Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

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COMPUTER SCIENCE **9618/11**

Paper 1 Theory Fundamentals **October/November 2022**

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 **20** pages. Any blank pages are indicated.

1 **(a)** **(i)** Convert the unsigned binary integer into denary.

00100111

Answer ..... [1]

(ii) Convert the Binary Coded Decimal (BCD) into denary.

00100111

Answer ..... [1]

(iii) Convert the 8-bit two's complement binary integer into denary.

11100111

Answer ..... [1]

(b) Perform the following binary subtraction. Show your working.

$$\begin{array}{rcccccccc} & 1 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ - & 0 & 1 & 1 & 1 & 0 & 1 & 0 & 1 \\ \hline \end{array}$$

[2]

(c) Give **one** similarity and **two** differences between the ASCII and Unicode character sets.

Similarity .....

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Difference 1 .....

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Difference 2 .....

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[3]

(d) Sound samples are recorded and saved in a file.

(i) State what is meant by **sampling rate**.

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..... [1]

(ii) Explain the effect of increasing the **sampling resolution** on the sound file.

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..... [2]

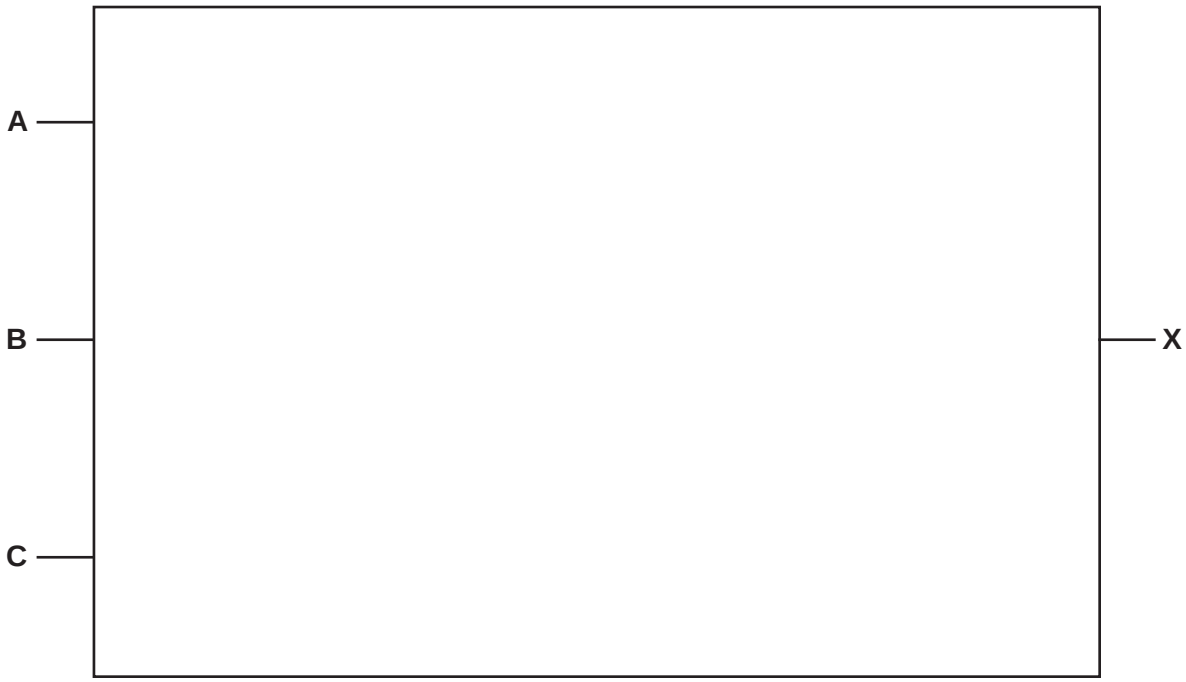
2 Draw **one** line from each security feature to its most appropriate description.

Security feature	Description
firewall	converts data to an alternative form
pharming	redirects a user to a fake website
anti-virus software	verifies the authenticity of data
encryption	scans files on the hard drive for malicious software
	accepts or rejects incoming and outgoing packets based on criteria

[4]

3 **(a)** Draw a logic circuit for the logic expression:

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



[2]

(b) Complete the truth table for the logic expression:

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

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		

[2]

4 A photographer creates a relational database to store data about photographs taken at birthday parties.

The database, PHOTOGRAPHS, stores details of the customer, the party, the photographs taken and the cameras used.

The photographer has several cameras that are used for taking the photographs at the parties.

Each camera has a specific lens type (for example, XY32Z) and lighting type (for example, F1672).

Data about each photograph is stored in the database including the party at which it was taken, the time it was taken and the camera used.

The database has these four tables:

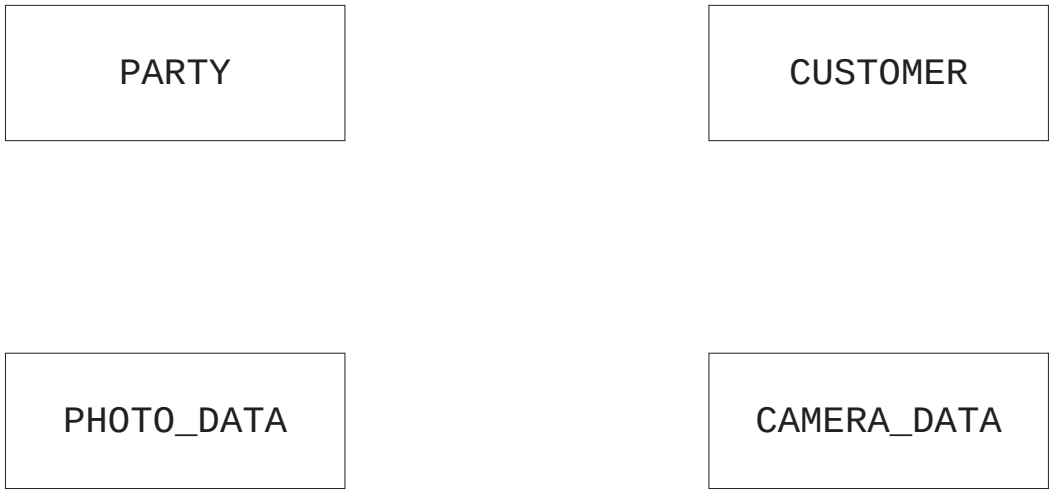
CUSTOMER(CustomerID, FirstName, LastName, Telephone)

PARTY(PartyID, CustomerID, PartyDate, StartTime)

PHOTO_DATA(PhotoID, PartyID, TimeTaken, CameraID)

CAMERA_DATA(CameraID, LensType, LightingType)

(a) Complete the entity-relationship (E-R) diagram for the database PHOTOGRAPHS.



[3]

(b) The database is normalised and is in Third Normal Form (3NF).

Describe the characteristics of a database that is in Third Normal Form (3NF).

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..... [3]

(c) The table shows some sample data for the table PHOTO_DATA.

PhotoID	PartyID	TimeTaken	CameraID
ST23-56	BD987	08:34	NIK-02
ST23-57	BD987	08:55	NIK-02
ST23-60	BC08	09:01	CAN-01
ST23-61	BC08	10:23	CAN-12
ST23-62	BC08	10:56	NIK-01

(i) State what is meant by a **tuple**. Give an example of a tuple from PHOTO_DATA.

Tuple .....

.....

Example .....

.....

[2]

(ii) Complete the Structured Query Language (SQL) script to display the total number of photographs that have been taken using a camera with a camera ID starting with CAN.

```
SELECT ..... (.....)
FROM .....
WHERE CameraID LIKE ..... ;
```

[4]

(d) Write an SQL script to include two new fields in CAMERA_DATA to store the number of photographs currently on the camera **and** the date the camera was last used.

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..... [3]

Question 5 begins on page 10.

5 **(a)** State what is meant by the **stored program concept** in the Von Neumann model of a computer system.

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..... [1]

(b) A Central Processing Unit (CPU) contains several special purpose registers and other components.

(i) State the role of the following registers.

Program Counter (PC) .....

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Index Register (IX) .....

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Status Register (SR) .....

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[3]

(ii) Tick (✓) **one** box in each row to identify the system bus used by each CPU component.

CPU component	Data bus	Address bus	Control bus
System clock			
Memory Address Register (MAR)			

[1]

(iii) Describe the purpose of the Control Unit (CU) in a CPU.

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..... [2]

(c) Describe the purpose of an interrupt in a computer system.

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..... [2]

(d) Identify **two** causes of a software interrupt.

1 .....

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2 .....

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[2]

6 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
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 the ACC
ADD	#n	Add the denary number n to the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	#n	Compare the contents of ACC with number n
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
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
<address> can be an absolute or a symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

(a) The current contents of main memory and selected values from the ASCII character set are given.

(i) Trace the program currently in memory using the trace table.

Address	Instruction
77	LDR #0
78	LDX 110
79	CMP #35
80	JPE 92
81	ADD 100
82	STO 101
83	LDM #1
84	ADD 100
85	STO 100
86	INC IX
87	LDX 110
88	CMP #35
89	JPN 81
90	LDD 100
91	ADD #48
92	OUT
93	END
…	
100	0
101	0
…	
110	66
111	65
112	35

ASCII value	Character
49	1
50	2
51	3
52	4
65	A
66	B
67	C
68	D

Instruction address	ACC	IX	Memory address					Output
			100	101	110	111	112	
			0	0	66	65	35	

[4]

(ii) The following instructions are repeated for your reference.

Instruction		Explanation
Opcode	**Operand**	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
STO	<address>	Store contents of ACC at the given address

State the purpose of this part of an assembly language program.

```
LDD 100
STO 165
LDD 101
STO 100
LDD 165
STO 101
```

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[1]

Question 6(b) begins on page 16.

(b) The following table shows another part of the instruction set for the processor.

Instruction		Explanation
Opcode	**Operand**	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	Bn	Bitwise AND operation of the contents of ACC with the binary number n
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	Bn	Bitwise XOR operation of the contents of ACC with the binary number n
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	Bn	Bitwise OR operation of the contents of ACC with the binary number n
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 or a symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

(i) The current contents of the ACC are:

1	0	0	1	0	0	1	1

Show the result after the execution of the following instruction.

```
XOR B00011111
```

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[1]

(ii) The current contents of the ACC are:

1	0	0	1	0	0	1	1

Show the result after the execution of the following instruction.

```
AND B11110000
```

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.....

[1]

(iii) The current contents of the ACC are:

1	0	0	1	0	0	1	1

Show the result after the execution of the following instruction.

```
OR B11001100
```

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.....

[1]

(iv) The current contents of the ACC are:

1	0	0	1	0	0	1	1

Show the result after the execution of the following instruction.

```
LSR #2
```

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[1]

(c) Tick (✓) **one or more** boxes in each row to indicate whether the task is performed in the first pass or the second pass of a two-pass assembler.

Task	First pass	Second pass
Remove comments.		
Read the assembly language program one line at a time.		
Generate the object code.		
Check the opcode is in the instruction set.		

[2]

7 **(a)** State **two** benefits to a programmer of using Dynamic Link Library (DLL) files.

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2 .....

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[2]

(b) Memory management is one of the tasks performed by an Operating System (OS).

Describe the ways in which memory management organises and allocates Random Access Memory (RAM).

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..... [2]

(c) An Operating System may include a utility program to compress text files.

Describe **one** appropriate method of compressing a text file.

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..... [3]

(d) Explain the reasons why increasing the amount of cache memory can improve the performance of a CPU.

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..... [2]

(e) State the name of a peripheral device port that provides a physical connection in the computer for each of these peripherals.

3D printer .....

Monitor .....

[2]

8 A Local Area Network (LAN) uses a bus topology.

Describe how Carrier Sense Multiple Access / Collision Detection (CSMA / CD) is used in a bus network.

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..... [4]

9 Many modern televisions are examples of embedded systems.

(a) Explain why these televisions are embedded systems.

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..... [2]

(b) Embedded systems use Electrically Erasable Programmable ROM (EEPROM).

Describe **one** benefit of using EEPROMs in an embedded system.

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..... [2]

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