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# O-LEVELS COMPUTER SCIENCE TOPICALS PAPER - 1 : NEW SYLLABUS

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# 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 "ALIGN" 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							
<b>A (97):</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>
<b>L (108):</b>								
<b>I (105):</b>								
<b>G (103):</b>								
<b>N (110):</b>								

[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**

<b>L:</b>											
<b>G:</b>											

[4]

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

<b>0</b>	<b>3</b>	<b>F</b>	<b>C</b>
----------	----------	----------	----------

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]

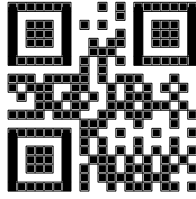
Identify which seat is stored in the following 4-bit registers.

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.

.....

.....

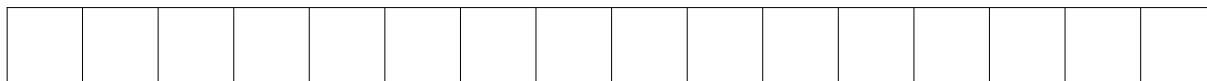
.....

.....[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.

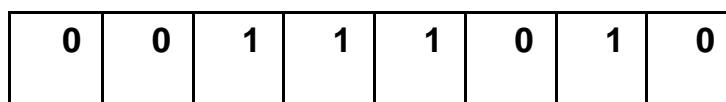
Give **two** other uses for a binary number stored in a register.

Use 1 .....

Use 2 .....

[2]

13. A register in a computer contains binary digits.



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:

0	2	:	3	1	:	5	8
---	---	---	---	---	---	---	---

**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:

<b>w</b>	<b>w</b>	<b>w</b>	<b>.</b>	<b>c</b>	<b>i</b>	<b>e</b>	<b>.</b>	<b>o</b>	<b>r</b>	<b>g</b>	<b>.</b>	<b>u</b>	<b>k</b>
%??	%??	%??											

[3]

Complete the web address from the given hexadecimal codes:

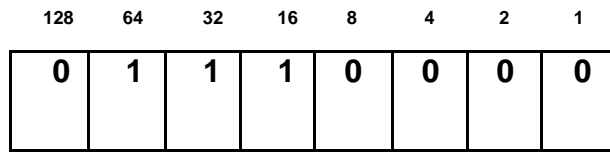
<b>%??</b>	<b>%??</b>	<b>%??</b>	<b>%2E</b>	<b>%72</b>	<b>%6F</b>	<b>%63</b>	<b>%6B</b>	<b>%69</b>	<b>%63</b>	<b>%74</b>	<b>%2E</b>	<b>%63</b>	<b>%6F</b>	<b>%6D</b>
W	W	W												

[3]

21.A computer uses an 8-bit register.

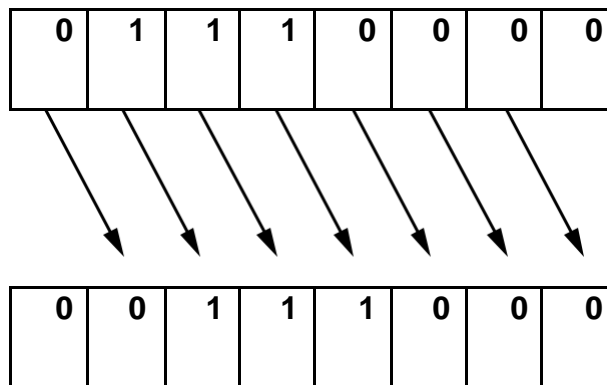
The 8-bit register contains binary integers.

Write the denary (base 10) value represented by:



.....[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.

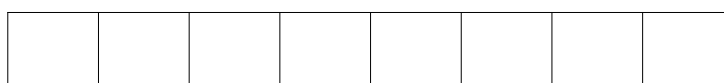
.....[1]

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	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> </tr> </table>	1	1	1	1
1	1	1	1		
DOWN	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> </tr> </table>	0	0	0	1
0	0	0	1		
LEFT	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> </tr> </table>	1	0	0	1
1	0	0	1		
RIGHT	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> </tr> </table>	0	1	1	0
0	1	1	0		
OPEN	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> </table>	1	1	0	0
1	1	0	0		
CLOSE	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> </tr> </table>	0	0	1	1
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 .....

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]