

Name:

Class Teacher:

Date:



OCR J276

GCSE Computer Science




REVISION BOOKLET

2.6 DATA REPRESENTATION

Content in J276 GCSE Computer Science:

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- 1.2 Memory
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- 2.6 Data Representation

2.6 DATA REPRESENTATION

TOPIC			
Units: bit, nibble, byte, kilobyte, megabyte, gigabyte, terabyte, petabyte			
Units: how data needs to be converted into a binary format to be processed by a computer			
Numbers: how to convert positive denary whole numbers (0-255) into 8-bit binary numbers and vice versa			
Numbers: how to add two 8-bit binary integers and explain overflow errors which may occur			
Numbers: binary shifts			
Numbers: how to convert positive denary whole numbers (0-255) into 2-digit hexadecimal numbers and vice versa			
Numbers: how to convert from binary to hexadecimal equivalents and vice versa			
Numbers: check digits			
Characters: the use of binary codes to represent characters			
Characters: the term 'character set'			
Characters: the relationship between the number of bits per character in a character set and the number of characters which can be represented (for example ASCII, extended ASCII and Unicode)			
Images: how an image is represented as a series of pixels represented in binary			
Images: metadata included in the file			
Images: the effect of colour depth and resolution on the size of an image file			
Sound: how sound can be sampled and stored in digital form			
Sound: how sampling intervals and other factors affect the size of a sound file and the quality of its playback:			
Sample size			
Bit rate			
Sampling frequency			
Compression: need for compression			
Compression: types of compression			
Lossy			
Lossless			

2.6 DATA REPRESENTATION

BIT, NIBBLE, BYTE, KILOBYTE, MEGABYTE, GIGABYTE, TERABYTE, PETABYTE

HOW DATA NEEDS TO BE CONVERTED INTO A BINARY FORMAT TO BE PROCESSED BY A COMPUTER

HOW TO CONVERT POSITIVE DENARY WHOLE NUMBERS (0-255) INTO 8-BIT BINARY NUMBERS AND VICE-VERSA

HOW TO ADD TWO 8-BIT BINARY INTEGERS AND EXPLAIN OVERFLOW ERRORS WHICH MAY OCCUR

BINARY SHIFTS

HOW TO CONVERT POSITIVE DENARY WHOLE NUMBERS (0-255) INTO 2-DIGIT HEXADECIMAL NUMBERS AND VICE VERSA

HOW TO CONVERT FROM BINARY TO HEXADECIMAL EQUIVALENTS AND VICE VERSA

CHECK DIGITS

THE USE OF BINARY CODES TO REPRESENT CHARACTERS

THE TERM 'CHARACTER-SET'

THE RELATIONSHIP BETWEEN THE NUMBER OF BITS PER CHARACTER IN A CHARACTER SET AND THE NUMBER OF CHARACTERS WHICH CAN BE REPRESENTED (FOR EXAMPLE ASCII, EXTENDED ASCII AND UNICODE)

HOW AN IMAGE IS REPRESENTED AS A SERIES OF PIXELS REPRESENTED IN BINARY

METADATA INCLUDED IN THE FILE

THE EFFECT OF COLOUR DEPTH AND RESOLUTION ON THE SIZE OF AN IMAGE FILE

HOW SOUND CAN BE SAMPLED AND STORED IN DIGITAL FORM

**HOW SAMPLING INTERVALS AND OTHER FACTORS AFFECT THE SIZE OF A SOUND FILE
AND THE QUALITY OF ITS PLAYBACK**

SAMPLE SIZE

BIT RATE

SAMPLING FREQUENCY

NEED FOR COMPRESSION

TYPES OF COMPRESSION

LOSSY

LOSSLESS

EXAM QUESTIONS

QUESTION 1

Kofi uses his computer to record an audio file of himself playing his guitar. Outline what happens when the computer converts the music into a file.

.....

.....

[2]

Kofi increases the sample rate his computer is using to record his guitar. Explain **two** effects this will have on Kofi's recording.

1

.....

.....

2

.....

.....

[4]

Kofi is emailing his recording to a record label. He uses lossy compression to produce the music file. Explain **two** reasons why using lossy compression is beneficial.

1

.....

.....

2

.....

.....

[4]

QUESTION 2

Order the following units from smallest to largest:

GB bit PB byte nibble MB

.....

[1]

Convert the decimal number 191 into an 8-bit binary number.

.....

[1]

Convert the hexadecimal number 3E into a decimal number. You must show your working.

.....

.....

.....

[2]

There is a subroutine, HEX(), that takes a denary number between 10 and 15 and returns the corresponding hexadecimal number. E.g. HEX(10) would return "A", HEX(15) would return "F". Write an algorithm, using the subroutine HEX(), to convert any whole decimal number between 0 and 255 into a 2 digit hexadecimal number.

.....

.....

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.....

.....

.....

.....

.....

[4]

Add together the following two 8-bit binary numbers. Express your response in an 8-bit binary form.

0 1 1 0 1 0 1 0
1 0 0 1 0 1 1 0

.....

.....

[2]

Identify the problem this addition has created.

.....

[1]

QUESTION 3

Complete a 2-place right shift on the binary number 11001011.

.....

[1]

Explain the effect of performing a 2-place right shift on the binary number 11001011.

.....

.....

[2]

QUESTION 4

Explain why data is stored in computers in a binary format.

.....

.....

[2]

In the ASCII character set, the character codes for the first three capital letters are given below.

Letter	ASCII character code
A	0100 0001
B	0100 0010
C	0100 0011

State how the ASCII character set is used to represent text in a computer.

.....

.....

[1]

Convert the word CAB into binary using the ASCII character set.

.....
.....

[1]

Explain why the ASCII character set is **not** suitable for representing text in all the languages of the world.

.....
.....
.....

[2]

QUESTION 5

When recording a sound file on a computer, the sound needs to be sampled. Describe how sampling is used when storing sound.

.....
.....

[2]

Explain the effect of the sampling interval on the size and quality of the sound file recorded.

.....
.....
.....

[3]

QUESTION 6

Add the following bytes.

$$\begin{array}{r} 1\ 1\ 0\ 1\ 1\ 0\ 0\ 0 \\ +\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 0 \\ \hline \end{array}$$

[2]

State the problem that will occur if a computer is to store the result as a byte.

.....
.....

[1]

QUESTION 7

Files are often compressed before they are sent over the internet. State what is meant by compression.

.....

[1]

State **one** advantage of compressing files before sending them over the internet.

.....
.....

[1]

Two types of compression are lossy and lossless. State which type of compression is most appropriate for each of the following and explain why it is appropriate.

- Downloading the source code of a large program

Type of compression:

.....

Explanation:

.....
.....

[3]

- Streaming a large video file

Type of compression:

.....

Explanation:

.....

.....

[3]

QUESTION 8

Numbers can be represented in denary, binary or hexadecimal. Convert the binary number 01101001 to denary, showing your working.

.....

.....

[2]

Convert the denary number 154 to binary.

.....

.....

[2]

The security code for an alarm system is a long binary number which begins

1000111110010111011 ...

The technicians prefer to use hexadecimal to enter the security code. When the number is converted into hexadecimal, the first two digits are 8F as shown below. Complete the gaps to show the next three digits.

Binary:	1000	1111	1001	0111	1011
Hexadecimal:	8	F

[3]

Explain why the technicians prefer to use hexadecimal.

.....
.....

[2]

QUESTION 9

Bob's computer has 512 kilobytes of ROM and 8 gigabytes of RAM. State how many bytes are in a kilobyte and a gigabyte.

A kilobyte

.....
.....

A gigabyte

.....
.....

[2]

QUESTION 10

The number 62 could be a denary number or a hex number. If 62 is a hex number, calculate its value as a denary number. You **must** show your working.

.....
.....

[2]

If 62 is a denary number, calculate its value as a hex number. You **must** show your working.

.....
.....

[2]

QUESTION 11

Add the following two 8-bit binary numbers.

$$\begin{array}{cccccccc} 1 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ \hline & & & & & & & \\ \hline \end{array}$$

[2]

An overflow error can occur when adding two 8-bit binary numbers. Describe what is meant by an overflow error.

.....
.....

[2]

QUESTION 12

The website of a school allows visitors to download JPG, MP3, MPEG and PDF files. The video clip is compressed using lossy compression. Explain why lossy compression is suitable for a video clip, but not suitable for a text document.

.....
.....
.....
.....

[3]

QUESTION 13

Convert the decimal number 191 into 8-bit binary.

.....

[1]

Perform the following binary addition.

$$\begin{array}{r} 01101011 \\ + 01011011 \\ \hline \end{array}$$

[2]

QUESTION 14

Alex is producing images and sound effects for a website. Part of a bitmap image is shown in Figure 2 below.

W	W	R	R	R	B	B
W	W	R	Y	R	B	B
B	B	R	R	R	B	B
B	B	B	LG	B	DG	B
B	DG	DG	LG	DG	B	B
B	B	DG	LG	B	B	B
B	B	B	LG	B	B	B

The letters represent a colour, as shown in Figure 3.

Letter	Colour
W	White
B	Blue
R	Red
Y	Yellow
DG	Dark Green
LG	Light Green

Using the example in Fig 2, explain how a bitmap image is stored on a computer.

.....

.....

.....

.....

[3]

QUESTION 15

Explain how reducing the number of colours in an image can reduce its file size.

.....
.....

[2]

The final image file may contain metadata. Describe, using an example, what is meant by metadata.

.....
.....

[2]

Alex needs to create an audio recording of himself playing his guitar. Explain how sampling is used to make the recording.

.....
.....
.....
.....

[3]

State the effects of increasing the sample rate of the recording.

.....
.....
.....

[2]

QUESTION 16

The character **é** is part of a computer’s character set. Describe what is meant by a character set.

.....
.....

[1]

When sending text messages using a mobile phone, people can choose from hundreds of characters, called emoji, to insert in their message. An example of an emoji is 🤖.

The Unicode character code for the emoji 🤖 in hexadecimal is 1F64A. Convert the hexadecimal number 1F64A to binary. The first three hexadecimal digits have been done for you.

Hexadecimal:	1	F	6	4	A
Binary:	0001	1111	0110

[2]

Explain why mobile phones that can send emoji would use Unicode instead of ASCII as their character set.

.....
.....
.....

[2]