Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

7002132446

COMPUTER SCIENCE **9618/13**

Paper 1 Theory Fundamentals **May/June 2021**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages.

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1 Anya scans an image into her computer for a school project.

(a) The scanned image is a bitmapped image.

(i) Complete the following table to describe the two terms about graphics.

Term	Description
Pixel	....
File header	....

[2]

(ii) The image is scanned with an image resolution of 1024 × 512 pixels, and a colour depth of 8 bits per pixel.

Calculate an estimate for the file size, giving your answer in mebibytes. Show your working.

Working .....

.....

.....

.....

Answer ..... mebibytes

[3]

(b) The image is compressed using lossless compression.

Identify **one** method of lossless compression that can be used to compress the image **and** describe how the method will reduce the file size.

Lossless compression method .....

Description .....

.....

.....

.....

.....

[3]

(c) One of the colours used in the image has the hexadecimal colour code:

`#FC238A`

`FC` is the amount of red, `23` is the amount of green and `8A` is the amount of blue in the colour.

(i) Convert the hexadecimal code `FC` into denary.

..... [1]

(ii) The amount of green in binary is `00100011`. This has the denary number `15` added to it to create a second colour.

Add the denary number `15` to the binary number `00100011` and give your answer in binary.

Perform the addition in binary. Show your working.

Working .....

.....

.....

.....

.....

Answer (in binary) .....

[3]

(iii) Hexadecimal `23` in two's complement representation is `00100011`. The denary number `10` needs to be subtracted from this value.

Subtract the denary number `10` from the two's complement representation `00100011`.

Give your answer in binary. Show your working.

Working .....

.....

.....

.....

.....

Answer (in binary) .....

[3]

(d) Anya made sure that the image was not subject to any copyright before scanning it.

Describe what is meant by **copyright**.

.....

.....

.....

..... [2]

2 Bingwen's computer comes with an Operating System and utility software.

(a) Draw **one** line from each utility software to its correct description.

Utility software	Description
	Scans software for errors and repairs the problems
Disk formatter	Moves parts of files so that each file is contiguous in memory
Defragmentation	Creates a copy of data that is no longer required
Back-up	Sets up a disk so it is ready to store files
Disk repair	Scans for errors in a disk and corrects them
	Creates a copy of data in case the original is lost

[4]

(b) Identify **four** key management tasks that the Operating System will perform.

1 .....

2 .....

3 .....

4 .....

[4]

3 A processor has one general purpose register, the Accumulator (ACC), and several special purpose registers.

(a) Complete the following description of the role of the registers in the fetch-execute cycle by writing the missing registers.

The ..... holds the address of the next instruction to be loaded. This address is sent to the ..... .

The ..... holds the data fetched from this address.

This data is sent to the ..... and the Control Unit decodes the instruction's opcode.

The ..... is incremented.

[5]

(b) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDI	<address>	Indirect addressing: The address to be used is at the given address. Load the contents of this second 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
MOV	<register>	Move the contents of the accumulator to the given register (IX)
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a 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
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
<address> can be an absolute address or a symbolic address # denotes a denary number, e.g. #123		

The current contents of the main memory and selected values from the ASCII character set are shown.

Address	Instruction
200	LDD 365
201	CMP 366
202	JPE 209
203	INC ACC
204	STO 365
205	MOV IX
206	LDX 365
207	OUT
208	JMP 200
209	END
...	
365	1
366	3
367	65
368	66
IX	0

ASCII code table (selected codes only)

ASCII code	Character
65	A
66	B
67	C
68	D

Complete the trace table for the program currently in main memory.

Instruction address	ACC	Memory address				IX	Output
		365	366	367	368		
		1	3	65	66	0	

[6]

(c) (i) The Accumulator currently contains the binary number:

0	0	1	1	0	1	0	1

Write the contents of the Accumulator after the processor has executed the following instruction:

```
LSL #2
```


[1]

(ii) The Accumulator currently contains the binary number:

0	0	1	1	0	1	0	1

Identify the mathematical operation that the following instruction will perform on the contents of the accumulator.

```
LSR #3
```

.....

..... [1]

4 Melinda and her friends set up a peer-to-peer network between their computers to share data.

(a) Describe the key features of a peer-to-peer network.

.....

.....

.....

..... [2]

(b) Describe **two** drawbacks to Melinda and her friends of using a peer-to-peer network.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(c) Melinda connects her laptop to the internet through her router.

(i) Tick (✓) **one** box in each row to identify whether the task is performed by the router or not.

Task	Performed by router	Not performed by router
Receives packets from devices		
Finds the IP address of a Uniform Resource Locator (URL)		
Directs each packet to all devices attached to it		
Stores the IP and/or MAC address of all devices attached to it		

[2]

(ii) Melinda mainly uses the internet to watch films and play computer games.

Tick (✓) **one** box to identify whether Melinda should connect to the router using a wired or wireless network **and** justify your choice.

Wired	
Wireless	

Justification .....

.....

.....

.....

.....

..... [3]

(d) Melinda sends emails from her webmail account (email account accessed through a website).

Explain whether Melinda is using the internet, or the World Wide Web (WWW), or both.

.....

.....

.....

.....

.....

..... [3]

5 Kiara has a washing machine and a refrigerator.

(a) She has an embedded system in her washing machine.

Describe what is meant by an **embedded system**, using the washing machine as an example.

.....

.....

.....

..... [2]

(b) The washing machine's embedded system makes use of both Random Access Memory (RAM) and Read Only Memory (ROM).

State the purpose of RAM and ROM within the washing machine's embedded system.

RAM .....

.....

ROM .....

.....
[2]

(c) The temperature in her refrigerator must be kept between 4 and 6 degrees Celsius.

The microprocessor in the refrigerator turns on the cooling if the temperature is too high, and turns off the cooling if the temperature is too low.

Explain why the system in the refrigerator is a control and not a monitoring system.

.....

.....

.....

.....

.....

..... [2]

6 Each of the following algorithms performs data validation.

State the type of validation check that each of the algorithms performs.

(a)

```
INPUT x
IF x < 0 OR x > 10 THEN
  OUTPUT "Invalid"
ENDIF
```

..... [1]

(b)

```
INPUT x
IF x = "" THEN
  OUTPUT "Invalid"
ENDIF
```

..... [1]

(c)

```
INPUT x
IF NOT(x = "Red" OR x = "Yellow" OR x = "Blue") THEN
  OUTPUT "Invalid"
ENDIF
```

..... [1]

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7 Bobby and Kim are discussing databases.

(a) Bobby tells Kim that a file-based approach is usually better than a relational database.

Explain why Bobby is incorrect.

.....

.....

.....

.....

.....

..... [3]

(b) Bobby has a shop that sells products to customers. His database will store data about his customers, their payment details, orders and the products he sells. Customers will have login details to access their accounts. The database will update customers' payment and login details without keeping any historical records.

(i) Give **one** example of each of the following relationships from Bobby's database.

one-to-one

.....

.....

one-to-many

.....

.....

many-to-many

.....

.....

[3]

(ii) Tick (✓) **one** box to identify the relationship that cannot be directly implemented in a normalised relational database.

Relationship	**Tick** (✓)
one-to-one	
one-to-many	
many-to-many	

[1]

(iii) Bobby wants to name his database `SHOPORDERS`.

Write a Data Definition Language (DDL) statement to define a new database with the name `SHOPORDERS`.

.....

..... [1]

(c) A database has a data dictionary.

Give **three** items that are stored in a data dictionary.

1 .....

2 .....

3 .....

[3]

8 Tick (✓) **one** box in each row to identify the logic gate that each statement describes.

Statement	AND	NAND	NOR	XOR	OR
The output is 1 only when both inputs are 1					
The output is 1 only when both inputs are different					
The output is 1 only when both inputs are 0					

[3]

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