Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

COMPUTER SCIENCE **9608/13**

Paper 1 Theory Fundamentals **October/November 2018**

1 hour 30 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **14** printed pages and **2** blank pages.

1 A product designer is creating a poster.

(a) The designer creates a 6-colour bitmap image for the poster as shown.

Each colour is represented by a letter, for example, R = red, B = blue.

R	R	P	P	P	G
B	R	R	P	G	G
B	W	B	B	O	O
B	W	W	P	P	O
B	B	R	P	G	O
B	R	R	P	G	O

(i) State the minimum number of bits needed to represent each pixel in the image in **part (a)**.

.....[1]

(ii) Calculate the minimum file size of the image shown in **part (a)**. Show your working.

Working .....

.....

.....

File size .....

[3]

(b) **(i)** The designer takes a photograph to put on the poster. The photograph has a resolution of 50 000 pixels by 50 000 pixels. The colours are represented using 4 bytes per pixel.

Estimate the file size of the photograph in gigabytes. Show your working.

Working .....

.....

.....

.....

Estimated file size .....

[4]

(ii) The photograph needs to be sent by email but the file size is too big. It needs to be compressed.

The table lists several methods of making an image file size smaller.

Tick (✓) **one** box on each row to indicate whether each method is lossy or lossless.

Compression method	Lossy	Lossless
Cropping the image		
Reducing the resolution of the image		
Using run-length encoding (RLE)		
Reducing the colour depth of the image		

[4]

(c) Explain how run-length encoding would compress the image in **part (a)**.

.....

.....

.....

.....

.....

.....[3]

2 The following table shows assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC) and an Index Register (IX).

Instruction		Explanation
Op code	**Operand**	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC.
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC.
LDR	#n	Immediate addressing. Load the number n to IX.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX).
CMP	<address>	Compare contents of ACC with contents of <address>.
JPE	<address>	Following compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following compare instruction, jump to <address> if the compare was False.
JMP	<address>	Jump to the given address.
OUT		Output to the screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

(a) State what is meant by **relative addressing** and **indexed addressing**.

Relative addressing .....

.....

.....

Indexed addressing .....

.....

.....

[2]

(b) The current contents of a general purpose register (X) are:

X	1	1	1	1	0	0	1	0

(i) The contents of X represent an unsigned binary integer.

Convert the value in X into denary.

.....[1]

(ii) The contents of X represent an unsigned binary integer.

Convert the value in X into hexadecimal.

.....[1]

(iii) The contents of X represent a two's complement binary integer.

Convert the value in X into denary.

.....[1]

(iv) Show the result on the general purpose register (X) after the following instruction is run.

```
INC X
```


[1]

(c) The current contents of the main memory, Index Register (IX) and selected values from the ASCII character set are provided with a copy of the instruction set.

Address	Instruction
20	LDD 96
21	CMP 97
22	JPE 32
23	LDX 86
24	CMP 98
25	JPN 27
26	OUT
27	LDD 96
28	INC ACC
29	STO 96
30	INC IX
31	JMP 21
32	END
…	
93	453
94	453
95	452
96	8
97	10
98	453

IX	8

ASCII code table (selected codes only)

ASCII code	Character
450	<
451	>
452	=
453	&
454	(
455	)

Instruction set

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC.
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JMP	<address>	Jump to the given address.
OUT		Output to the screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

7

Complete the trace table for the given assembly language program.

Instruction address	ACC	Memory address						IX	OUTPUT
		93	94	95	96	97	98		
		453	453	452	8	10	453	8	
20									

[7]

3 This question presents three scenarios. Tick (✓) **one** box for each scenario to indicate whether you think the person's behaviour is ethical or unethical. Justify your choice.

(a) Mason is using his work computer to book a holiday whilst at work.

Ethical	
Unethical	

Justification .....

.....

.....

.....[2]

(b) Ethan is supervising a trainee. The trainee asks Ethan for a reference for another job. Ethan does not want to lose the trainee, so refuses to give him a reference.

Ethical	
Unethical	

Justification .....

.....

.....

.....[2]

(c) Margarita finds that one of her team members has produced some inventive code. She presents this to her manager, praising the individual by name.

Ethical	
Unethical	

Justification .....

.....

.....

.....[2]

4 Ava needs to view a website and she knows the Uniform Resource Locator (URL).

(a) Complete the series of steps that take place.

Write the **letter** of the appropriate statement in each space.

A	DNS finds corresponding IP
B	DNS looks up URL in table
C	Ava types the URL into a web browser

1 .....

2 Web browser sends URL to Domain Name Service (DNS)

3 .....

4 .....

5 DNS returns IP address to web browser

[2]

(b) (i) An IPv4 address has been entered as 12.258.3

Give **two** reasons why this IP address is invalid.

1 .....

.....

2 .....

.....

[2]

(ii) An IPv6 address has been entered as 15EF:5L63::2014:BB::60AA

Give **two** reasons why this IP address is invalid.

1 .....

.....

2 .....

.....

[2]

(c) The table shows four descriptions of IP addresses.

Tick (✓) **one** box in each row to identify whether each description applies to a public or private IP address.

Description	Public	Private
The address can be reached over the Internet.		
The address is more secure.		
The address can only be accessed through the same LAN.		
The address can be duplicated in different networks.		

[4]

5 Arnold is a software developer. He has created a computer game for people to download over the Internet. Arnold is considering releasing the game as a piece of commercial software.

(a) (i) Describe what is meant by a **commercial licence**.

.....

.....

.....

.....[2]

(ii) Name and describe **one** other type of licence that Arnold can consider using.

Licence type .....

Description .....

.....

.....

.....
[3]

(b) Users need to enter their name and email address to create an account. The information is stored in a database on Arnold's computer.

Give **three** ways that Arnold can ensure users' details are kept secure.

1 .....

2 .....

3 .....
[3]

6 The fetch-execute (FE) cycle uses special purpose registers.

(a) The stages in the FE cycle are shown in register transfer notation.

```
MAR ← [.............]

PC ← PC + 1

..... ← [ [MAR] ]

..... ← [MDR]
```

(i) The steps shown in **part (a)** are incomplete.

Write the missing register names in the spaces in **part (a)**. [3]

(ii) The third instruction `[ [MAR] ]` has double brackets.

State the purpose of the double brackets.

.....

.....[1]

(b) One stage of the FE cycle includes checking for interrupts.

State what is meant by an **interrupt**.

.....

.....

.....

.....[2]

(c) There are two types of RAM: dynamic RAM (DRAM) and static RAM (SRAM).

The following table shows **five** statements about DRAM and SRAM.

Tick (✓) **one** box in each row to indicate whether the statement applies to DRAM or SRAM.

Statement	DRAM	SRAM
Does not need to be refreshed as the circuit holds the data while the power supply is on		
Mainly used in cache memory of processors where speed is important		
Has less complex circuitry		
Requires higher power consumption under low levels of access, which is significant when used in battery-powered devices		
Requires data to be refreshed occasionally so it retains the data		

[5]

7 The network manager of a Local Area Network (LAN) has replaced the Ethernet cables with a wireless network.

(a) Give **three** benefits of a wireless network compared to a wired network.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

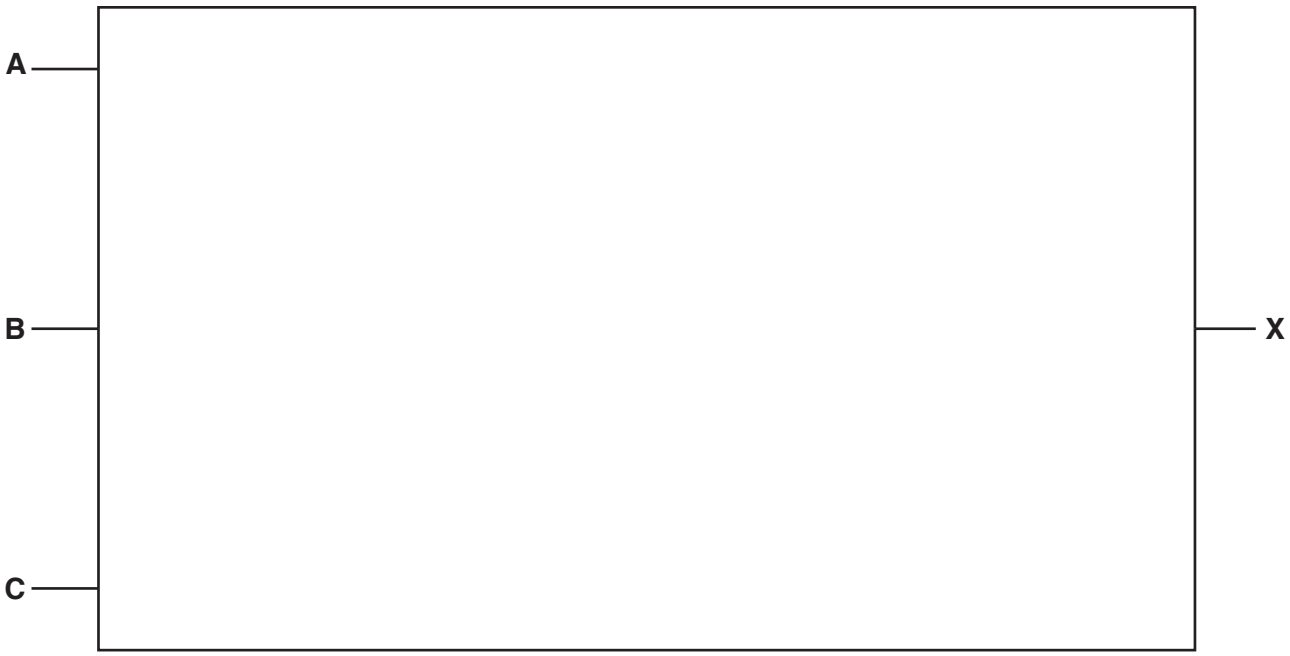
(b) Give **one** drawback of a wireless network compared to a wired network.

.....

.....[1]

8 **(a)** Draw a logic circuit to represent the logic expression:

X = (**A** XOR **B**) OR (NOT(**C** AND **A**))



[4]

(b) Complete the truth table for the logic expression in **part (a)**.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

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