Name _____

62 /63

CIE Computer Science

CHAPTER 1 - DATA REPRESENTATION

38

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**.

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
	128	64	32	16	8	4	2	1

5/[3]

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

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

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
			32	16	8	4	2	1

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

05 : 26 : 55
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.

① Analogue to digital conversion. ✓

② Images converted into many pixels. ✓

③ Each pixel assigned a binary value and a colour. ✓

④ Pixels ordered in sequence. ✓

⑤ ~~B~~ Pixel arrayed in a grid. ✓

⑥ Processed by a computer, turned into JPEG file etc. ✓

4/[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.

Smallest

bit

nibble ✓

byte ✓

kilobyte (kB)

megabyte (MB) ✓

gigabyte (GB) ✓

Largest

terabyte (TB)

4/[4]

A B C D E F
9 10 11 12 13 14 15

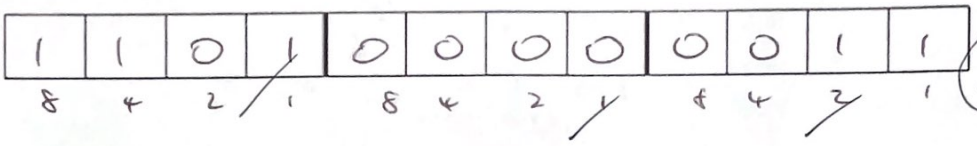
4)

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.



3/[3]

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 ✓

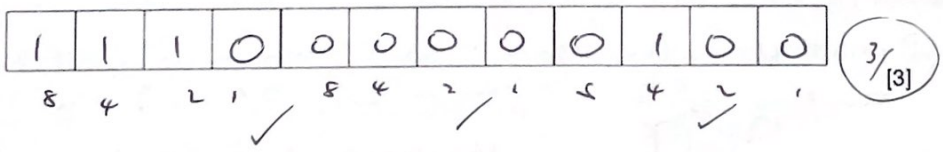
1/[1]

(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.



3/[3]

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

Hexadecimal is shorter, more concise, requires less storage space, easier to read and understand. ✓

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	.txt
Sound	.mp4
Video	~~data~~ .wav

3/[3]

7)

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

① Binary is base 2. denary is base 10.

② Binary has 2 values. denary has 10 values (0 or 1) (0,1,2,3,4,5,6,7,8,9).

③ ~~Bin~~ Binary unit goes up in powers of 2. denary unit go up in power of 10.

4/[4]

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

① Write down the value of each place value. consider the power of 2: (start from $2^0 = 1$, at the right-most side)

place values: 8 (1) 4 (0) 2 (1) 1 (0)

(2^3 2^2 2^1 2^0)

② Identify the values with a 1, which show that they are included in the total (or ~~off~~, instead of off)

$(1\times8 + 1\times2 + 0\times4 + 0\times1 = 8+2)$

③ Add these values up: 8 + 2 = 10 (in denary)

∴ 1010 (base 2) = 10 (base 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	15	F
DOWN	0	0	0	1	1	1
LEFT	1	0	0	1	9	9
RIGHT	0	1	1	0	6	6
OPEN	1	1	0	0	12	C
CLOSE	0	0	1	1	3	3
	8	4	2	1		

A 10
B 11
C 12

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.

57 = 32+16+8+1 ✓1

1 1 1 0 0 1
32 16 8 4 2 1

111001 ✓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 ✓1

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

Register 2 ✓1 ✓1

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 Data ✓ ½

Use 2 Number / character ✓ ½ V. similar

1/[2]

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

0	0	1	1	1	0	1	0

3 10

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

A 10
B 11
C 12
D 13
E 14
F 15

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
	8	4	2	1	8	4	2	1

6/[6]

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

① Media Access Control address. ✓

② ~~Every~~ device has one which is unique to ~~it~~ it ✓

③ Manufacturer sets it. ✓

④ Two parts - manufacturer number first, then the serial number ✓

4/[4]

11)

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

Example 1 ...HEX colour codes (RGB)... ✓

Example 2 ...IP Addresses... ✓

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.

① An algorithm compresses this file without removing any data permanently (the data can be recovered). ✓ 1

② The text is indexed (tabulated) ✓ 1

③ Repeated words/letters are stored as one index in the table ✓ 1

④ Each index is assigned a word/letter and as well as the number of times that word/letter occurs in the file ✓ 1

⑤ This is good for text files (we don't want the file to lose letters by lossy compression and be unreadable) ✓ 1

5/[5]