



Oxford Cambridge and RSA

# AS Level Computer Science

## H046/01 Computing Principles

### Monday 5 June 2017 – Morning

### Time allowed: 1 hour 15 minutes



**Do not use:**

- a calculator



First name										
Last name										
Centre number						Candidate number				

#### INSTRUCTIONS

- Use black ink.
- Complete the boxes above 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).
- Do **not** write in the barcodes.

#### 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 (\*).
- This document consists of **16** pages.

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]



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 <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.

.....

.....

.....

..... [2]



- (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.

$$\begin{array}{r} 11000011 \\ - 01110010 \\ \hline \\ \hline \end{array}$$

[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.

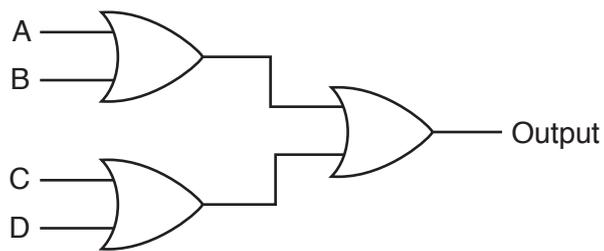
.....

.....

.....

..... [2]

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



(i) Complete the logic table below.

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	

[4]

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

.....  $\equiv$  Output

[2]

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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.





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