Data representation – Images

1. Digital images are not stored on computers as the actual picture. Instead, they are represented using:

(a) Text documents
(b) Sound waves
(c) Numbers (binary digits)
(d) Special symbols

2. Each tiny dot that makes up a digital image is called a:

(a) Byte
(b) Pixel
(c) Bit
(d) Resolution

3. The number of bits used to represent the colour of a single pixel determines the image's:

(a) Size
(b) Clarity
(c) Colour depth
(d) Resolution

4. An image with a higher colour depth will typically have:

(a) Faster loading times
(b) More colours
(c) Smaller file size
(d) Lower resolution

5. What is a pixel, and how is it represented in binary?

6. Explain the concept of “colour depth" in image representation?

7. How is image size calculated?

8. Explain the relationship between image resolution and file size.

9. What is metadata, and what information does it include in an image file?

10. Sam takes a true colour photograph on his phone. The size of the photo is 1200 x 800 pixels. Construct an expression to calculate the file size **IN MiB. HINT:** look at question 6 if you don't know the colour depth of a true colour image.

ANSWERS

1. C – like everything stored digitally, images are represented using binary digits.

2. B – pixels make up digital images

3. C – Colour depth. Each pixel has a colour. The number of colours each pixel could be is determined by how many bits are available to store the data about the colour. As each colour needs a unique colour code (in binary), more bits are needed for more colours. The number of bits is known as colour depth.

4. B – see explanation above.

5. A pixel (short for "picture element") is the smallest unit of an image. It represents a single dot or point in the image. Each pixel is represented by a binary number. For example, in a black-and-white image, 0 can represent black (off), and 1 can represent white (on).

6. Colour depth refers to the number of bits used to represent each pixel's colour in an image. Higher colour depth allows for a wider range of colours. For example:

   1 bit per pixel: 2 possible colours (black and white)
   8 bits per pixel: 256 possible colours
   24 bits per pixel (true colour): over 16 million possible colours

   The formula 2^n where n is the number of bits (colour depth) can be used to work out how many colours there could be in a given colour depth.

7. Image size is calculated as height and width in pixels x colour depth in bits. Eg. 640 x 480 x 8
   Image resolution describes how tightly packed the pixels are.

8. Resolution is defined as the number of pixels **PER** INCH in an image. Low-resolution images have larger pixels and look blocky, while high-resolution images have more pixels, which are smaller. A high resolution image will look clearer especially when enlarged. Higher resolution leads to larger file sizes.

9. Metadata is extra data about the file itself. Image file metadata includes details like file type, creation date, type of camera used, location.

10. The formula is width x height x colour depth. The result is always **IN BITS.** A true colour image has a colour depth of 24. This is what is used for photographs.
   1200 x 800 x 24 = answer in bits
   The question asks for MiB so the answer in bits needs to be divided by 8 (to give bytes), then by 1024 (to give KiB), then 1024 (to give MiB)
   Final answer: $\frac{1200 \times 800 \times 24}{8 \times 1024 \times 1024}$