AP COMPUTER SCIENCE PRINCIPLES • EXERCISE SHEET

2.2 Data Compression

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

Objective

Build the skills to answer exam questions on **data compression**.

You must be able to:

- explain why **compression** 压缩 reduces the bits needed to store or transmit data
- distinguish **lossless** 无损 from **lossy** 有损 compression
- describe the trade-off between file **size** and data **quality**
- explain how removing **redundancy** 冗余 speeds up transmission

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Compression

Reduces the number of **bits** needed to store or send data, saving space and time.

■ Lossless vs lossy

- **Lossless** restores the original data **exactly** (used for text, program files; e.g. ZIP).
- **Lossy** discards some data, so it cannot be restored exactly, but achieves **smaller** files (e.g. JPEG, MP3).

■ The trade-off

Smaller size usually means lower quality. Removing redundancy makes transmission **faster** over a network.

2 Practice

2.1 State what data compression does. [1]

2.2 State the difference between lossless and lossy compression. [2]

2.3 State one situation where lossless compression is needed. [1]

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3 Exam-style questions

3.1 Lossless compression [1]

- **A** loses some of the data
- **B** restores the original data exactly
- **C** works only on images
- **D** increases the file size

3.2 A JPEG image file uses _____ compression. [1]

- **A** lossless
- **B** lossy
- **C** no
- **D** text

3.3 A user must compress a legal text document, with no loss of data allowed.

(a) State which type of compression to use. [1]

(b) State why lossy compression is not suitable. [1]

(c) State one benefit of compression when sending files. [1]

4 Go further

- work through the **2.2 Data Compression** lesson on the **Learn** page;
- read the **Data** section of the AP Computer Science Principles handout on the **Know** page.

Solutions

2.1 it reduces the number of bits needed to store or transmit the data.

2.2 lossless compression restores the original exactly; lossy compression discards some data and cannot.

2.3 any one where exact data matters: text, program code, legal or medical files.

3.1 B.

3.2 B.

3.3 (a) lossless. (b) it would lose or change some of the text. (c) faster transmission (or less storage used).