

**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 24pt

First name		Last name	
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Centre number						Candidate number				
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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'.

[2]

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

[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.

[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]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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

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

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 total 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.

[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 m^3 and weigh less than 4 kg cost £5 to send.**
- **All other parcels cost £20 per m^3 or £2 per kg, whichever is greater.**

Examples

Parcel A weighs 2.5 kg, has a volume of 0.1 m^3 and costs £5 to send.

Parcel B weighs 6 kg, has a volume of 0.2 m^3 and costs £12 to send.

Parcel C weighs 6 kg, has a volume of 0.8 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)
```

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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.**

[2]

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

[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.

[3]

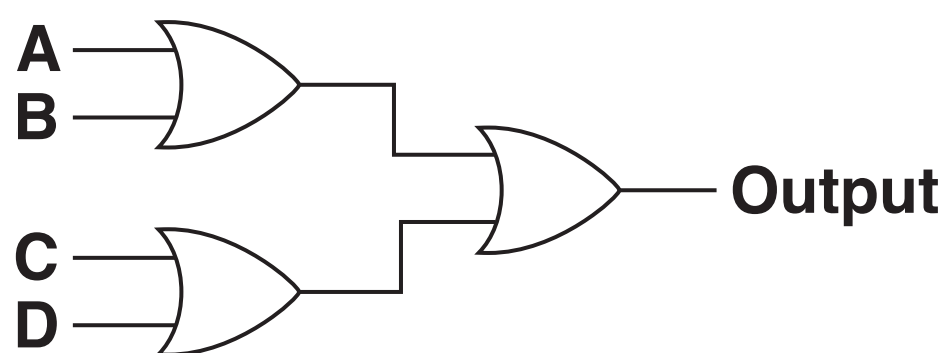
6 (a) Draw an XOR gate.

[1]

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

[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’.

[3]

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

[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]

END OF QUESTION PAPER

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