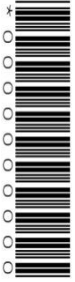


A Level Computer Science

H446/01 Computer systems

Practice paper - Set 1

Time allowed: 2 hours 30 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.
- If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION

- The total mark for this paper is **140**.
- 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 **24** pages.

Answer **all** the questions.

1 A company releases a utility called RAMStore. The utility creates a virtual storage drive from an area of the computer's RAM.

(a) Describe what is meant by the term utility software.

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..... [2]

(b) Give **one** advantage of using RAM as storage in this way.

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..... [1]

(c) The utility periodically copies what is in the RAM drive to secondary storage, such as a hard disk. Explain why this is necessary.

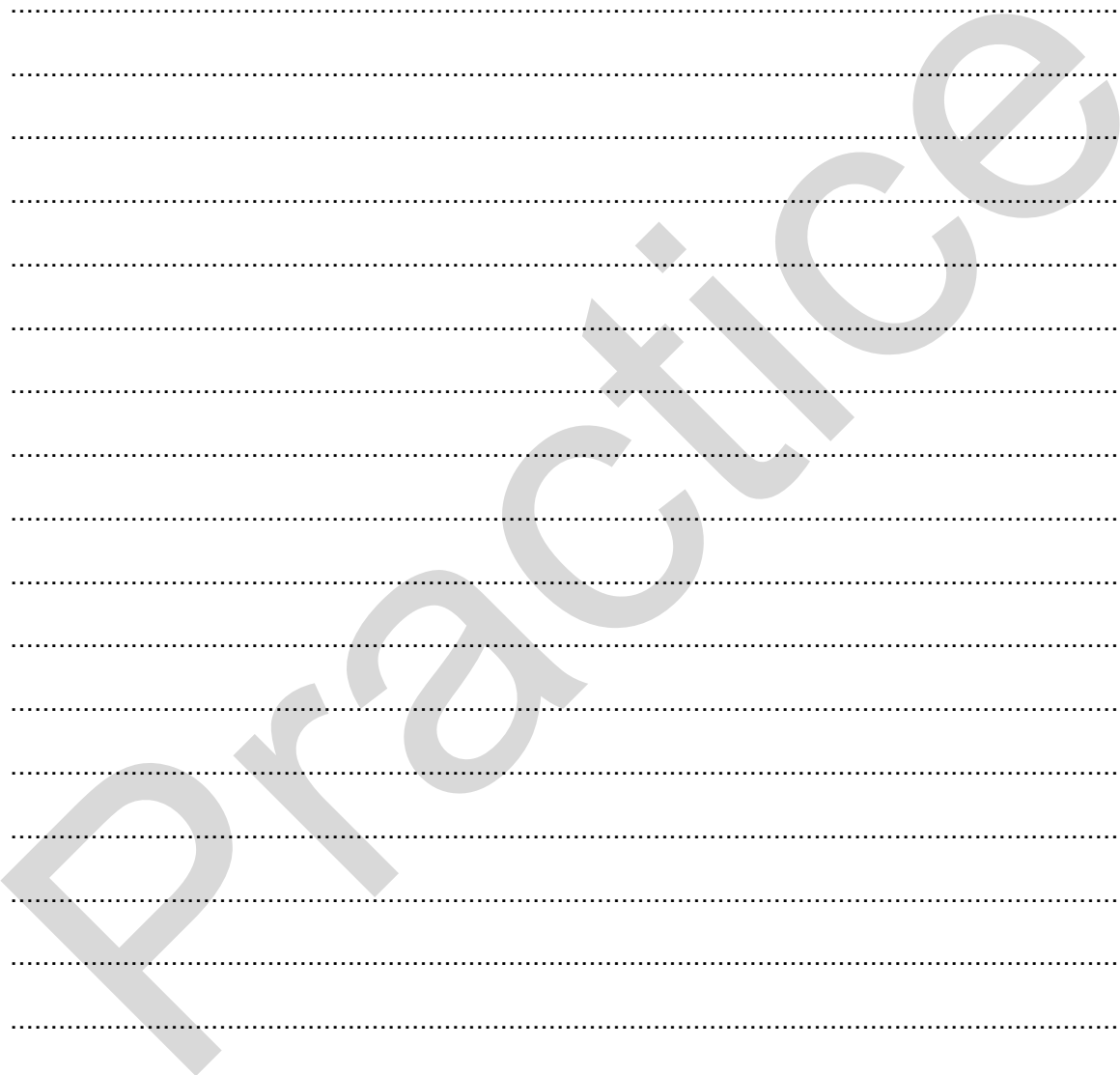
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..... [2]

(d) It is important that enough RAM is left for the operating system to use. Describe a technique that allows operating systems to overcome a lack of available RAM.

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..... [4]

- 2 * Modern computers tend to have magnetic or solid state (flash) hard drives. Discuss which hard drive you would recommend for a keen video games player to use on their desktop PC.

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3 (a) Convert the unsigned binary number 11110000 to:

(i) Denary:

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 [1]

(ii) Hexadecimal:

.....

 [1]

(b) An AND operation with the mask 10101010 is applied to the binary number 01010101. Show the result.

01010101

10101010 AND

[1]

(c) An OR operation with the mask 10101010 is applied to the binary number 01010101. Show the result.

01010101

10101010 OR

[1]

(d) 00001100 is shifted two places to the left.

(i) Show the result.

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..... [1]

(ii) Identify what arithmetic operation this shift is equivalent to.

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..... [1]

(e) Convert the denary number -8 to:

(i) An 8-bit sign and magnitude binary number.

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..... [1]

(ii) An 8-bit two's complement binary number.

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..... [1]

4 Below are extracts from the ASCII and EBCDIC character sets.

ASCII

Denary Value	65	66	67	68	69	70	71	72	73	74	75	76	77
Character	A	B	C	D	E	F	G	H	I	J	K	L	M
Denary Value	78	79	80	81	82	83	84	85	86	87	88	89	90
Character	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

EBCDIC

Denary Value	193	194	195	196	197	198	199	200	201	...	209	210	211	212
Character	A	B	C	D	E	F	G	H	I	...	J	K	L	M
Denary Value	213	214	215	216	217	...	226	227	228	229	230	231	232	233
Character	N	O	P	Q	R	...	S	T	U	V	W	X	Y	Z

(a) Explain, referring to ASCII and EBCDIC, what would happen if computers were to use different character sets when communicating.

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[2]

(b) Write a function that given the denary value of an EBCDIC uppercase letter, returns the denary value of an ASCII uppercase letter. If a value is entered that doesn't correspond to an uppercase EBCDIC letter the function should return -1

e.g.

`convert(201)` returns 73

`convert(209)` returns 74

`convert(78)` returns -1

```
function convert(ebValue)
```

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```
endfunction
```

[5]

5 The following is a program written using the Little Man Computer instruction set.

```
start LDA one
      OUT
      LDA zero
      OUT
      LDA count
      SUB one
      STA count
      BRP start
      HLT
one   DAT 1
zero  DAT 0
count DAT 3
```

(a) Describe the difference between the STA and LDA instructions.

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..... [2]

(b) Identify the type of memory addressing the program uses.

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..... [1]

(c) State the output this program generates.

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..... [3]

- (b) Part of the program checks that the HTML tags are well formed. Well formed HTML has tags that are nested but never overlapping.

e.g.

`<p>The cat sat on the mat.</p>` is well formed.

Whereas `<p>The cat sat</p> on the mat.` is not well formed as `p` closes before the `strong` inside it has been closed.

All comments and single tags (e.g. `img`, `br` etc) are removed from `dataStructureA`. All attributes are removed from the within the tags.

- (i) The contents of `dataStructureA` may look similar to below:

<code><html></code>	<code><head></code>	<code><title></code>	<code></title></code>	<code></head></code>	<code><body></code>	<code><h1></code>	<code></h1></code>	<code></body></code>	<code></html></code>
---------------------------	---------------------------	----------------------------	-----------------------------	----------------------------	---------------------------	-------------------------	--------------------------	----------------------------	----------------------------

Tags are removed from `dataStructureA` in the same order they were added.

Identify what type of data structure `dataStructureA` is.

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 [1]

`dataStructureB` is given a closing tag and gives the corresponding opening tag.

e.g.

```
openingTag=dataStructureB.get("</head>")
```

openingTag is "<head>" (courier font)

- (ii) Identify what type of data structure `dataStructureB` is.

.....
 [1]

The following code is used to check if the tags are well formed.

```
function checkTags(dataStructureA)
{
    valid=true
    //loops while code is still valid
    //and dataStructureA has tags
    while valid==true and dataStructureA.isEmpty()==false
        tag=DataStructureA.remove()
        //Next, check if closing tag
        if tag.substring(1,1)=="/" then
            if dataStructureC.remove() !=dataStructureB.get(tag) then
                valid=false
            endif
        else
            dataStructureC.add(tag)
        endif
    endwhile
    return valid
}
```

(iii) Identify what type of data structure `dataStructureC` is.

.....
 [1]

(iv) Explain why `dataStructureC` is suited to checking if HTML is well formed.

.....

 [2]

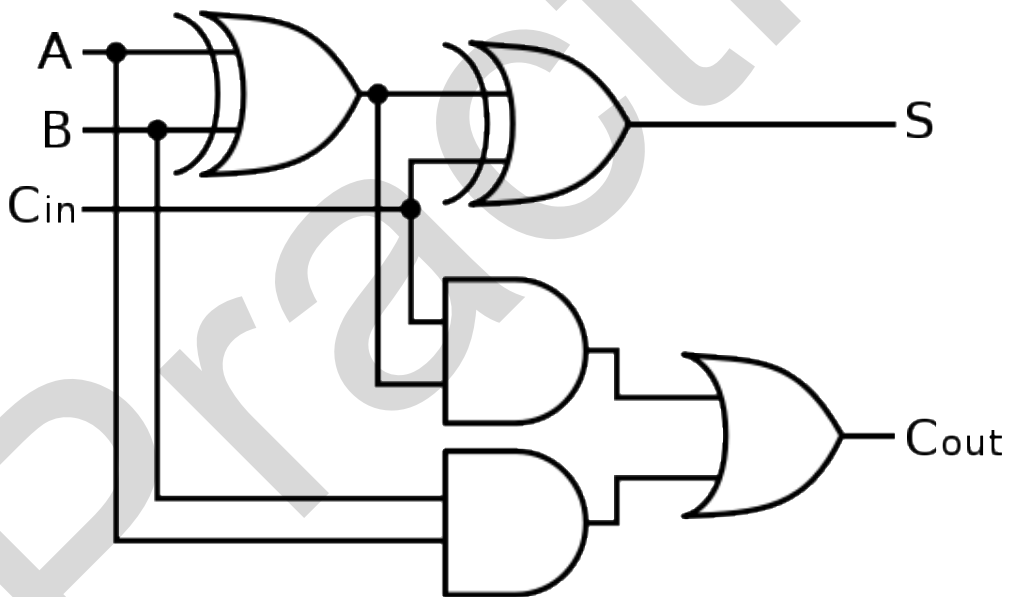
- 7 (a) An XOR gate is shown below. Complete the truth table for XOR.



A	B	Q
1	1	
1	0	
0	1	
0	0	

[2]

- (b) A set of logic gates are connected as below.



(i) Complete the Truth Table below:

A	B	C _{in}	S	C _{out}
1	1	1		
1	1	0		
1	0	1		
1	0	0		
0	1	1		
0	1	0		
0	0	1		
0	0	0		

[4]

(ii) Explain what the circuit does. You should refer to A, B, C_{in}, S and C_{out} in your answer.

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[4]

(c) (i) Write a Boolean expression equivalent to S.

[1]

$S \equiv$

(ii) Write a Boolean expression equivalent to C_{out}.

[2]

$C_{out} \equiv$

8 A database stores information about songs on a music streaming service.

One of the tables called `Song` has the fields.

`Title`, `Artist`, `Genre`, `Length`

(a) Explain why none of these fields would be suitable as a primary key.

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..... [2]

(b) Give **one** advantage and **one** disadvantage of indexing the field `Artist`.

Advantage

.....

Disadvantage

..... [2]

(c) Users can build up playlists of their songs. Another table is created called `Playlist`.

Explain why a third table which we shall call `PlaylistEntry` is needed. You should use an ER diagram to illustrate your answer.

[4]

(d) A band called *RandomBits* removes their permission for their songs to be streamed.

The company removes all the songs belonging to *RandomBits* from their service.

(i) Identify the law with which the company are complying.

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

(ii) Write an SQL statement that will remove all songs by *RandomBits* from the table *Song*.

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

(iii) When the songs have been removed, explain what must happen to the table *PlayListEntry* if the database is to retain its referential integrity. (You are not expected to write the SQL to do this).

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

Practice

10 A software development company is building an operating system for a mobile phone that is in the process of being designed.

(a) Give **one** reason the phone needs an operating system.

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..... [1]

(b) Explain how the developers could use virtual machines.

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..... [2]

(c) One of the developers is responsible for writing the code for what happens when the CPU receives an interrupt. Outline what the code must do.

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..... [6]

(d) The developers follow the waterfall lifecycle.

(i) List **three** stages of the waterfall lifecycle.

- 1.....
- 2.....
- 3..... [3]

(ii) Justify why the waterfall lifecycle is suited to the development of the operating system.

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-
- [2]

(iii) Give **one** disadvantage of using the waterfall lifecycle to develop the operating system.

-
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- [1]

Practice

11 A website has the following HTML code.

```
<html>
<head>
<title>My Stamp Collection - European Stamps</title>
</head>
<body>
<h1 style="font-family:Arial; color:darkGreen">United
Kingdom</h1>
<p>These are my stamps from the uk.</p>
<!-- Code A -->

<!-- Code B -->

</body>
</html>
```

the site's owner wants to add the photo UKstamps.jpg in place of the comment

```
<!-- Code A -->
```

(a) Write the code that should go in place of the comment `<!-- Code A -->`:

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..... [2]

(b) Where the comment `<!-- Code B -->` is, the site's owner wants to add the text:

Find out more about UK stamps

as a link to the UK Stamp Collectors Guild website which has the URL:

<http://ukstampcollectorsguild.co.uk>

Write the code that should go in place of the comment `<!-- Code B -->`

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..... [2]

(c) The site uses styling set out as attributes in tags rather than a linked CSS file.

(i) Give **one** disadvantage of this to the site's owner.

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..... [1]

(ii) Give **one** disadvantage of this to the site's visitors.

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

(d) The site needs a light green (web colour lightGreen) background.
Explain what change needs to be made to the current page in order to do this.

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..... [3]

(e) The site's owner notices that his site doesn't come up high in the results from a search engine that uses the PageRank algorithm. State what would affect his site's ranking.

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..... [2]

END OF QUESTION PAPER

