Ch1

Information Representation

CHAPTER ASSIGNMENT · 54 MARKS

Name _____ Class _____ No. _____ Date _____

Answer every question in the space given. Show your working. You may use the chapter page to help you.

Questions from *Computer Science for Cambridge International AS & A Level Coursebook*, 2nd edition, Sylvia Langfield and Dave Duddell (Cambridge University Press), for classroom use.

Tasks and questions from the chapter

1.01 Convert each of the denary numbers 96, 215 and 374 into hexadecimal numbers.
Convert each of the hexadecimal numbers B4, FF and 3A2C to denary numbers.

Q1.01 Does a computer ever use hexadecimal numbers?

1.02 Take the two's complement of the binary code for −7 and show that you get the code for +7.

1.03 Convert the two's complement number 1011 to the denary equivalent. Then do the same for 111011 and convince yourself that you get the same value.

DP **Discussion Point:** What is the two's complement of the binary value 1000? Are you surprised by this?

1.04 Using a byte to represent each value, carry out the subtraction of denary 35 from denary 67 using binary arithmetic with two's complement representations.

Q1.02 Many years ago, a byte was defined as six bits. If a character was to be represented by one byte, which characters would you expect to be representable and which ones would you expect to be unavailable?

1.05 Construct a partial drawing list for the graphic shown in Figure 1.05. You can take measurements from the image and use the bottom left corner of the box as the origin of a coordinate system. You can invent your own format for the drawing list.

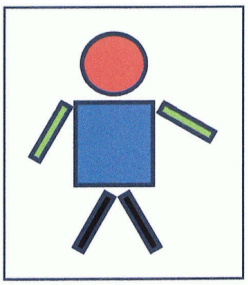


Figure 1.05 A simple example of a vector graphic image

EQ1.01 **Extension Question 1.01:** Graphic files can be stored in a number of formats. For example, JPEG, GIF, PNG and TIFF are just a few of the possibilities. What compression techniques, if any, do these use?

RP **Reflection Point:** Can you recall the different possibilities for what one byte might be coded to represent?

Exam-style questions

1 A file contains binary coding. The following are two successive bytes in the file: 10010101 and 00110011

(a) One possibility for the information stored is that the two bytes together represent one unsigned integer binary number.

(i) Calculate the denary number corresponding to this. [2]

(ii) Calculate the hexadecimal number corresponding to this. [2]

(b) Give **one** example of when a hexadecimal representation is used. [1]

(c) Another possibility for the information stored is that the two bytes individually represent two signed integer binary numbers in two's complement form.

(i) State which byte represents a negative number and explain the reason for your choice.

(ii) Calculate the denary number corresponding to each byte. [3]

(d) Give **two** advantages of representing signed integers in two's complement form rather than using a sign and magnitude representation. [2]

(e) Give **three** different examples of other options for the types of information that could be represented by two bytes. For each example, state whether a representation requires two bytes each time, just one byte or only part of a byte each time. [3]

2 A designer wishes to include some multimedia components on a web page.

(a) If the designer has some images stored in files there are two possible formats for the files.

(i) Describe the approach used if a graphic is stored in a vector graphic file. [2]

(ii) Describe the approach used if a graphic is stored in a bitmap file. [2]

(iii) State which format gives better image quality if the image has to be magnified and explain why. [2]

(b) The designer is concerned about the size of some bitmap files.

(i) If the resolution is to be 640 × 480 and the colour depth is to be 16, calculate an approximate size for the bitmap file. State the answer using sensible units. [2]

(ii) Explain why this calculation only gives an approximate file size. [1]

(c) The designer decides that the bitmap files need compressing.

(i) Explain how a simple form of lossless compression could be used. [2]

(ii) Explain **one** possible approach to lossy compression that could be used. [2]

3 An audio encoder is to be used to create a recording of a song. The encoder has two components.

(a) One of the components is an analogue-to-digital converter (ADC).

(i) Explain why this is needed. [2]

(ii) Two important factors associated with the use of an ADC are the sampling rate and the sampling resolution. Explain the two terms. Sketch a diagram if this will help your explanation. [5]

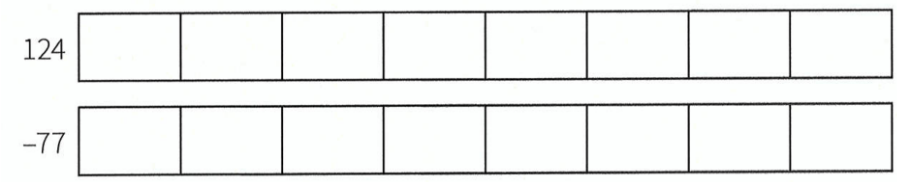
(b) The other component of an audio encoder has to be used before the ADC is used.

(i) Identify this component. [1]

(ii) Explain why it is used. [2]

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(a) Using two's complement, show how the following denary numbers could be stored in **(i)** an 8-bit register: [2]



(ii) Convert the two numbers in **part (a) (i)** into hexadecimal. [2]

(b) Binary Coded Decimal (BCD) is another way of representing numbers.

(i) Write the number 359 in BCD form. [1]

(ii) Describe a use of BCD number representation. [2]

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(a) Sound can be represented digitally in a computer. Explain the terms sampling resolution and sampling rate. [4]

(b) The following information refers to a music track being recorded on a CD:

- music is sampled 44 100 times per second
- each sample is 16 bits
- each track requires sampling for left and right speakers.

(i) Calculate the number of bytes required to store one second of sampled music. Show your working. [2]

(ii) A particular track is four minutes long. Describe how you would calculate the number of megabytes required to store this track. [2]

(c) When storing music tracks in a computer, the MP3 format is often used. This reduces file size by about 90%. Explain how the music quality is apparently retained. [3]

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End of assignment · Check your answers against the chapter at gurujazzy.com/subjects/computer-science/as-a-level/information-representation/