



## Wednesday 07 October 2020 - Morning

## **A Level Computer Science**

H446/01 Computer Systems

Time allowed: 2 hours 30 minutes

You can use: • an HB pencil		
Do not use:  • a calculator		



Please write clea	arly in	black	ink.	Do no	ot writ	e in the barcodes.			
Centre number						Candidate number			
First name(s)									
Last name									

#### **INSTRUCTIONS**

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer all the questions.

#### **INFORMATION**

- The total mark for this paper is **140**.
- The marks for each question are shown in brackets [ ].
- Quality of extended response will be assessed in questions marked with an asterisk (\*).
- This document has 24 pages.

#### **ADVICE**

· Read each question carefully before you start your answer.

2

### Answer all the questions.

1			uses a computer system to keep track of room bookings. The hotel staff are able to quase to discover which rooms are booked or which rooms are free.	ery
	(a)	The	e hotel's computer network uses a client-server model.	
		(i)	Describe what is meant by the term 'client-server' in this context.	
				[3]
		(ii)	Give <b>two</b> advantages of client-server compared to peer-to-peer.	
			1	
			2	
				 [2]
	The	hote	el's network uses multiple switches.	
	(b)	Ехр	plain the purpose of a network switch.	

tl	Discuss the threats which potentially exist to the hotel's computer network and how hreats could be eliminated or reduced.
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4

(i)	Draw an Entity Relationship Diagram for this database.
	[4]
(ii)	
(,	Define what is meant by the term 'foreign key', giving <b>one</b> example of where a foreign key would be used in the hotel booking database.
(,	
(,	key would be used in the hotel booking database.
()	key would be used in the hotel booking database.
()	key would be used in the hotel booking database.
()	key would be used in the hotel booking database.  Definition

	(111)	Describe two different ways that hashing could be used in this database.
		1
		2
		[4
The	hote	el booking database enforces referential integrity.
(e)	Exp brol	lain what is meant by the term 'referential integrity' and how this could potentially be sen.
		[2]

6

2	A supermarket uses an object-oriented approach to organise items that it offers for sale. Part of
	the class definition for the ItemForSale class is shown below.

class ItemForSale
public itemName
public price
public discount

•••

#### endclass

(a) The discount attribute represents a percentage discount on the price. The discount can be between 0 and 50 (inclusive). All new items for sale initially have a discount value of 0.

(i)	Write the constructor method for the ItemForSale class.
	[4
(ii)	Write a line of code to create an object of type ItemForSale called mushypeas that has a name of "mushy peas" and a price of £0.89
	[3

(iii) Write the calculatePrice() method, which applies the percentage discount to the price and returns the new value.
[3
<b>(b)</b> The supermarket has previously had issues with discounts being set as values above 50.
Explain how encapsulation could be applied to the <code>ItemForSale</code> class to stop this probler from occurring.
You are <b>not</b> expected to write any code in your answer to this question.
[3

Some items in the supermarket are only available through home delivery. These items are the same as ItemsForSale with the following exceptions:

- the supermarket also stores the location of the stock
- the percentage discount allowed is up to 75 rather than the standard 50.

(c)	Explain how inheritance can be used to implement the above requirements.
	[4]

3	(a) (i)	Convert the denary number -119 to an 8-bit binary number with two's complement representation.
		[1]
	(ii)	Convert the unsigned binary number 1101101 to hexadecimal.
		[1]
	(iii)	Convert the denary number 171 to hexadecimal.
		[1]
	(iv)	Convert the hexadecimal number A6 to binary.
		[2]

••••								
(i)	Show the re	sult of apply				11 to the byte		•••••
(i)	Show the res	sult of apply	∕ing an X					
(i)			ving an X0					
(i)	Byte	0101	ving an X0					
(i)	Byte	0101	ving an X0					
	Byte XOR mask	0101 1100	ving an XI 1101 0111	OR mask o	of 1100 01 <sup>-</sup>	11 to the byte	0101 1101.	
(i)	Byte XOR mask	0101 1100	ving an XI 1101 0111	OR mask o	of 1100 01 <sup>-</sup>		0101 1101.	
	Byte  XOR mask  Describe a note the most	0101 1100	ving an Xi  1101  0111  ould be aput bit is alw	OR mask of the population of t	of 1100 01	11 to the byte	0101 1101.	
	Byte  XOR mask  Describe a note the most	0101 1100  nask that cost significant	ving an Xi  1101  0111  ould be aput bit is alw	OR mask of the population of t	of 1100 01	11 to the byte	0101 1101.	
	Byte  XOR mask  Describe a note the most	0101 1100  nask that cost significant	ving an Xi  1101  0111  ould be aput bit is alw	OR mask of the population of t	of 1100 01	11 to the byte	0101 1101.	
	Byte  XOR mask  Describe a note the most	0101 1100  nask that cost significant	ving an Xi  1101  0111  ould be aput bit is alw	OR mask of the population of t	of 1100 01	11 to the byte	0101 1101.	

4 (a) (i) Complete the Karnaugh map below for the Boolean expression  $(\neg A \land \neg B) \lor (A \land \neg B)$ 

			AB		
		00	01	11	10
	00				
CD	01				
	11				
	10				

[3]

(ii)	Use the Karnaugh n	•	find a	simplified	Boolean	expression	that is	equivalent	to
	(¬A∧¬B) ∨ (A∧¬	В)							

[2]

(b) (i)	State the purpose of a D-type flip-flop circuit.
	[2]
(ii)	Describe the inputs and outputs used by a D-type flip-flop circuit, explaining how the inputs are used to control the outputs.
	[4]

5*	"When it comes to government electronic surveillance, if you have nothing to hide, you have nothing to fear."							
	Discuss whether or not you agree with this statement. You should include:							
	<ul> <li>To what extent the UK government is able to monitor electronic communications of its citizens</li> <li>Technical measures citizens can take to help prevent their communications being monitored.</li> </ul>							
	[9]							

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- **6** Two people play a counting game. The rules of the game are as follows:
  - The first player starts at 1
  - Each player may choose one, two or three numbers on their turn and the numbers must be in ascending order
  - Players take it in turns to choose
  - The player who chooses "15" loses the game.

For example, if the first player chooses three numbers (1, 2, 3) then the second player could choose one number (4), two numbers (4, 5) or three numbers (4, 5, 6). The first player then takes another go.

Write an algorithm using pseudocode that allows two players to play this game. The algorithm should:

- Alternate between player 1 and player 2
- Ask the player how many numbers they would like to choose, ensuring that this is between 1 and 3
- Display the numbers that the player has chosen

Display a displayed.					

		81

7 The table below shows the Little Man Computer instruction set.

Mnemonic	Instruction
ADD	Add
SUB	Subtract
STA	
LDA	Load
	Branch always
BRZ	
BRP	
INP	Input
OUT	Output
	End program

(a)	Complete the table above to show the missing mnemonics and instructions.	[5]
(b)	Write a program using the Little Man Computer instruction set that will allow a user to inp two numbers and then output the larger of the two numbers. The program should loc continuously.	ор

 	 [6]

*	Procedural programming and object-oriented programming are two paradigms commonly used by programmers when developing computer games.
	Discuss the advantages of using object-oriented programming over procedural programming when developing computer games. You should refer to inheritance, encapsulation and polymorphism in your answer.

8\*

nogen buys a desktop computer. It comes with an operating system installed.	
) Describe <b>two</b> ways that an operating system could manage physical memory.	
1	
	••••
2	
Explain one benefit of memory management to the user.	
) Describe how virtual memory allows a user to run programs when physical me	
full.	
	••••
Turn	

Operating systems make use of device drivers.

Define what is meant by the term 'device driver', giving <b>one</b> example of a device driver that a home user would need.
Definition
Example
[3]
erating systems usually come with utility software pre-installed.
Give <b>two</b> examples of utility software, explaining the purpose of both.
1
2
[4]

(d) Imogen installs a compiler for a high-level programming language onto her of makes use of an open source IDE (Integrated Development Environment).				
	(i)	State what is meant by the term 'open source software'.		
		[2]		
	(ii)	Give <b>one</b> benefit to Imogen of using an open source IDE rather than a closed source IDE.		
		[1]		

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(e)	When Imogen creates programs in a high-level language, she makes use of libraries.				
	(i)	Explain what is meant by a library, giving one example of when one may be used.			
		[3]			
	(ii)	Describe <b>one</b> advantage of the use of library files to programmers.			
		[2]			
	(iii)	Describe <b>one</b> disadvantage of the use of library files to programmers.			
	<i>(</i> ; )	[2]			
	(iv)	Explain how linkers are used during the compilation process.			
		ioi			
		[3]			

# 23 ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined pages. The question numbers must be clearly shown in the margins. 




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