

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
AS LEVEL**

**H046/01**

**COMPUTER SCIENCE**

**Computing Principles**

**MONDAY 5 JUNE 2017: Morning**

**TIME ALLOWED: 1 hour 15 minutes  
plus your additional time allowance**

**MODIFIED ENLARGED**

<b>First name</b>		<b>Last name</b>	
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<b>Centre number</b>						<b>Candidate number</b>				
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**DO NOT USE:  
a calculator**

**READ INSTRUCTIONS OVERLEAF**



## **INSTRUCTIONS**

**Use black ink.**

**Complete the boxes on the front page with your name, centre number and candidate number.**

**Answer ALL the questions.**

**Write your answer to each question in the space provided.**

**Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).**

## **INFORMATION**

**The total mark for this paper is 70.**

**The marks for each question are shown in brackets [ ].**

**Quality of extended responses will be assessed in questions marked with an asterisk (\*).**

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**Answer ALL the questions.**

**1 (a) Processors following the Von Neumann Architecture use registers.**

**(i) Describe what is meant by the term 'register'.**

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[2]

**(ii) Give ONE other feature of the Von Neumann Architecture.**

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[1]

**(b) An example of a register is the Accumulator (ACC).**

**Give a Little Man Computer instruction that will copy the contents of the accumulator into memory when executed.**

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[1]

**(c) Another register is the Program Counter (PC).**

**(i) State what the Program Counter holds.**

\_\_\_\_\_  
\_\_\_\_\_ **[1]**

**(ii) Give the name of TWO Little Man Computer instructions that may change the contents of the Program Counter when executed.**

**1** \_\_\_\_\_  
**2** \_\_\_\_\_ **[2]**

**2\* A student, Dan, on a limited budget finds his computer is running slowly. He uses his computer for university work and internet browsing.**

**Discuss what measures can be taken to improve Dan's computer's performance. You should explain what these measures are, why they improve the performance and justify whether you would recommend them. [9]**

[illegible]

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3 The following JavaScript has been found to crash certain web browsers.

Line	Code
1	<code>var total = "";</code>
2	<code>for(var j = 0; j &lt; 200000; j++)</code>
3	<code>{</code>
4	<code>total = total + j.toString();</code>
5	<code>history.pushState(0,0, total);</code>
6	<code>}</code>

`j.toString()` converts `j` to a string. It is the JavaScript equivalent to `str(j)`.

(a) Complete the table below.

Line	Effect of Code
1	
2	
3	
4	
5	Pushes <code>total</code> onto a stack that holds the browser's history.
6	

[2]

[1]

[1]



**(b) Line 5 pushes `total` onto a stack. Define the term stack, stating why it is suited to holding a web browser's history.**

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**[2]**

#### **4 A delivery company sends parcels across the UK.**

**(a) The company charges on the following basis:**

- **Parcels that have a volume of less than  $0.3\text{ m}^3$  and weigh less than 4 kg cost £5 to send.**
- **All other parcels cost £20 per  $\text{m}^3$  or £2 per kg, whichever is greater.**

#### **Examples**

**Parcel A weighs 2.5 kg, has a volume of  $0.1\text{ m}^3$  and costs £5 to send.**

**Parcel B weighs 6 kg, has a volume of  $0.2\text{ m}^3$  and costs £12 to send.**

**Parcel C weighs 6 kg, has a volume of  $0.8\text{ m}^3$  and costs £16 to send.**

**The function `getCost` takes in the `volume` and `weight` of a parcel and returns the cost.**

**`getCost(2.5, 0.1)` returns 5**

**`getCost(6, 0.2)` returns 12**

**`getCost(6, 0.8)` returns 16**

**Complete the pseudo-code below so that the function `getCost` returns the correct cost.**

```
function getCost(weight, volume)
```

[illegible]

endfunction

[4]

- (b) Details of customers sending parcels are stored in a database. The database contains a table called `parcel` and a table called `customer`.**

**Draw an entity relationship diagram showing the `parcel` and `customer` tables. [2]**

- (c) To prove parcels have not been damaged in transit, the delivery drivers use a digital camera to take a photograph of them when they arrive at their destination. The digital camera uses flash memory.**

- (i) Describe ONE advantage of the digital camera using flash storage rather than magnetic.**

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[2]

**(ii) Explain whether lossless or lossy compression would be most appropriate to store the photographs. Justify your response.**

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**[3]**

- 5 (a) Convert the binary number 01101111 to a hexadecimal number.

\_\_\_\_\_ [1]  
\_\_\_\_\_

- (b) Convert the denary number -19 to an 8-bit number using:

- (i) Two's complement representation.

\_\_\_\_\_ [1]  
\_\_\_\_\_

- (ii) Sign and Magnitude representation.

\_\_\_\_\_ [1]  
\_\_\_\_\_

- (c) The two values below are stored using unsigned binary. Calculate the subtraction of 01110010 from 11000011. Show your working.

11000011  
01110010 -

\_\_\_\_\_

[2]

- (d) Convert the denary number  $1\frac{5}{8}$  (i.e. 1.625) to a normalised floating point binary number using 5 bits for the mantissa and 3 bits for the exponent. Show your working.

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[3]

6 (a) Draw an XOR gate.

[1]

(b) Explain the difference in the function of OR and XOR gates.

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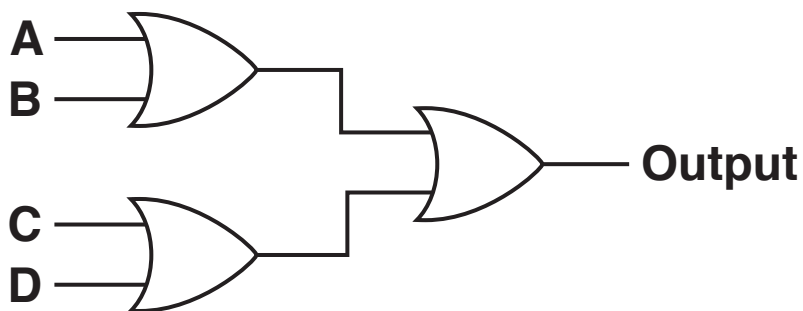
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[2]

(c) A circuit contains the logic gates shown below.





(i) Complete the logic table below. [4]

A	B	C	D	Output
1	1	1	1	
1	1	1	0	
1	1	0	1	
1	1	0	0	
1	0	1	1	
1	0	1	0	
1	0	0	1	
1	0	0	0	
0	1	1	1	
0	1	1	0	
0	1	0	1	
0	1	0	0	
0	0	1	1	
0	0	1	0	
0	0	0	1	
0	0	0	0	

(ii) Complete the Boolean expression below to represent the circuit.

\_\_\_\_\_  $\equiv$  Output [2]

- 7 A company releases an Internet connected fridge. Users can email messages to the fridge and it puts them on its display.**

**(a) The fridge uses the TCP/IP stack.**

**Explain what is meant by the term ‘TCP/IP stack’.**

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**[3]**

**(b) The fridge uses the ASCII character set. Give ONE disadvantage of the fridge using ASCII rather than Unicode.**

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**[1]**

When the fridge receives a message it takes the string and stores it in a queue called words.

For example REMEMBER TO TAKE CHARLIE TO THE DENTIST THIS AFTERNOON becomes a queue:

```
words= [ "REMEMBER" , "TO" , "TAKE" , "CHARLIE" ,  
"TO" , "THE" , "DENTIST" , "THIS" , "AFTERNOON" ]
```

words.remove() then returns the next item in the queue

for example temp=words.remove() assigns temp the value "REMEMBER" and leaves words as [ "TO" , "TAKE" , "CHARLIE" , "TO" , "THE" , "DENTIST" , "THIS" , "AFTERNOON" ]

The display has four lines; each can show a maximum of 20 characters including spaces.

If a word can't fit on a line a new line is started.

## Examples

R	E	M	E	M	B	E	R		T	O		T	A	K	E				
C	H	A	R	L	I	E			T	O		T	H	E					
D	E	N	T	I	S	T			T	H	I	S							
A	F	T	E	R	N	O	O	N											

G	E	T		S	O	M	E		M	O	R	E							
C	H	O	C	O	L	A	T	E		P	L	E	A	S	E				

The contents of the display are stored in a 2D array of characters called `display`.

The procedure `updateDisplay` receives the queue `words` which holds the message and writes the message to the display.

(c) Write the procedure `updateDisplay`. Credit will be given for the readability of your code.

You can assume:

- Messages contain no punctuation.
- All messages will fit on the display.
- The previous message is removed before the procedure is run.

```
global array display[20,4]
```

```
...
```

```
...
```

```
...
```

```
procedure updateDisplay(words) [7]
```

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**endprocedure**

[illegible]

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**END OF QUESTION PAPER**

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