

Computer Science Unplugged Activities

1 Acknowledgements

These activities have been adapted from the Binary Numbers and Image Representation resources from the CS Unplugged website: <http://csunplugged.com/>

CS Unplugged are a collection of free resources for teaching Computational Thinking without the use of a computer.

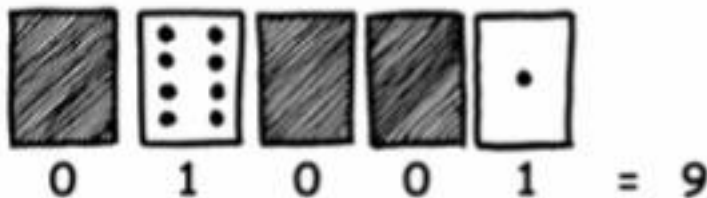
2 Activity 1 – Binary Numbers

2.1 What are Binary Numbers?

Computers use a base 2 (binary) number system, whereas humans usually use a base 10 (decimal) number system. This means that everything you do on a computer – for example browsing the web, playing a game or editing a video – is eventually translated into 1s and 0s. Most Computer Scientists are unlikely to directly use binary numbers in their work but understanding how numbers are represented on computers is important. For an example of where this understanding is important, see this news article: goo.gl/dHRVgS

2.2 Binary Number Cards

You have been given five binary cards with dots on them, which we will use for this activity. When a binary card is not showing, it is represented by a zero. When it is showing, it is represented by a one. This is the binary number system.



2.3 Exercises

2.3.1 What number is 10001 in decimal?

2.3.2 What would 17 be in binary?

2.3.3 How about 6, 15, 21?

2.3.4 What do you notice about the number of dots on the cards?

2.3.5 How many dots would the next card have if we carried on to the left?

2.3.6 What is the biggest number you can make? What is the smallest?

2.3.7 Is there more than one way to get any number?

2.3.8 Is there any number you can't make between the smallest and biggest numbers?

2.3.9 Now try counting from zero onwards, is there a pattern?

2.3.10 What happens when you put a 0 on the right of a binary number?

2.3.11 Is there a pattern for odd and even numbers?

3 Activity 2 – Image Representation

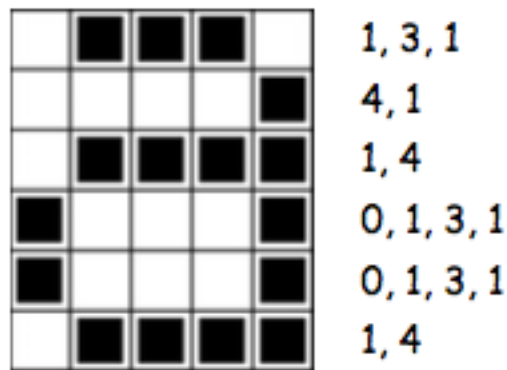
3.1 How can images be represented on computers?

Computer screens are divided up into a grid of small dots called pixels (picture elements).

In a black and white picture, each pixel is either black or white.



The letter “a” has been magnified above to show the pixels. When a computer stores a picture, all that it needs to store is which dots are black and which are white.



The picture above shows us how a picture can be represented by numbers. The first line consists of one white pixel, then three black, then one white. Thus the first line is represented as 1, 3, 1.

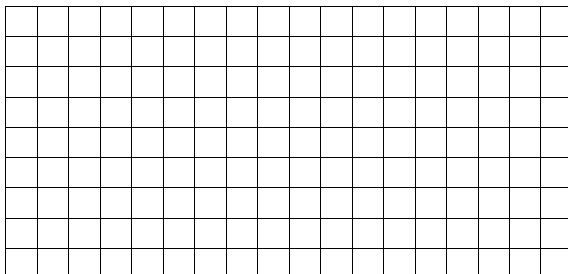
The first number always relates to the number of white pixels. If the first pixel is black the line will begin with a zero.

3.2 Example Images

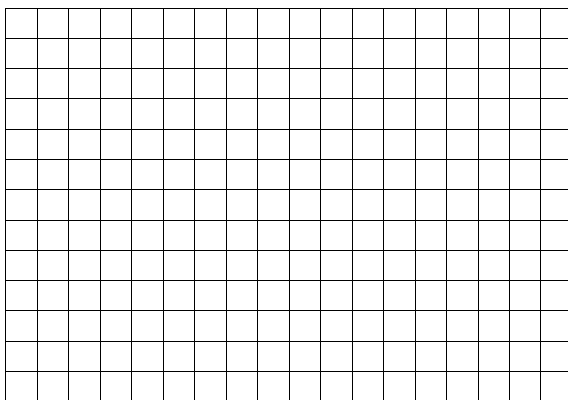
A few example images from the CSUnplugged worksheet are shown on the next page for you to complete. The solutions to these are available on the original worksheet version on the CSUnplugged website.

Worksheet Activity: Kid Fax

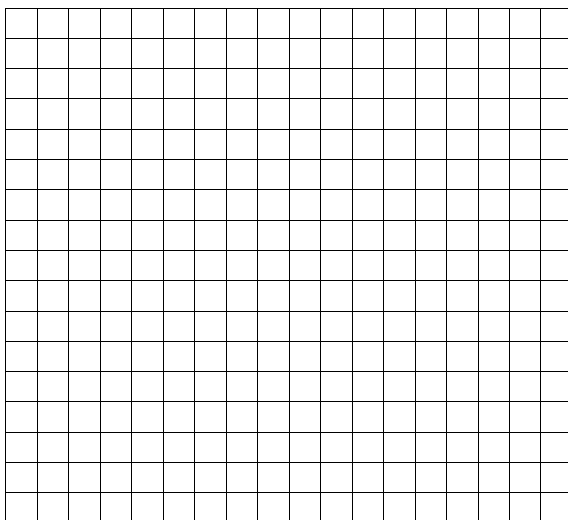
The first picture is the easiest and the last one is the most complex. It is easy to make mistakes and therefore a good idea to use a pencil to colour with and have a rubber handy!



4, 11
 4, 9, 2, 1
 4, 9, 2, 1
 4, 11
 4, 9
 4, 9
 5, 7
 0, 17
 1, 15



6, 5, 2, 3
 4, 2, 5, 2, 3, 1
 3, 1, 9, 1, 2, 1
 3, 1, 9, 1, 1, 1
 2, 1, 11, 1
 2, 1, 10, 2
 2, 1, 9, 1, 1, 1
 2, 1, 8, 1, 2, 1
 2, 1, 7, 1, 3, 1
 1, 1, 1, 1, 4, 2, 3, 1
 0, 1, 2, 1, 2, 2, 5, 1
 0, 1, 3, 2, 5, 2
 1, 3, 2, 5



6, 2, 2, 2
 5, 1, 2, 2, 2, 1
 6, 6
 4, 2, 6, 2
 3, 1, 10, 1
 2, 1, 12, 1
 2, 1, 3, 1, 4, 1, 3, 1
 1, 2, 12, 2
 0, 1, 16, 1
 0, 1, 6, 1, 2, 1, 6, 1
 0, 1, 7, 2, 7, 1
 1, 1, 14, 1
 2, 1, 12, 1
 2, 1, 5, 2, 5, 1
 3, 1, 10, 1
 4, 2, 6, 2
 6, 6