OCR
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'.

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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.

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..... **[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.

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..... **[9]**

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.

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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 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)
    .....
    .....
    .....
    .....
    .....
    .....
    .....
    .....
    .....
    .....
    .....
    .....
    .....
    .....
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.

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..... **[1]**

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

(i) Two's complement representation.

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..... **[1]**

(ii) Sign and Magnitude representation.

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..... **[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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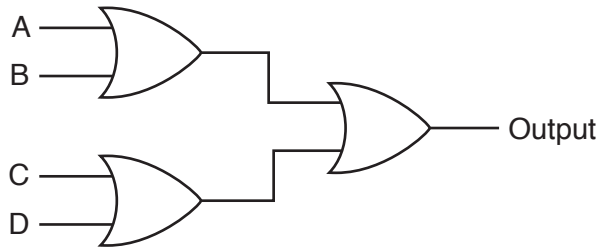
..... **[2]**

(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.

..... ≡ Output

[2]

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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]
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…
procedure updateDisplay(words)
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```
endprocedure
```

[7]

8* Many websites try to ensure they are accessible to all visitors regardless of disability, language spoken or the device being used to access it. Discuss the technical and design measures that can be taken to ensure a website is accessible.

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