

Images need to be stored and processed using binary. The simplest image format is for an image to be stored as a **bitmap image**. Bitmap images are made up of **picture elements** called **pixels**. These contain a mapping of the colour of each pixel to bits.

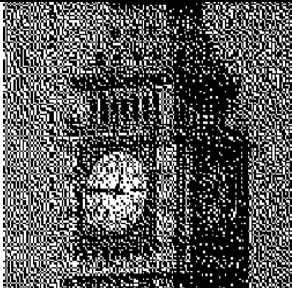
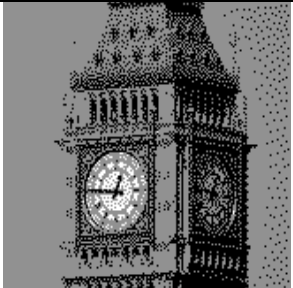

Black and white images have two colours (black and white) which can be stored with 1 bit per pixel.

Bitmap image file

```

00011110000
00100011000
001010101000
001000001000
001101011000
000110110001
000001000011
000111110110
000101011100
000101000000
011101000000
010011100000
000011110000
000110110000
000100010000
000100010000
000100010000
000100010000
000100010000
001100011000
000000000000
    
```

Images that have different shades of gray are called **grayscale images**. We can use more bits to store the level of gray each pixel will have. The number of bits used for each pixel is called the **colour depth**.

Type of image Example	Bitmap	Grayscale	Grayscale
			
Colour depth	1 bit/pixel	2 bits/pixel	8 bits/pixel
Total number of colours	2	4	256

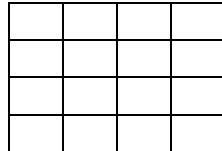
Full colour images store 8 bits for each of red, green and blue colours (**RGB**). These correspond to the sub-pixels on a computer display. This allows for 2^{24} (about 16.8 million) different colours. These can be written as 6 digits of hexadecimal. For example, FFFFFFFF is white and FF0000 is red.

Q 71

Images & Pixels - Questions

1. A bitmap file contains the binary on the left below. 1 is white and 0 is black. Colour in each of the squares. What is the letter that is revealed?

0000
0111
0111
0000



Letter revealed: _____ [1]

2. Pixels are named after what? Fill in **one** circle.

- Picture Elements Part Elements
 Picture Cells Picture Hex Elements
- [1]

3. A black and white image will require how many bits per pixel?

Number of bits: _____ [1]

4. The number of bits per pixel is called what?

_____ [1]

5. A grayscale image is stored using the following colour depth. For each, state how many colours (shades of gray) will be available.

- a) 1 bit _____
 b) 2 bits _____
 c) 4 bits _____
 d) 8 bits _____
 e) 16 bits _____
- [5]

6. A grayscale image contains 1024 pixels. 4 colours (shades of gray) have been used. How much storage space will the data for this image require?

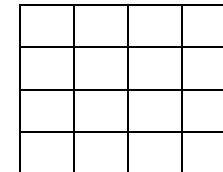
Space required: _____ bytes [1]

7. As you increase the colour depth what happens to the image quality? Fill in **one** circle.

- It makes no difference It improves
 It gets worse You cannot change it
- [1]

8. A bitmap file contains the binary on the left below. 11 is white, 10 is gray, 01 is light gray and 00 is black. Colour in each of the squares. What is the letter that is revealed?

11 11 11 11
11 10 10 11
11 11 11 11
11 00 00 00



Letter revealed: _____ [1]

9. An colour image has a 24 bit colour depth. Its dimensions are 1024x768. How much storage space will be taken up with the data for the image?

Space required: _____ megabytes [1]

10. A school logo requires 5 different colours. How many bits will be required for each pixel? Bits required: _____ [1]

11. Computer displays use 3 colours for each pixel. What are they?

Colour 1: _____ Colour 2: _____ Colour 3: _____ [1]

12. A web designer wishes to use 24 bit colour for their images. How many colours will be available for them to use?

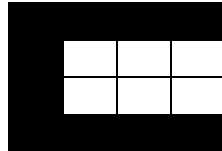
_____ colours [1]

13. What do each of the following colours represent in hexadecimal?

- a) FFFFFFFF _____
 b) 0000FF _____
 c) 00FF00 _____
 d) 555555 _____
- [4]

1. A bitmap file contains the binary on the left below. 1 is white and 0 is black. Colour in each of the squares. What is the letter that is revealed?

0000
0111
0111
0000



Letter revealed: C [1]

2. Pixels are named after what? Fill in one circle.

- Picture Elements Part Elements
 Picture Cells Picture Hex Elements
- [1]

3. A black and white image will require how many bits per pixel?

Number of bits: 1 [1]

4. The number of bits per pixel is called what?

Colour depth [1]

5. A grayscale image is stored using the following colour depth. For each, state how many colours (shades of gray) will be available.

- a) 1 bit 2
 b) 2 bits 4
 c) 4 bits 16
 d) 8 bits 256
 e) 16 bits 65 536
- [5]

6. A grayscale image contains 1024 pixels. 4 colours (shades of gray) have been used. How much storage space will the data for this image require?

$$2 \text{ bits} * 1024 \text{ pixels} = 2048 \text{ bits} / 8$$

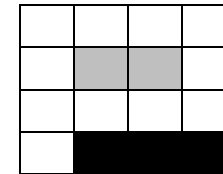
Space required: = 256 bytes [1]

7. As you increase the colour depth what happens to the image quality? Fill in one circle.

- It makes no difference It improves
 It gets worse You cannot change it
- [1]

8. A bitmap file contains the binary on the left below. 11 is white, 10 is gray, 01 is light gray and 00 is black. Colour in each of the squares. What is the letter that is revealed?

11 11 11 11
11 10 10 11
11 11 11 11
11 00 00 00



Letter revealed: P [1]

9. An colour image has a 24 bit colour depth. Its dimensions are 1024x768. How much storage space will be taken up with the data for the image?

Space required: 2.25 megabytes
 $1024 * 768 * 24 / 8 = 2359296 \text{ bytes} / (1024 * 1024) = 2.25 \text{ MB}$ [1]

10. A school logo requires 5 different colours. How many bits will be required for each pixel?

Bits required: 3
 (This allows for 8 colours) [1]

11. Computer displays use 3 colours for each pixel. What are they?

Colour 1: Red Colour 2: Green Colour 3: Blue [1]

12. A web designer wishes to use 24 bit colour for their images. How many colours will be available for them to use?

16 777 216 colours [1]

13. What do each of the following colours represent in hexadecimal?

- a) FFFFFFF White
 b) 0000FF Blue
 c) 00FF00 Green
 d) 555555 Gray / Dark gray
- [4]

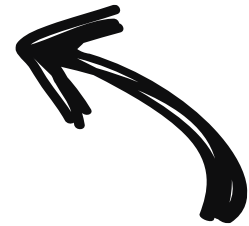
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