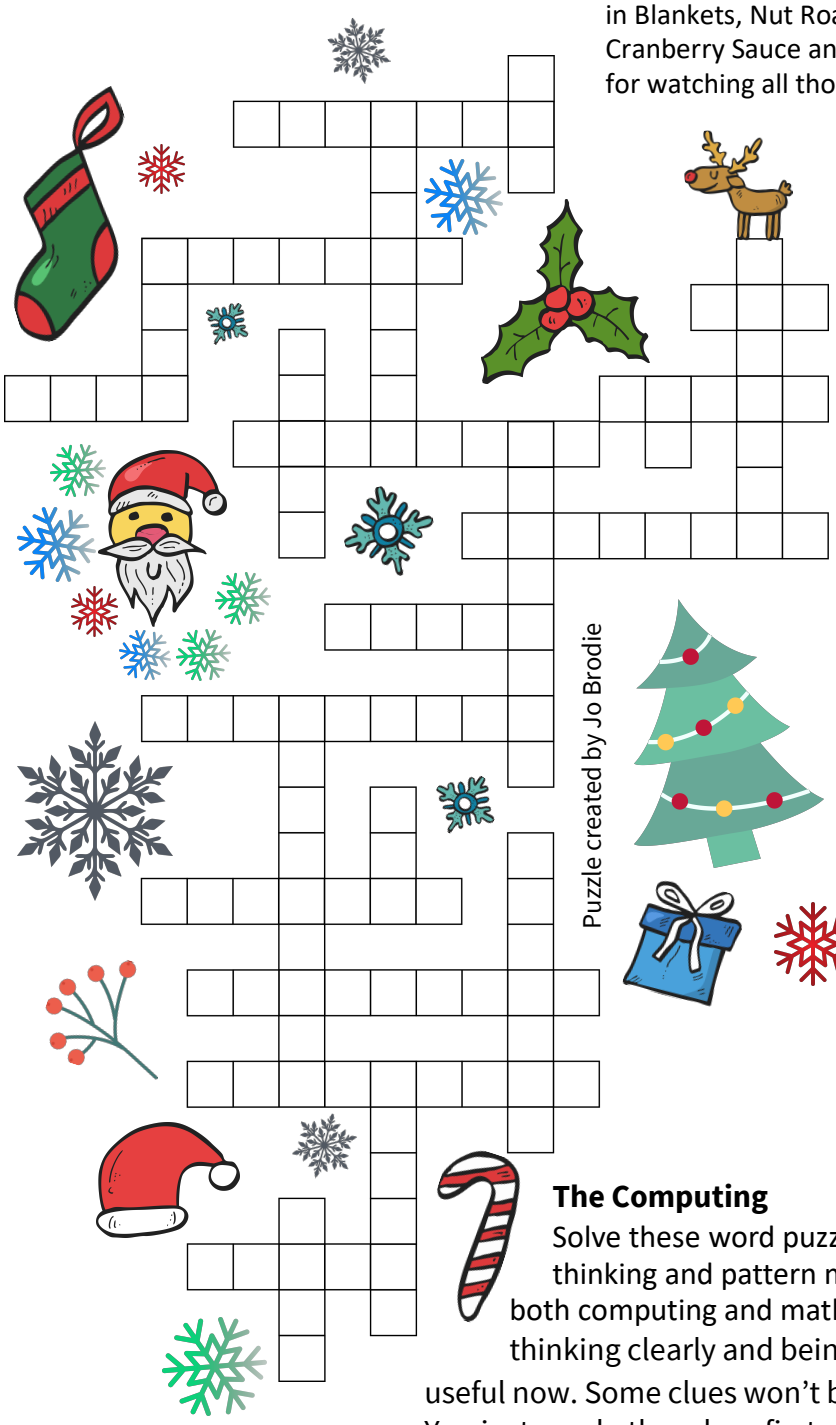
Find out more at: https://**teaching**london**computing**.org/kriss-kross-puzzles/

Christmas Kriss Kross 3

If there is only one word of any length left then find the blank word in the grid of that length and the word goes there.

If you know some letters of a word in the grid then count how many letters long it is and compare the unused words of that length with the pattern of known letters. If only one matches you have found where it goes. Otherwise you need more information so try another word in the grid.

This puzzle is full of delicious festive food like Pigs in Blankets, Nut Roast, Chocolate Log, Mince Pies, Cranberry Sauce and Red Cabbage. The popcorn's for watching all those Christmas films!



Puzzle created by Jo Brodie

2 Letters
in

3 letters
log, nut, red

4 letters
nuts, pigs, pies

5 letters
gravy, mince, roast, sauce

6 letters
turkey

7 letters
cabbage, carrots, popcorn
pudding, sprouts

8 letters
blankets, parsnips, potatoes
stuffing

9 letters
chestnuts, chocolate,
chocolate (yes, twice!),
cranberry

The Computing

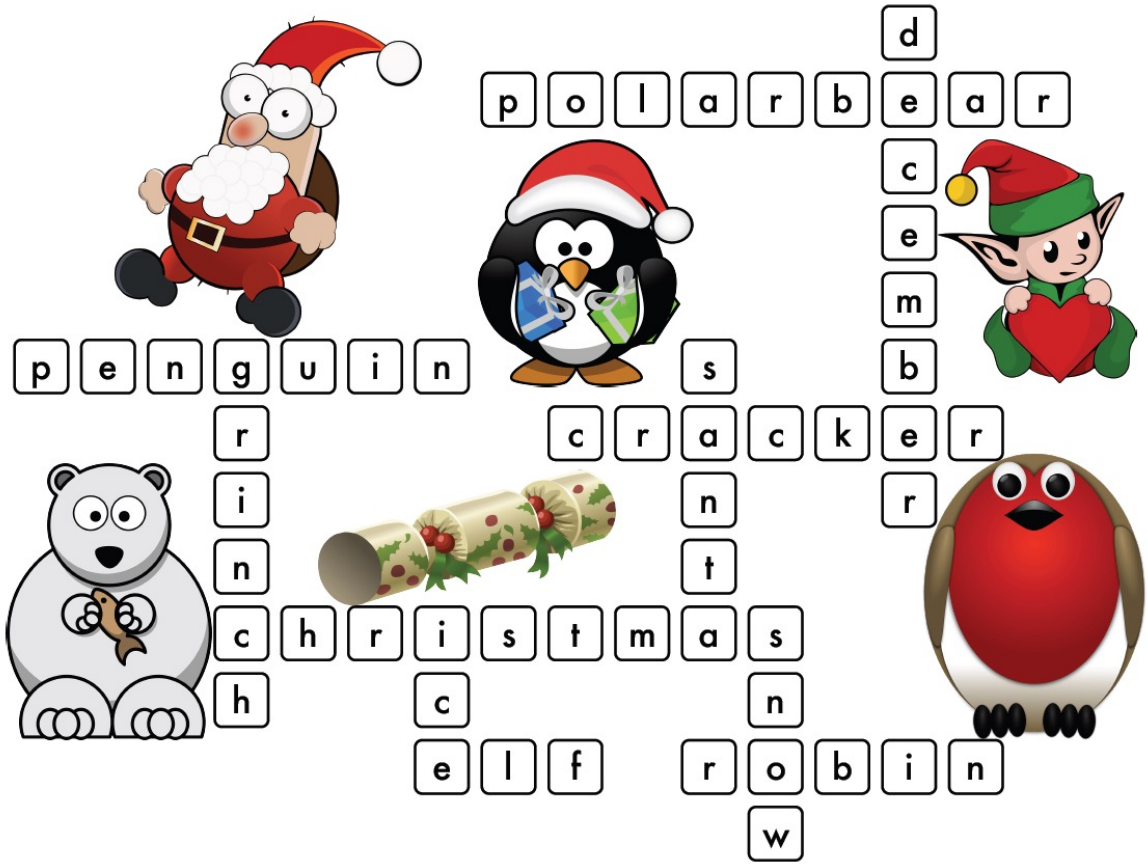
Solve these word puzzles as a way to develop the logical thinking and pattern matching skills needed to enjoy both computing and maths. Logical thinking is just about thinking clearly and being careful. Look for clues that are useful now. Some clues won't be useful yet. Just be patient! You just need other clues first.

Find out more at: https://**teaching**london**computing**.org/kriss-kross-puzzles/

Christmas Kriss Kross 1: SOLUTION

If there is only one word of any length left then find the blank word in the grid of that length and the word goes there.

If you know some letters of a word in the grid then count how many letters long it is and compare the unused words of that length with the pattern of known letters. If only one matches you have found where it goes. Otherwise you need more information so try another word in the grid.



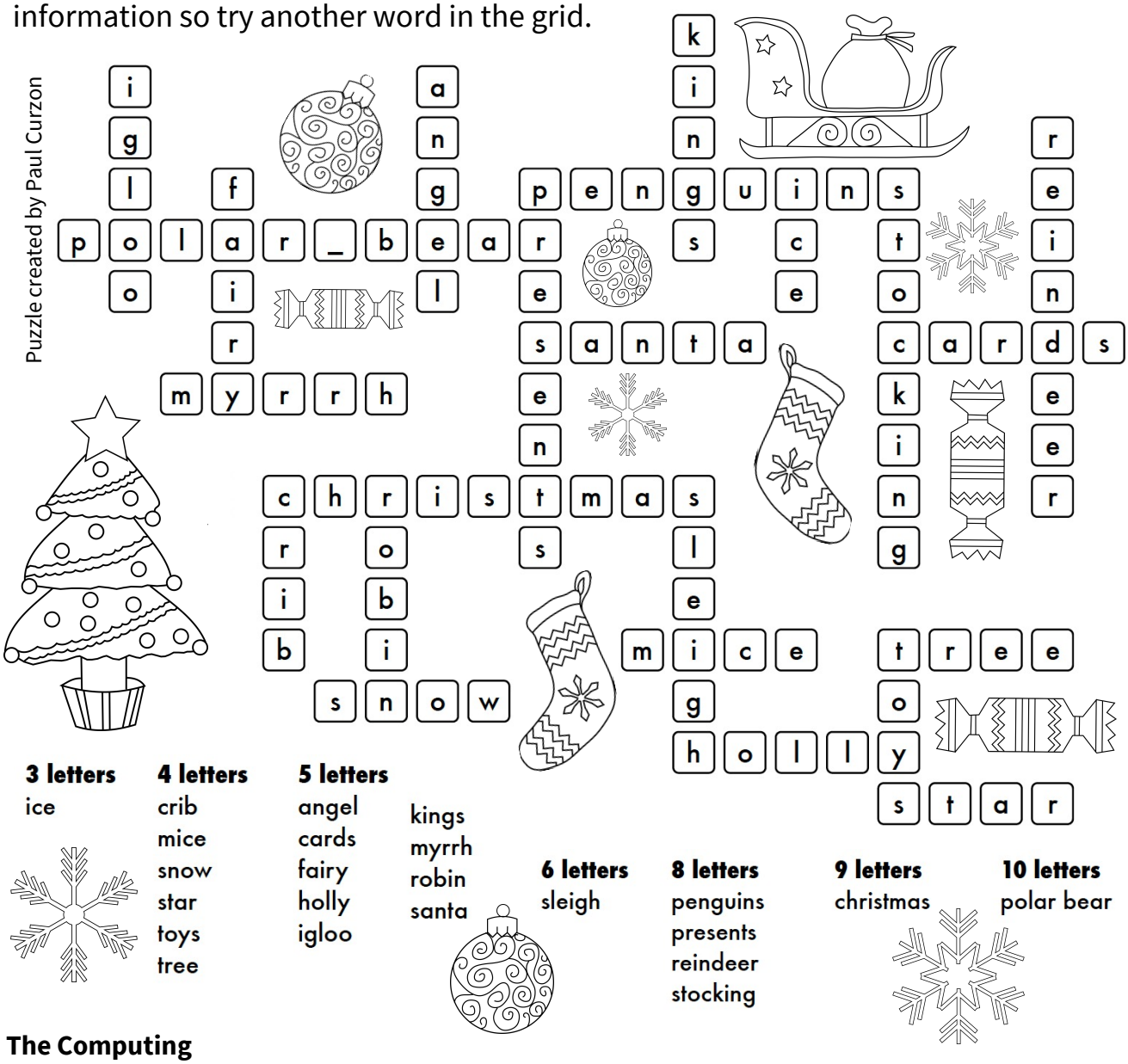
Puzzle created by Paul Curzon

Find out more at:
https://**teaching**london**computing**.org/kriss-kross-puzzles/

Christmas Kriss Kross 2: SOLUTION

If there is only one word of any length left then find the blank word in the grid of that length and the word goes there.

If you know some letters of a word in the grid then count how many letters long it is and compare the unused words of that length with the pattern of known letters. If only one matches you have found where it goes. Otherwise you need more information so try another word in the grid.



The Computing

Solve these word puzzles as a way to develop the logical thinking and pattern matching skills needed to enjoy both computing and maths. Logical thinking is just about thinking clearly and being careful. Look for clues that are useful now. Some clues won't be useful yet. Just be patient! You just need other clues first.

Find out more at:
https://**teaching**london**computing**.org/kriss-kross-puzzles/

Christmas Kriss Kross 3: SOLUTION

If there is only one word of any length left then find the blank word in the grid of that length and the word goes there.

If you know some letters of a word in the grid then count how many letters long it is and compare the unused words of that length with the pattern of known letters. If only one matches you have found where it goes. Otherwise you need more information so try another word in the grid.

2 Letters
in

3 letters
log, nut, red

4 letters
nuts, pigs, pies

5 letters
gravy, mince, roast, sauce

6 letters
turkey

7 letters
cabbage, carrots, popcorn
pudding, sprouts

8 letters
blankets, parsnips, potatoes
stuffing

9 letters
chestnuts, chocolate
chocolate (yes, twice!)
cranberry

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Find out more at: https://**teaching**london**computing**.org/kriss-kross-puzzles/