YEAR: MAY/JUNE 2015

Q 1 An alarm clock is controlled by a microprocessor. It uses the 24 hour clock. The hour is represented by an 8-bit register, **A**, and the number of minutes is represented by another 8-bit register, **B**.

(a) Identify what time is represented by the following two 8-bit registers.

A									B								
128	64	32	16	8	4	2	1		128	64	32	16	8	4	2	1
0	0	0	1	0	0	1	0	:	0	0	1	1	0	1	0	1

Hours ..... Minutes .....

[2]

(b) An alarm has been set for 07:30. Two 8-bit registers, **C** and **D**, are used to represent the hours and minutes of the alarm time.

Show how 07:30 would be represented by these two registers:

C									D							
								:								
Hours									Minutes							

[2]

(c) Describe how the microprocessor can determine when to sound the clock alarm.

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.....

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.....

.....

.....[3]

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Q 2 Draw a line to connect each question to the correct answer.

Question	Answer
What is the denary (base 10) equivalent to the hexadecimal digit **E**?	8
If 1 GB = 2^X then what is the value of X?	12
How many bits are there in one byte?	14
If the broadband data download rate is 40 megabits per second, how many seconds will it take to download a 60 MB file?	19
What is the denary (base 10) value of the binary number 0 0 1 0 0 1 0 0 ?	30
What hexadecimal value is obtained when the two hexadecimal digits **C** and **D** are added together?	36

[6]

Q 3 Give the denary (base 10) value of the byte: **1 0 1 1 1 1 1 0**

.....

.....[1]

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Q 4 Letters from the alphabet are represented in a computer by the following denary (base 10) values:

A = 97
G = 103
I = 105
L = 108
N = 110

The word "**A L I G N**" is stored as: 97 108 105 103 110

(a) Convert each of the five values to binary. The first one has been done for you.

Letter	Denary value							
A (97):	0	1	1	0	0	0	0	1
L (108):								
I (105):								
G (103):								
N (110):								

(b) An encryption system works by shifting the binary value for a letter one place to the left. "A" then becomes:

1	1	0	0	0	0	1	0

This binary value is then converted to hexadecimal; the hexadecimal value for "A" will be:

C 2

For the two letters "L" and "G", shift the binary values one place to the left and convert these values into hexadecimal:

									hexadecimal
L:									.....
G:									.....

[4]

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Q 5 The barcode in **part (a)** contains the denary value 2 6 4 0

Convert this value to hexadecimal.

.....

.....

Write the value as a 12-bit binary number.

4 A F

[3]

The 2016 Olympic Games will be held in Rio de Janeiro. A timer that counts down to the opening of the Games is shown on a microprocessor-controlled display.

The number of hours, minutes and seconds until the Games open are held in three 8-bit registers.

The present register values are:

0	1	1	0	1	0	0	1	105 hours
0	0	1	0	0	0	0	0	32 minutes
0	0	0	1	0	1	0	0	20 seconds

The timer will count **down** in seconds.

(i) Show the values in each 8-bit register **30 seconds** after the time shown above:

								hours
								minutes
								seconds

[3]

(ii) Write the hexadecimal value of the **minutes** register from **part (b)(i)**.

.....[1]

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Q 6 Each seat on a flight is uniquely identified on an LCD above the seat. For example, seat 035C is shown as:

The first three characters are digits that represent the row.
The fourth character is the seat position in that row. This is a single letter, A to F, that is stored as a hexadecimal value.

Each of the four display characters can be stored in a 4-bit register. For example, 0 and C would be represented as:

	8	4	2	1
0:	**0**	**0**	**0**	**0**
C:	**1**	**1**	**0**	**0**

Show how the 4-bit registers would store the remaining two characters, 3 and 5.

3 | | | | |

5 | | | | |

Identify which seat is stored in the following 4-bit registers.

0	0	0	1	→ .....
1	0	0	1	→ .....
0	1	0	0	→ .....
1	1	1	0	→ .....

[6]

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Q 7

In the following barcode, each binary number is made up of seven bars.

Each bar is black or grey.

A black bar is interpreted as a "1" and a grey bar is interpreted as a "0".

(a) Write the binary numbers that would be produced from this barcode:

Binary number A **Binary number B**

Binary number A:

Binary number B:

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Q 8 A computer uses an 8-bit register.

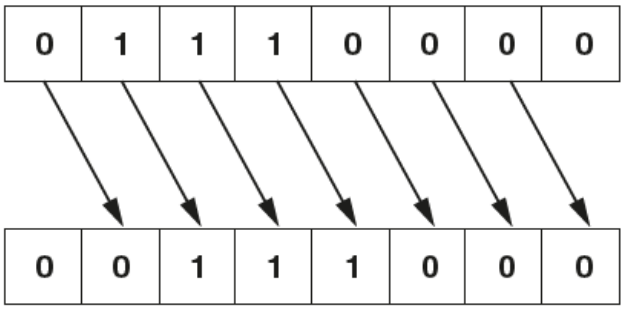
The 8-bit register contains binary integers.

(a) Write the denary (base 10) value represented by:

128	64	32	16	8	4	2	1
0	1	1	1	0	0	0	0

.....[1]

(b) All the bits in the register are shifted **one** place to the **right** as shown below.



Write the denary number that is represented after this shift.

.....[1]

(c) State the effect the shift to the right had on the original denary number from **part (a)**.

.....[1]

(d) The original number in **part (a)** is shifted **three** places to the **right**.

(i) Show the new binary number:

[1]

(ii) Write the equivalent denary number.

.....[1]

OCT/NOV 2016

Q 9 Describe the problems that could be caused if the original binary number in **part (a)** is shifted **five** places to the **right**.

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.....[2]

A security system is installed in a house. A hexadecimal number is entered to activate or deactivate the alarm.

(a) The alarm code is set to hexadecimal number **2 A F**

Show how this number would be stored in a 12-bit binary register.

[3]

(a) A manufacturer of aeroplane engines assigns a denary identification number (ID) to each engine.

One engine has the ID: 0431

(i) Convert this denary number to a 12-bit binary format.

[2]

(ii) Show how this number would be represented in hexadecimal.

.....

.....

[3]

OCT/NOV 2016

Q 10 A register in a computer contains binary digits.

0	0	1	1	1	0	1	0

The contents of the register represent a binary integer.

Convert the binary integer to hexadecimal.

.....

.....[1]

Q 11 Hexadecimal codes are used in MAC addresses.

(a) State what is meant by the term MAC.

.....[1]

(b) Explain what the hexadecimal code in a MAC address represents.

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.....[3]

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Q 12 Explain why a programmer might prefer to read the instruction in hexadecimal rather than in binary.

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..... [2]

Give **two** other uses of hexadecimal.

Use 1 .....

.....

Use 2 .....

Q 13 **(a)** The denary number 57 is to be stored in two different computer registers.

Convert 57 from denary to binary and show your working.

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.....[2]

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


Register 1


Register 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 .....

Use 2 .....

[2]