

Exercise walk-through

Binary Numbers ■ 2.1

eXercise

You must be able to

- explain why computers represent all data using **bits** 位, each a 0 or 1
- convert a whole number between **binary** 二进制 and **decimal** 十进制
- describe how a fixed number of bits can cause an **overflow error** 溢出错误
- relate 8 bits to one **byte** 字节

Method — Bits and bytes

A computer stores everything as **bits** (0 or 1). **8 bits = 1 byte**.

Method — Binary to decimal

Each bit has a place value 1, 2, 4, 8, 16, ... (powers of 2). Add the place values where the bit is 1:

$$1101_2 = 8 + 4 + 0 + 1 = 13.$$

Method — Decimal to binary

Subtract the largest powers of 2 that fit: $6 = 4 + 2 = 110_2$.

Practice 2.1 ■ 2 marks

Convert the binary number 1010 to decimal.

Solution 2.1

Worked steps

$$1010_2 = 8 + 0 + 2 + 0 = 10 \quad \text{M1} \quad \text{A1}.$$

Practice 2.2 ■ 2 marks

Convert the decimal number 6 to binary.

Solution 2.2

Worked steps

$$6 = 4 + 2 = 110_2 \quad \text{M1} \quad \text{A1}.$$

Practice 2.3 ■ 1 mark

State how many bits are in one byte.

Solution 2.3

Method: Bits and bytes

Worked steps

8 **B1**.

Exam-style 3.1 ■ 1 mark

The binary number 1000 in decimal is

A 4

B 8

C 16

D 2

Solution 3.1

A 4

B 8



C 16

D 2

Worked steps

B.

Exam-style 3.2 ■ 1 mark

A value too large for the available bits causes an

- A** logic error
- B** overflow error
- C** syntax error
- D** case with no error

Solution 3.2

- A logic error
- B overflow error**
- C syntax error
- D case with no error



Worked steps

B.

Exam-style 3.3 ■ 1 mark

Convert between the two bases.

- (a) Binary 1111 to decimal.
- (b) Decimal 10 to binary.

Solution 3.3

Worked steps

(a) $1111_2 = 8 + 4 + 2 + 1 = 15$ **B1**. (b) $10 = 8 + 2 = 1010_2$ **M1** **A1**.