Lossless compression 1

GCSE A Level

P P P P

Which **two** of the following statements describe lossless compression methods?

☐ A method where binary patterns are identified and replaced with codes, and a dictionary of the codes is also stored

☐ A method where information that is not useful to humans is discarded

☐ A method where blocks of pixels are approximated to a single value

☐ A method where a run of binary codes is replaced by a single code and the number of repetitions of the code in the run

Lossless compression 2

A Level

P P

Dictionary-based compression methods are lossless. What is the correct definition of a lossless compression method?

○ A method where the decompressed file has an identical binary form to the original uncompressed file

○ A method where data that is discarded during compression is re-created by a sophisticated algorithm

○ A method where the user cannot tell the difference between the original uncompressed file and the decompressed file

○ A method where the binary values of the original uncompressed file and the decompressed files are different, but the decoded data appears to be the same

Lossy compression 1

GCSE A Level

P P P P

Why might a developer choose a lossy method for file compression?

○ The file contains data of which an approximation of the original is good enough.

○ The file contains data that is made up of simple sequences of letters and numbers.

○ The file contains data that has lots of repeated patterns.

○ The file contains data that has no commercial value.

Compression ratios

GCSE A Level

C c C c
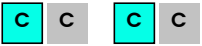
Three files have been compressed. Calculate the compression ratio for each file and then put them in order with the greatest compression achieved at the top and the lowest at the bottom.

Available items

Size before compression = 1800kB
Size after compression = 180kB

Size before compression = 820kB
Size after compression = 164kB

Size before compression = 210kB
Size after compression = 63kB

RLE applied to bitmap 4

GCSE A Level

c c   c c

Black and white pixels are used to show a bitmap image of a Space Invader.

Run length encoding (RLE) is used to compress the image.

In the encoded data, white is represented with by the code W and black is represented by the code B.
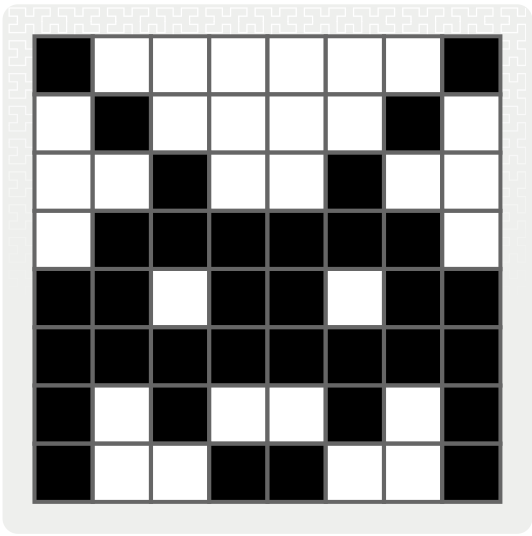
Move the encoded lines shown below into the correct order so that each line represents the equivalent line of the bitmap image.

Available items

B1, W2, B2, W2, B1

B8

B1, W1, B1, W2, B1, W1, B1

W2, B1, W2, B1, W2

B1, W6, B1

W1, B1, W4, B1, W1

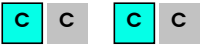B2, W1, B2, W1, B2

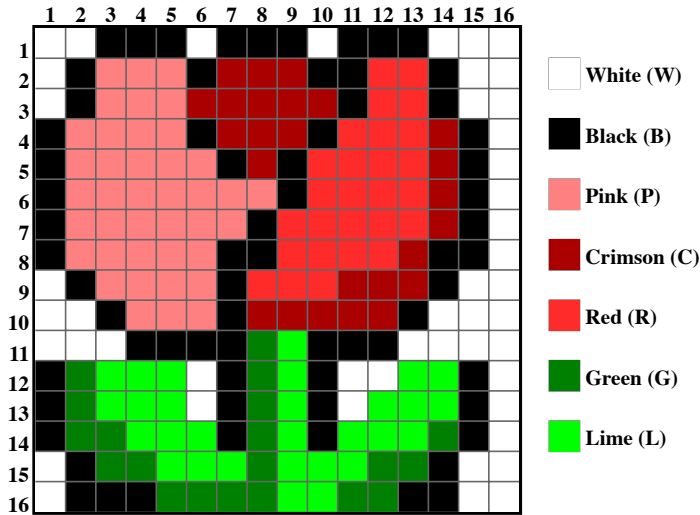W1, B6, W1

RLE suitability

A Level

C C

A shady corner

Why is an image of a real-life subject not suitable for compression using run length encoding (RLE)?

○ The image has too much detail.

○ The suimage is not a bitmap.

○ The image is too large.

○ The image doesn't have enough different colours.

RLE applied to bitmap 1

GCSE A Level

C c C c

The bitmap image below will be compressed using RLE.

Bitmap image

Row 6 is compressed as B1, P7, B1, R4, C1, B1, W1

How will row 11 be compressed? **Type your answer in the same format as that shown in the example**, with the 'colour letter' followed by the number, and each letter/number pair separated by commas.

RLE applied to sound samples

GCSE A Level

C C P P

Ultrasound machines are used in the medical field for diagnosis. During a medical examination, part of the sound captured by the ultrasound machine was digitised and converted into the following binary pattern:

0000 0011 1111 1000 0000 0000 0111 1111

This data is compressed using RLE and stored using one bit for the data bit followed by four bits to hold the number of consecutive repetitions of that data. Which of the following options would be the correct result of the compression?

○ 0 0110 1 0111 0 1100 1 0111

○ 0 010010 1 01110

○ 0 0100 0 0010 1 0010 1 0100 1 0001 0 0011
0 0100 0 0100 0 0001 1 0011 1 0100

RLE applied to bitmap 2

GCSE A Level
C c C c
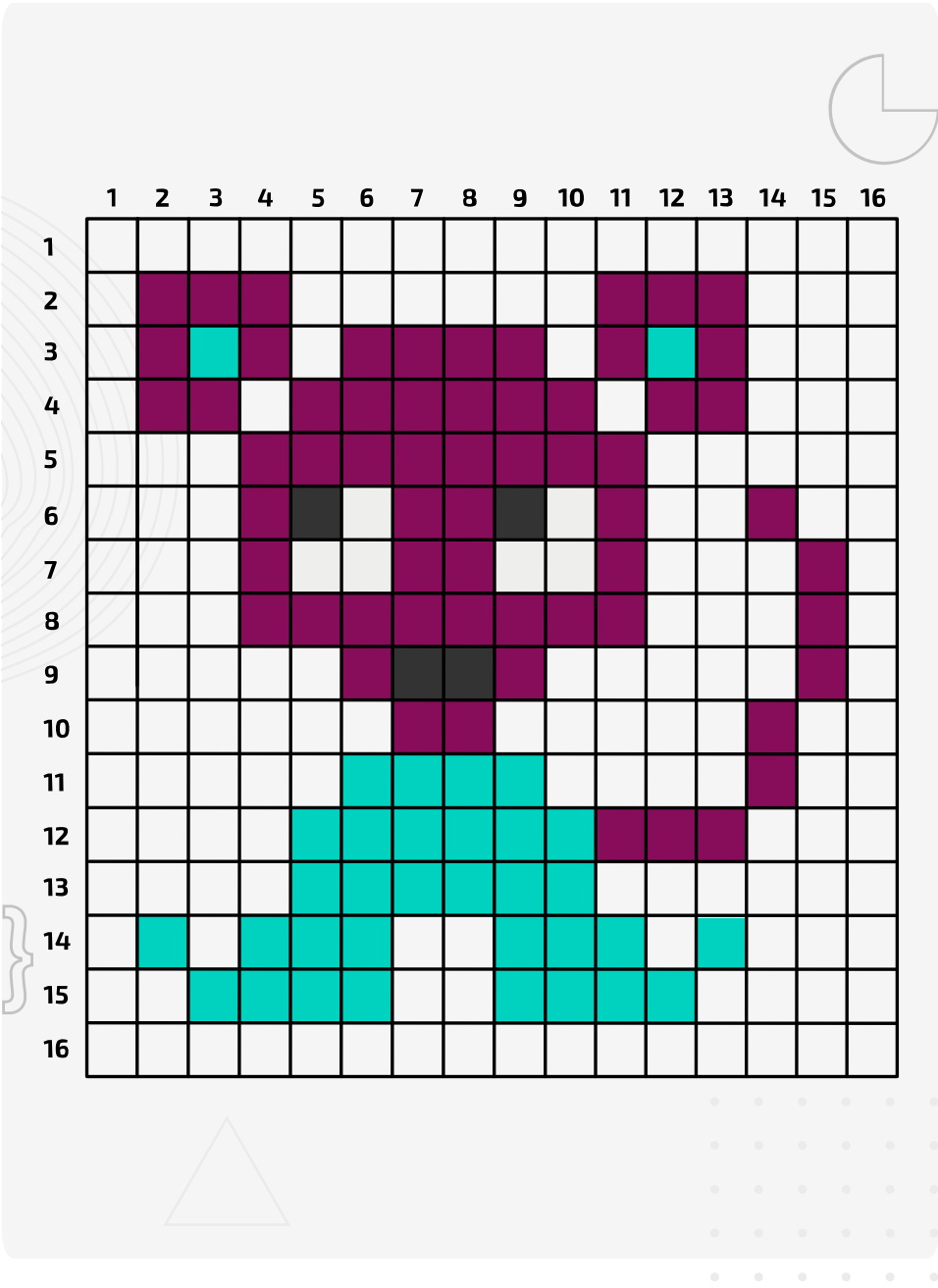
A simple bitmap image

The bitmap image shown above uses a colour depth of 3 bits.

The image will be compressed using run length encoding (RLE). Assume that a run is able to span multiple rows (for example, the initial run of white pixels has a run size of 17) and that the repetitions are stored as an 8-bit binary number.

Give an example of a binary code that could be used to represent the colour pink.

What degree of compression (divide the compressed size by the original file size) will be achieved for the **first two rows** only? Express your answer as a value with two decimal places.

Dictionary compression

Consider the following passage of text from *The Picture of Dorian Gray* by Oscar Wilde.

The artist is the creator of beautiful things. To reveal art and conceal the artist is art's aim. The critic is he who can translate into another manner or a new material his impression of beautiful things. The highest as the lowest form of criticism is a mode of autobiography. Those who find ugly meanings in beautiful things are corrupt without being charming. This is a fault. Those who find beautiful meanings in beautiful things are the cultivated. For these there is hope. They are the elect to whom beautiful things mean only Beauty. There is no such thing as a moral or an immoral book. Books are well written, or badly written. That is all.

The passage is encoded in standard 16-bit Unicode and compressed using a simple dictionary-based method, where each word is replaced by an 8-bit code.

Part A   Uncompressed storage   ⌃

How many bytes are needed to store the word "Beauty" in uncompressed form?

🏴

Part B   Compressed storage   ⌃

Ignoring the space needed for the dictionary, how many bytes are needed to store the word "Beauty" in compressed form?

🏴

Part C   Impact of compression

Which of the following words from the passage will have the biggest impact on reducing file size?

- ○ "beautiful"

- ○ "the"

- ○ "autobiography"

Part C   Impact of compression

Which of the following words from the passage will have the biggest impact on reducing file size?

- ○ "beautiful"

- ○ "the"

- ○ "autobiography"