# Chapter 1

1 Computers store data in binary form.

(a) State the difference between a tebibyte and a terabyte.

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(b) Convert the signed denary value –100 into an 8-bit two's complement binary integer.

Working ..................................................................................................................................

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Answer .......................................................................... [1]

(c) Convert the denary number 251 into hexadecimal. Show your working.

Working ..................................................................................................................................

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Answer ..........................................................................

[2]

(d) Add the following unsigned binary integers.

$$0\ 1\ 0\ 1\ 0\ 0\ 0\ 0$$

$$+\ \underline{0\ 0\ 1\ 1\ 1\ 1\ 1\ 0}$$

[1]

**2 (a)** Draw **one** line from each image representation term to its correct definition.

| Term | | Definition |
|------|---|------------|
| Pixel | | The number of pixels wide by the number of pixels high |
| Bit depth | | The smallest identifiable component of an image |
| Image resolution | | Stores data about the image file, e.g. file format, number of bits per pixel, file size |
| File header | | The number of bits used to represent each colour |

[3]

**(b)** The following section of a bitmap image is 10 pixels wide and 5 pixels high. In this example, each colour is represented by a letter, e.g. B is blue.

| B | B | B | B | B | B | B | B | B | B |
|---|---|---|---|---|---|---|---|---|---|
| Y | Y | P | Y | Y | Y | P | Y | Y | Y |
| R | R | M | R | P | K | T | T | R | R |
| B | O | P | Y | Y | Y | P | G | P | P |
| R | O | R | P | P | P | R | R | R | R |

The complete image can have up to 256 colours.

**(i)** Identify the smallest number of bits that can be used to represent each colour in the complete bitmap image.

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**(ii)** Calculate an estimate for the file size of the section of the bitmap image shown, giving your answer in bytes. Use your answer from **part (b)(i)**.

Show your working.

Working .................................................................................................................................

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Answer ................................... bytes

[2]

**(c)** Describe how changing the colour depth of an image affects its file size.

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**(d)** The first row of pixels in the image from **part (b)** is shown:

| B | B | B | B | B | B | B | B | B | B |
|---|---|---|---|---|---|---|---|---|---|

Explain how this row of pixels can be compressed using lossless compression.

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**3** Text and numbers are examples of data stored in a computer.

**(a)** A character set is used to represent characters in a computer.

**(i)** Describe what is meant by a **character set**.

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**(ii)** Identify **two** character sets and state **one** difference between them.

Character set 1 ...........................................................................................................

Character set 2 ...........................................................................................................

Difference ..................................................................................................................

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[3]

**(iii)** Describe how lossless compression can be used to reduce the file size of a text file.

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**(iv)** Explain why lossy compression should **not** be used on a text file.

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**(b)** A computer can represent numerical data in different forms.

Complete the table by writing the answer to each statement.

| Statement | Answer |
|---|---|
| The hexadecimal value 11 represented in denary | |
| The smallest denary number that can be represented by an unsigned 8-bit binary integer | |
| The denary number 87 represented in Binary Coded Decimal (BCD) | |
| The denary number 240 represented in hexadecimal | |
| The denary number –20 represented in 8-bit two's complement binary | |

[5]

Working space

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**3** Anya scans an image into her computer for a school project.

**(a)** The scanned image is a bitmapped image.

**(i)** Complete the following table to describe the two terms about graphics.

| Term | Description |
|---|---|
| Pixel | ........................................................................................................................... ........................................................................................................................... ........................................................................................................................... |
| File header | ........................................................................................................................... ........................................................................................................................... ........................................................................................................................... |

[2]

**(ii)** The image is scanned with an image resolution of 1024 × 512 pixels, and a colour depth of 8 bits per pixel.

Calculate an estimate for the file size, giving your answer in mebibytes. Show your working.

Working ......................................................................................................................

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Answer ......................................... mebibytes

[3]

**(b)** The image is compressed using lossless compression.

Identify **one** method of lossless compression that can be used to compress the image **and** describe how the method will reduce the file size.

Lossless compression method ........................................................................................

Description ....................................................................................................................

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[3]

**(c)** One of the colours used in the image has the hexadecimal colour code:

#FC238A

FC is the amount of red, 23 is the amount of green and 8A is the amount of blue in the colour.

**(i)** Convert the hexadecimal code FC into denary.

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**(ii)** The amount of green in binary is 00100011. This has the denary number 15 added to it to create a second colour.

Add the denary number 15 to the binary number 00100011 and give your answer in binary.

Perform the addition in binary. Show your working.

Working ..............................................................................................................

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Answer (in binary) .......................................

[3]

**(iii)** Hexadecimal 23 in two's complement representation is 00100011. The denary number 10 needs to be subtracted from this value.

Subtract the denary number 10 from the two's complement representation 00100011.

Give your answer in binary. Show your working.

Working ..............................................................................................................

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Answer (in binary) .......................................

[3]

**4** A computer uses the ASCII character set.

**(a)** State the number of characters that can be represented by the ASCII character set and the extended ASCII character set.

ASCII ..........................................................

Extended ASCII ..........................................................

[2]

**(b)** Explain how a word such as 'HOUSE' is represented by the ASCII character set.

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**(c)** Unicode is a different character set.

The Unicode value for the character '1' is denary value 49.

**(i)** Write the hexadecimal value for the Unicode character '1'.

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**(ii)** Write the denary value for the Unicode character '5'.

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**5 (a)** Draw **one** line from each binary value to its equivalent (same) value on the right.

**Binary value**

| 8 bits |

| 8000 bits |

| 1000 kilobytes |

| 1024 mebibytes |

| 8192 bits |

| 1 kibibyte |

| 1 gigabyte |

| 1 byte |

| 1 kilobyte |

| 1 gibibyte |

| 1 megabyte |

| 1 mebibyte |

[5]

**(b) (i)** Perform the following binary addition. Show your working.

10101010

+ 00110111

[2]

**(ii)** State how an overflow can occur when adding two binary integers.

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**(c)** Convert the hexadecimal value F0 into denary.

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6   A register stores the following binary number:

| 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 |
|---|---|---|---|---|---|---|---|

(a) The binary value in the register represents an unsigned binary integer.

Convert the unsigned binary integer into denary.

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(b) The binary value in the register represents a two's complement binary integer.

Convert the two's complement binary integer into denary.

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(c) The binary value in the register represents a hexadecimal number.

Convert the binary number into hexadecimal.

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(d) State why the value in the register cannot be interpreted as a Binary Coded Decimal (BCD).

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(e) The binary contents of **two** registers are:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Register 1** | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 |
| **Register 2** | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 |

(i) Add the contents of **Register 1** and **Register 2**. Show your working.

Answer ..........................................................................................................................................
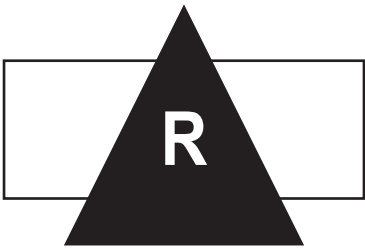                                                                                                                                    [2]

**(ii)** Subtract the contents of **Register 2** from the contents of **Register 1**. Show your working.

Answer ......................................................................................................................

[2]

**7** Riya has created the following logo as a vector graphic.



**(a)** Complete the table by writing a description of each vector graphic term **and** give an example for this logo.

| Term | Description | Example from logo |
|---|---|---|
| **Property** | | |
| **Drawing list** | | |

[4]

**(b)** Riya takes a photograph using a digital camera. The photograph is stored as a bitmap image.

**(i)** Describe **two** differences between a vector graphic and a bitmap image.

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[4]

**(ii)** Riya needs to email the photograph. She compresses the photograph before sending it using an email.

Describe **two** lossy methods that Riya can use to compress the image.

Method 1 ............................................................................................................................

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Method 2 ............................................................................................................................

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[4]

**8** A digital camera takes a bitmap image. The image is 2000 pixels wide by 1000 pixels high with a colour depth of 24-bits.

**(a)** Calculate an estimate of the file size for the image. Give your answer in megabytes. Show your working.

Working ...............................................................................................................................

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Answer ......................................................... MB

[3]

**(b)** A second image is taken, this time in black and white. It has the same number of pixels, but the file size is smaller.

Explain why the file size is smaller.

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**(c)** The digital camera allows a user to add text to an image. The text is encoded as ASCII values.

The table shows the ASCII denary values for five characters.

| Character | ASCII denary value |
|-----------|--------------------|
| a | 97 |
| b | 98 |
| c | 99 |
| d | 100 |
| e | 101 |

**(i)** Give the 8-bit binary value for the ASCII character 'b'.

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**(ii)** Complete the table by writing the ASCII denary value for the character 't' **and** its hexadecimal equivalent.

| Character | t |
|---|---|
| ASCII denary value | |
| Hexadecimal value | |

[2]

**9**

Samira uses a computer to draw a logo for her hotel and saves it as a vector graphic. The logo will be placed on the multimedia presentation and elsewhere, such as on signs at the entrance of the hotel.

Samira emails the logo to a company that prints signs, and other documentation for the hotel.

**(i)** Describe how the logo is represented by the computer.

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**(ii)** State **two** reasons why the hotel **logo** is saved as a vector graphic instead of a bitmapped graphic.

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2 ...................................................................................................................................

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[2]

10  Amir has created a sound file using his desktop computer.

(a)  Complete the table by writing the missing definitions and term about sound.

| Term | Definition |
|---|---|
| Sampling | .................................................................................................................... .................................................................................................................... .................................................................................................................... .................................................................................................................... |
| ...................................... ...................................... | The number of samples per unit time |
| Sampling resolution | .................................................................................................................... .................................................................................................................... .................................................................................................................... .................................................................................................................... |

[3]

(b)  The file is too large to be emailed and the file size needs to be reduced.

(i)  Name **one** lossless compression technique that can be used to reduce the size of the sound file.

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(ii)  Describe **one** lossy compression technique that can be used to reduce the size of the sound file.

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