1 Information representation – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English	**Write it 3 times** (English)		
bitmap			
pixel			
image resolution			
colour depth			
vector graphic			
sampling			
sampling rate			
Compression			
lossless			
lossy			
run-length encoding			

Recall

In **Part 1** you represented numbers (binary, denary, hexadecimal, two's complement, BCD) and text (character sets). Part 2 looks at how **images and sound** are stored as numbers, and how files are made smaller.

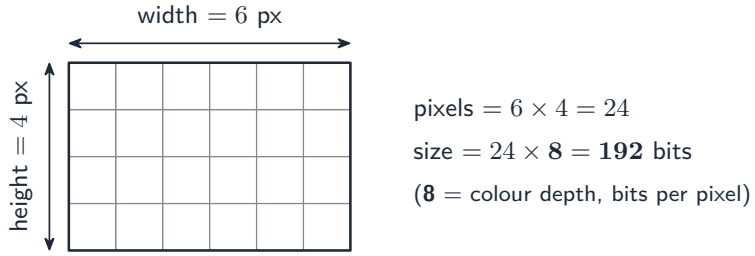
New ideas

1 Bitmap images (and vectors)

A **bitmap** image stores the colour of every **pixel** in a grid. Two settings decide its quality and size:

- **image resolution** – the width × height in pixels;
- **colour depth** – the number of bits per pixel (1 bit → black/white, 8 → 256 colours, 24 → "true colour").

$$\text{file size (bits)} = \text{width} \times \text{height} \times \text{colour depth}.$$

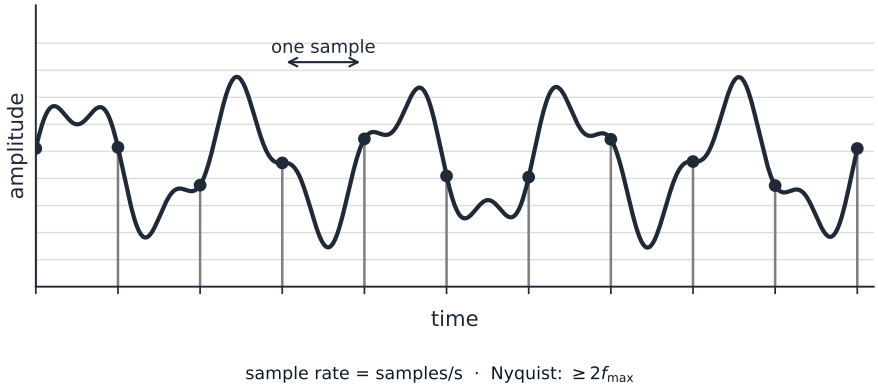


A **vector graphic** instead stores *instructions* to draw shapes (with properties like colour and position). It scales to any size without blur – great for logos – but cannot store a photograph.

Watch out: doubling the resolution does not double the file size – the width *and* the height both double, so the size goes up about *four* times.

2 Sound

Sound is **analogue** (a smooth wave). To store it the computer takes **sampling** – reading the wave's height at regular time steps. The **sampling rate** is the number of samples per second (CD quality is 44.1 kHz).



A higher sampling rate (or more bits per sample) gives better quality but a bigger file.

3 Compression

Compression makes a file smaller, saving storage and transmission time. Two kinds:

- **lossless** – the original is recovered **exactly** (text, programs, PNG, ZIP);
- **lossy** – some detail is dropped for a **much smaller** file (JPEG, MP3, streamed video).

One lossless method is **run-length encoding** (RLE): store "n copies of x" instead of repeating x – good for big flat areas.

lossless — recovered exactly (RLE, PNG, ZIP)
lossy — smaller, some detail lost (JPEG, MP3)

Practice

1.1 A bitmap image is 100 pixels wide, 100 high, with a colour depth of 24 bits. Find its file size in bits, then in bytes. [3]

1.2 State whether a bitmap or a vector graphic is better for a company logo, and give one reason. [2]

1.3 State the effect on (a) the quality and (b) the file size of using a higher sampling rate. [2]

1.4 State whether lossless or lossy compression should be used for (a) a program file, (b) streaming a video. [2]

1.5 Use run-length encoding to compress the pixel row `W W W W B B W W` (write your code as count–value pairs). [2]

1.6 Explain *why* a photograph cannot be stored well as a vector graphic. [2]