2210

O-LEVELS

COMPUTER SCIENCE

TOPICALS

PAPER - 1 : NEW SYLLABUS

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SECTION 1 COMPUTER SYSTEMS

1. Data representation

2. Data transmission

3. Hardware

4. Software

5. The internet and its uses

6. Automated and emerging technologies

SECTION 2 ALGORITHMS, PROGRAMMING AND LOGIC

7. Algorithm design and problem solving

8. Programming

9. Databases

10. Boolean Logic

1.1. Number Systems

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

.....

.....[1]

2. 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

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):								

[2]

3. 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]

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

0	3	F	C

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

[2]

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**

→ _____

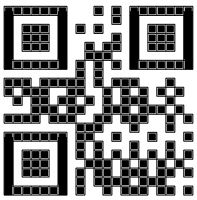
→ _____

→ _____

→ _____

[2]

5. (a) Name the following type of barcode:



.....[1]

(b) 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]

6 (a) Convert the following hexadecimal number into 12-bit binary:

4 A F

[3]

6(b) 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.

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

								hours

								minutes

								seconds

[3]

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

.....[1]

7. The memory of a computer contains data and instructions in binary.

The following instruction is stored in a location of the memory.

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

Convert the instruction into hexadecimal.

.....

.....

..... [2]

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

.....

.....

.....

..... [2]

9. Give **two** other uses of hexadecimal.

Use 1 .....

.....

Use 2 .....

.....

[2]

10 (a) The denary number 57 is to be stored in two different computer registers. Convert 57 from denary to binary and show your working.

.....

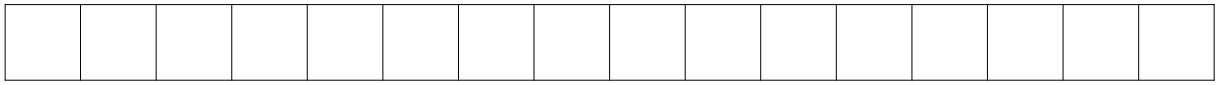
.....

.....

.....[2]

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

Register 1



Register 2

[2]

12. 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]

13. 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]

14. Jane answers an examination question about computers and data correctly.

Six different words or numbers have been removed from her answer.

Complete the sentences in Jane's answer, using the list given. Not all items in the list need to be used.

2
10
16
analogue
binary
denary
digital
hexadecimal

As humans, we process …… data, but a computer cannot

process this type of data. For a computer to be able to process data it needs to be

converted to …… data.

As humans, we mostly use a …… number system;

this is a base …… number system.

Computers use a …… number system;

this is a base …… number system.

[6]

15. Dheeraj identifies **three** hexadecimal numbers.

Write the **denary** number for each of the three hexadecimal numbers:

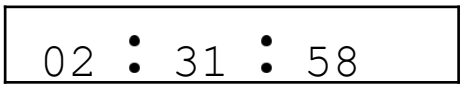
2A .....

101 .....

21E .....

[3]

16. A stopwatch uses six digits to display hours, minutes and seconds. The stopwatch is stopped at:



Hours **Minutes** **Seconds**

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

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

Hours

Minutes

Seconds

[3]

17. 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

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

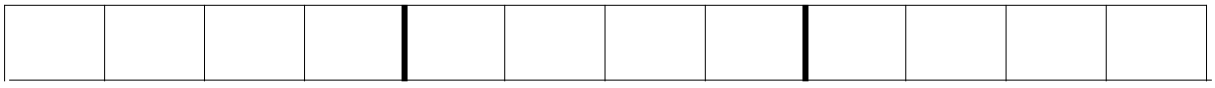
Hours Minutes Seconds

[3]

18. 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]

19. Convert the denary number 107 to binary.

..... [1]

Represent the denary number 300 as it would be stored in a 12-bit binary register.

..... [2]

Convert the denary number 179 to hexadecimal.

..... [2]

20. Characters can be represented in a computer by a numerical code.

The following list shows 16 characters with their numerical codes in denary:

a = 97	e = 101	k = 107	t = 116
b = 98	g = 103	m = 109	u = 117
c = 99	h = 104	o = 111	w = 119
d = 100	i = 105	r = 114	

. = 46 (code for the full stop)

Web addresses can be written using hexadecimal rather than denary. Hexadecimal codes are preceded by a % sign. For example, the word "**c a g e**" is written as:

either	99	97	103	101	(in denary)
or	%63	%61	%67	%65	(in hexadecimal)

Complete the conversion of the following web address into hexadecimal:

w	**w**	**w**	**.**	**c**	**i**	**e**	**.**	**o**	**r**	**g**	**.**	**u**	**k**
%77	%77	%77											

[3]

Complete the web address from the given hexadecimal codes:

%77	**%77**	**%77**	**%2E**	**%72**	**%6F**	**%63**	**%6B**	**%69**	**%63**	**%74**	**%2E**	**%63**	**%6F**	**%6D**
W	W	W												

[3]

21.A computer uses an 8-bit register.

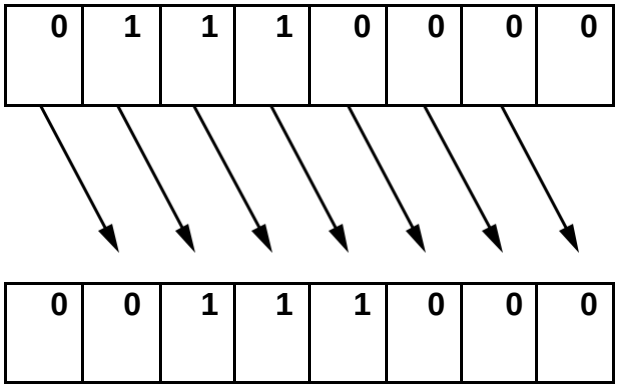
The 8-bit register contains binary integers.

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]

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]

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

.....[1]

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

Show the new binary number:

[1]

Write the equivalent denary number.

.....[1]

22. 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
DOWN	0 0 0 1
LEFT	1 0 0 1
RIGHT	0 1 1 0
OPEN	1 1 0 0
CLOSE	0 0 1 1

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 .....

1 .....

C .....

3 .....

F .....

[5]

23. Give the **12-bit binary** value of the denary value **250**.

..... [1]

Working space

.....

.....

.....

.....

24. Binary can be represented as hexadecimal to make it easier to read. Give the

hexadecimal values of the 8-bit binary values:

10010011 .....

00011101 .....

[2]

25. Using two's complement, show how the following denary numbers could be stored in an 8-bit register:

114

- 93

[2]