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| **DATA REPRESENTATION** |  |

## **Bitmap Images**



Definition - *“A bitmap image is made up of lots of tiny little blocks of colour called pixels. Each pixel is represented by a binary number.”*

A bitmap image file remembers the colour of every single pixel in an image. They take up a lot of storage space because of this. To the right is a representation of a 1 bit depth image. It uses two colours, black and white.

Imagine each block above is a pixel. A bitmap image would save this file as:

white, white, white, white, white, white, white, white, white, white, white, white, black, black, white, white, black, black, white, white and so on… Or in binary this would be: 00000000000011001100

*Why does 1 bit depth = 2 colours?*

This is due to the amount of numbers you can calculate with the number of bits available.

* A 1-bit system uses combinations of numbers up to one place value (1). There are just two options: 0 or 1.
* A 2-bit system uses combinations of numbers up to two place values (11). There are four options: 00, 01, 10 and 11.
* An 8-bit system uses combinations of numbers up to 8 places (11111111). There are 256 possible combinations, so I won’t list them here!!

The table below summaries bit depth and how to work out combinations:

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| --- | --- | --- | --- | --- |
| **Bit Depth** | **Largest number in binary** | **Largest number in denary** | **Total number of combinations (includes 0!)** | **Quick Calculation****(2^BitDepth)** |
| 1 | 1 | 1 | 2 | 2^1 |
| 2 | 11 | 3 | 4 | 2^2 |
| 3 | 111 | 7 | 8 | 2^3 |
| 4 | 1111 | 15 | 16 | 2^4 |
| 5 | 11111 | 31 | 32 | 2^5 |
| 6 | 111111 | 63 | 64 | 2^6 |
| 7 | 1111111 | 127 | 128 | 2^7 |
| 8 | 11111111 | 255 | 256 | 2^8 |

So, if an 8 bit image can represent up to 256 colours, how many colours would a 9 bit image have? (The answer is on the line below. Highlight or change the font colour to see!)

2^9 = 512

## **Core Questions**

* State the maximum number of different colours that can be encoded when using two bits for each pixel
* State the minimum number of bits needed to encode 32 different colours

## **Challenge Questions**

* State one factor, other than the number of bits used to represent individual colours, that can affect the quality of a bitmap image
* Not strictly image related but, The ASCII character set uses seven bits to encode every character. What is the total number of characters that can be encoded in ASCII?