Name_____

63 /63

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CIE Computer Science

CHAPTER 1 - DATA REPRESENTATION

1)

A stopwatch uses six digits to display hours, minutes and seconds.

The stopwatch is stopped at:

0 2 : 3 1 : 5 8
Hours **Minutes** **Seconds**

An 8-bit register is used to store each pair of digits.

(a) Write the 8-bit binary numbers that are currently stored for the **Hours**, **Minutes** and **Seconds**.

	128	64	32	16	8	4	2	1
Hours	0	0	0	0	0	0	1	0
Minutes	0	0	0	1	1	1	1	1
Seconds	0	0	1	1	1	0	1	0

3 [3]

(b) The stopwatch is started again and then stopped.

When the watch is stopped, the 8-bit binary registers show:

	128	64	32	16	8	4	2	1
Hours	0	0	0	0	0	1	0	1
Minutes	0	0	0	1	1	0	1	0
Seconds	0	0	1	1	0	1	1	1

Write the denary values that will now be shown on the stopwatch.

0 5 : 2 6 : 5 5
Hours **Minutes** **Seconds**

3 [3]

2)

Nancy has captured images of her holiday with her camera. The captured images are stored as digital photo files on her camera.

Explain how the captured images are converted to digital photo files.

The photo is split into a predefined amount of pixels, tiny squares of RGB color. Each pixel is stored as a string of binary which determines the color of the pixel in RGB. If the file is compressed, the file size decreases. Lossy compression loses detail to be left esp. unnecessary data such as metadata while lossless compression keeps all data. [4]

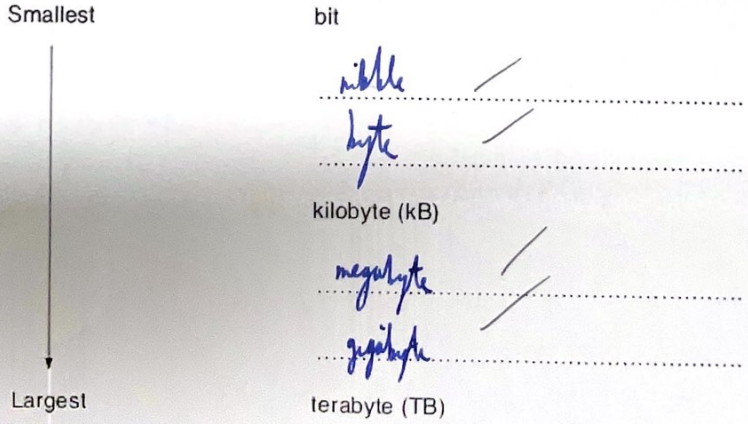
3)

Different units of data can be used to represent the size of a file, as it changes in size.

Fill in the missing units of data, using the list given:

- byte
- gigabyte (GB)
- megabyte (MB)
- nibble

The units of data increase in size from smallest to largest.



[4]

4)

Jafar is using the Internet when he gets the message:

"D03, page is not available"

Jafar remembers that hexadecimal is often used to represent binary values in error codes.

Convert the hexadecimal number in the error message into 12-bit binary.

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

3/[3]

1 1 0 1

5)

A washing machine has a small display screen built into it.

One use of the display screen is to show an error code when a problem has occurred with a washing cycle.

(a) State whether the display screen is an **input, output** or **storage device**.

output ..... 1/[1]

(b) The display screen shows a hexadecimal error code:

E04

This error code means that the water will not empty out of the washing machine.

Convert this error code to binary.

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

3/[3]

(c) State why hexadecimal is used to display the error code.

It is easier to read than plain binary and takes significantly less graphical space while still being simple and low level enough for the processor to easily display

1/[1]

6)

Data files are stored in different file formats.

Complete the table by providing a suitable file format for each file type. The first one has been done for you.

File type	File format
Pictures	.JPEG
Text	. Pdf
Sound	. MP3
Video	. MP4

3/[3]

7)

(a) Explain the differences between the binary number system and the denary number system.

- binary number system uses base 2
- goes up in descending of the power of 2
- denary ~~no~~ number system uses base 10
- goes up in descending of 10

4/[4]

(b) Explain the process of converting the binary number 1010 into a denary number.

- Going from right to left align each unit column with ascending power of 2 starting at 2
- If there is a 0, ignore the number
- If there is a 1, add the ~~unit~~ power of 2 assigned to that column to the total
- 1010 = 1(8) + 0(4) + 1(2) + 0(1) = 10

5/[5]

8)

A robot arm in a factory is programmed to move products.

The binary instructions to operate the robot arm are:

Operation	Binary Instruction	
UP	1 1 1 1	F
DOWN	0 0 0 1	1
LEFT	1 0 0 1	9
RIGHT	0 1 1 0	
OPEN	1 1 0 0	C
CLOSE	0 0 1 1	3

The instructions are entered as hexadecimal values.

An operator enters the values:

9 1 C 3 F

Convert the values and write down the operation (e.g. RIGHT) carried out by the robot arm.

9 ..... Left .....

1 ..... Down .....

C ..... Open .....

3 ..... Close .....

F ..... Up .....

5/[5]

9)

5 **(a)** The denary number 57 is to be stored in two different computer registers.

Convert 57 from denary to binary and show your working.

~~64~~ x

57 = 32+16+8+1 ✓

= 0111001 ✓

64 32 16 8 4 2 1

2

.....[2]

(b) Show the binary number from **part (a)** as it would be stored in the following registers.

0	0	1	1	1	0	0	1

Register 1 ✓

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

Register 2 ✓

2

[2]

(c) A binary number stored in a register can have many different uses, for example an address in main memory.

Give **two** other uses for a binary number stored in a register.

Use 1 address in storage eg HDD ✓

Use 2 Instruction for CPU ✓

2

[2]

(d) A register in a computer contains binary digits.

10 = A

2 1 8 2

0	0	1	1	1	0	1	0

The contents of the register represent a binary integer.

Convert the binary integer to hexadecimal.

3A ✓

1

.....[1]

10)

I Hexadecimal is used for MAC addresses.

Part of a MAC address is given:

97 – 5C – E1

Each pair of digits is stored as binary in an 8-bit register.

(a) Show what the binary register stores for each pair of the given digits.

97	1	0	0	1	0	1	1	1
5C	0	1	0	1	1	1	0	0
E1	1	1	1	0	0	0	0	1

6/ [6]

(b) Explain what is meant by a MAC address.

- Media Access Control address
- Unique identifying code / fingerprint
- given to network controllers as an address to use for communication with other devices on a network

4/ [4]

11)

Give **two** other examples where hexadecimal can be used.

Example 1 RGB color codes

Example 2 Error codes

2/ [2]

12)

The following text is stored as a text file:

> She sells sea shells on the seashore. The shells that she sells are sea shells I am sure.

Explain how lossless compression would compress this file.

- Converts text to binary ✓
- Identifies modul (repeating) words/patterns ✓
- assigns an identifier to them ✓
- uses shortened identifiers instead of the binary for the characters ✓
- adds dictionary ~~to~~ in order to decode the identifier ✓
- No data is lost, only compressed ✓

5/ [5]