

A Level Computer Science

H446/01 Computer systems

Practice paper - Set 1

Time allowed: 2 hours 30 minutes



- a calculator	
First name	
Last name	
Centre number	Candidate number

INSTRUCTIONS

Do not use:

- 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

	ompany releases a utility called RAMStore. The utility creates a virtual storage drive from area of the computer's RAM.
(a)	Describe what is meant by the term utility software.
	[2
(b)	Give one advantage of using RAM as storage in this way.
	[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.
(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.
	[4

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		5 /			
•••••				 	
	.,		 	 	
	·····		 	 	

3	(a)	Con	vert the unsigned binary number 11110000 to:	
		(i)	Denary:	
				 .[1]
		(ii)	Hexadecimal:	
				 .[1]
	(b)	An A	AND operation with the mask 10101010 is applied to the binary number 01010101. w the result.	
		010	10101	
		1010	01010 AND	[1]
	(c)	An (Sho	OR operation with the mask 10101010 is applied to the binary number 01010101. w the result.	
		010	10101	
		1010	01010 OR	

[1]

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

(i)	Show the result.
	[1]
(ii)	Identify what arithmetic operation this shift is equivalent to.
	[1]
(e) Cor	nvert the denary number -8 to:
(i)	An 8-bit sign and magnitude binary number.
	[1]
(ii)	An 8-bit two's complement binary number.
	F43
	[1]

(f) A computer represents floating point binary numbers using a 6-bit mantissa and 4-bit exponent, both using two's complement.

Add the following three numbers together and give the answer in the format described. You must show your working.

10100 0010	
11000 0001	
00010 0010	
	••••

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

<u>ASCII</u>

Denary Value	65	66	67	68	69	70	71	72	73	74	75	76	77
Character	Α	В	C	Д	Е	F	G	Η	_	7	K	L	М
Denary Value	78	79	80	81	82	83	84	85	86	87	88	89	90
Character	Ν	0	Р	Q	R	S	Т	U	٧	W	Х	Υ	Z

EBCDIC

Denary Value	193	194	195	196	197	198	199	200	201	·	209	210	211	212
Character	Α	В	O	ם	Е	H	G	Н		·	{ J	K	J	М
Denary Value	213	214	215	216	217		226	227	228	229	230	231	232	233
Character	N	0	Р	Q	R		S	Т	C	٧	W	Х	Υ	Z

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

(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)
	endfunction

[5]

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

5

star	rt LDA	one				
	OUT					
	LDA	zero				
	OUT LDA	count				
	SUB	one				
	STA	count				
	BRP	start				
	HLT					
one	DAT	1				
zero	DAT	0				
cour	nt DAT	3				
(a) D	occribo th	e difference betw	oon the CITY	and I Da	inetructions	
(a) D	escribe un	e dilierence betw		A allu LDA	ii isti uctioi is.	
••						
						 [2]
(1-) 1-	l = .= 4: £ . 4!= =		4			
(a) 10	ientity the	type of memory a	addressing t	ne program	ı uses.	
••						
						 [1]
(-) O	4-4-41					
(c) S	tate the ot	utput this program	i generates.	•		
••		,				 · • • • • • • • • • • • • • • • • • • •
						[31

(d)	Explain the buses and registers used when the line SUB one is executed.
	[5]
(e)	Explain, giving an example, how pipelining in a CPU could speed up the execution of this program.
	[3]
(f)	Describe one issue the line BRP start may cause for a CPU using pipelining.
	[2]
(g)	Pipelining is one factor that affects the performance of a CPU. Identify one other factor.

6	A company	is writing a	syntax	checker	to be us	sed when	writing H	ΓML.

(a)	The first thing the program does is add every tag in a piece of text to the data structure	re
	lataStructureA.	

The string ${\tt X}$ is added to ${\tt dataStructureA}$ with the code

dataStructureA.add("X")

The string type variable htmlCode holds the code that is to have its tags added.

If htmlCode were to contain:

<html><head><title>My Page</title></head><body>Hello</body></html>

dataStructureA would have the following contents:

<html></html>	<head></head>	<title></td><td></title>		<body></body>			

Write the code to fill dataStructureA with the tags in htmlCode.
[7]

(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.

The cat sat on the mat. is well formed.

Whereas The cat sat 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:

<	<html></html>	<head></head>	<title></th><th></title>		<body></body>	<h1></h1>				

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

Identify what type of data structure dataStructureA is.

[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.

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]
```

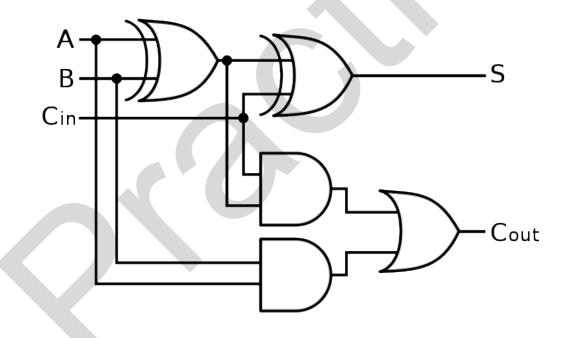
7 (a) An XOR gate is shown below. Complete the truth table for XOR.



Α	В	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	В	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. answer.	You should refer to A,B, C _{in} , S and C _{out} in your	
				[4]
				•
(c)	(i)	Write a Boolean expression e	quivalent to S.	[1]
		S≡		
		J =		
	(ii)	Write a Boolean expression e	equivalent to C _{out} .	[2]
		C _{out} ≡		
		- out		

8

A da	database stores information about songs on a music streaming service.						
One	One of the tables called Song has the fields.						
Tit	Title, Artist, Genre, Length						
(a)	Explain why none of these fields would be suitable as a primary key.						
		[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.

(d) A band called <i>RandomBits</i> 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 <i>RandomBits</i> from the table song.					
	(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).					
		[1]					

Discuss th	e extent to wh	ich you agr	ee with this	statemen	t.		
						·	
							ı

10 A software development company is building an operating system for a mobile phone the process of being designed.						
	(a)	Give one reason the phone needs an operating system.				
		[1]				
	(b)	Explain how the developers could use virtual machines.				
		[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.				
		[6]				

(d)	The	e 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.	
			[2]
	(iii)	Give one disadvantage of using the waterfall lifecycle to develop the operating system.	
			[1]

* The code is written using an object-oriented programming (OOP) language. Discuss the advantages and disadvantages to the team of developers of using OOP over procedural programming. You should refer to inheritance, encapsulation and polymorphism in your answer.

A website has the following HTML code.

	<html></html>
	<pre><head> <pre></pre> <pre></pre> <pre></pre> <pre>Callegtion</pre> <pre>European</pre> <pre>Champa</pre> <pre>/title></pre></head></pre>
	<title>My Stamp Collection - European Stamps</title>
	<body></body>
	<pre><h1 style="font-family:Arial; color:darkGreen">United</h1></pre>
	Kingdom
	$\protect\$ These are my stamps from the uk. $\protect\$
	Code A
	Code B
	(/hadii)
	V/ Heliti
	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 :
	[2]
(h)	Where the comment Code B is, the site's owner wants to add the text:
(D)	where the comment view code is> 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
	[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.
		[1]
	(ii)	Give one disadvantage of this to the site's visitors.
		[1]
(d)		site needs a light green (web colour lightGreen) background. lain what change needs to be made to the current page in order to do this.
		[3]
(e)		site's owner notices that his site doesn't come up high in the results from a search ine that uses the PageRank algorithm. State what would affect his site's ranking.
	,	
		ren

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).



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