Cambridge Assessment International Education

Done

Cambridge International AS & A Level

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COMPUTER SCIENCE **9618/12**

Paper 1 Theory Fundamentals **May/June 2025**

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.

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1 (a) The table has six statements about the Von Neumann model for a computer system. Three of the statements are incorrect.

Statement number	Statement
1	The Program Counter (PC) stores the next instruction to be fetched from memory.
2	The Arithmetic and Logic Unit (ALU) performs mathematical and logical operations.
3	The Control Unit (CU) sends signals to other components on the data bus.
4	The Memory Data Register (MDR) transfers data to the memory address stored in the Memory Address Register (MAR).
5	The MAR stores an address from memory.
6	The Accumulator (ACC) stores the result of calculations.

Complete the table by writing the **three** incorrect statement numbers and the corrected statements.

Incorrect statement number	Corrected statement
1)	The program counter stores the address of the next instruction to be fetched from memory.
3)	The control unit (cu) sends the signals to other component on the control bus.
4)	MDR fetch data from the memory address stored in MAR.

[3]

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(b) Registers that are used in the Fetch-Execute (F-E) cycle include the PC, MAR, MDR and the ACC.

Identify **one** other register and describe its role in the Fetch-Execute (F-E) cycle.

Register Status Register

Role It contain the bits that referenced individually to indicate a state or event

[2]

(c) Explain how an interrupt from an input device will be detected and handled in the F-E cycle.

At the start the F-E cycle the interrupt register is checked. The priority of any interrupts waiting is checked. If the priority of the interrupt is higher than current process the contents of register are stored in stack.

[4]

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2 (a) Convert the denary integer 558 into 12-bit binary and hexadecimal.

2048 1024 512 256 128 64 32 16 8 4 2 1
0 0 1 0 0 0 1 0 1 1 1 0

Binary 0010 0010 1110

Hexadecimal 8 4 2 1 | 8 4 2 1 | 8 4 2 1
0010 | 0010 | 1110
2 2 E
22E ANS

[2]

(b) (i) Convert the two's complement binary integer 11100010 into denary.

-128 64 32 16 8 4 2 1
0 0 0 1 1 1 1 0

= -30

[1]

(ii) Write the smallest and the largest two's complement binary integers that can be represented in 8 bits.

Smallest 10000000

Largest 01111111

[2]

(c) Give **one** application where Binary Coded Decimal (BCD) is used and justify its use.

Application Barcode System

Justification It is because there is a conversation between denary and BCD which is accurately completed.

[2]

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3 A computer program uses a digital camera to read the words on an item.

The program can read the words that are written on the item, translate the words to a chosen language and then output the words as audio. For example, when used in a supermarket, the program can output the words written on the labels on products.

The program uses Artificial Intelligence (AI).

(a) Explain how AI is used in the computer program described.

The AI uses image recongnitation to analyse the photograph in order to convert the pattern of pixels in character. Uses text speech to generate the audio waveform corresponding to the words.

[4]

(b) State **two** social benefits of the use of AI in the computer program described.

1 It can help people who cannot understand the language

2 It can help people who has difficulty in reading

[2]

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(c) The computer program is released under a commercial software licence.

(i) Describe the features of a commercial software licence.

In commercial software user have no access to source code. In this source code is being protected. There is limited number of installations. Anyone can purchase.

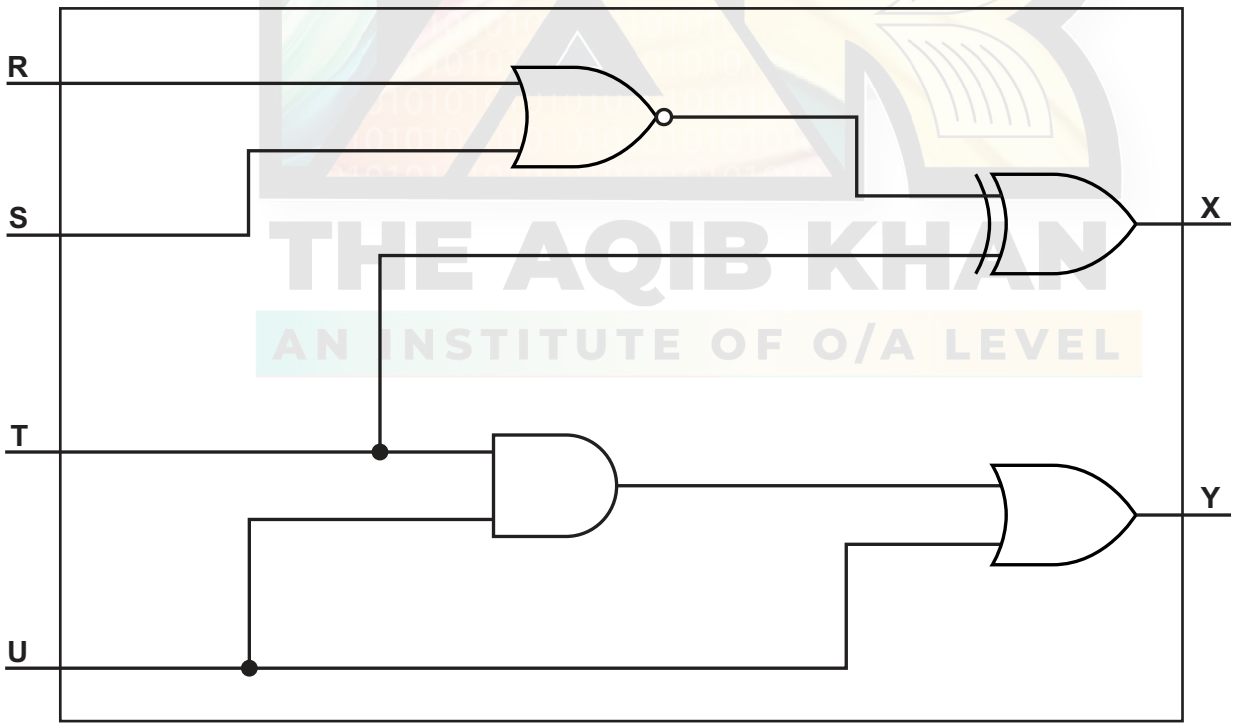
[3]

(ii) Explain the reasons why an open source software licence might **not** be appropriate for the computer program described.

The source code would be accessible therefore it cannot be changed, which might lead to program output an incorrect response so people could purchase wrong item.

[3]

4 (a) Write the logic expressions for the following logic circuit.



X = (R NOR S) XOR T

Y = (T AND U) OR U

[2]

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

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

A	B	C	Working space: B XOR C	Working space: (A AND (B XOR C))	X
0	0	0	0	0	1
0	0	1	1	0	1
0	1	0	1	0	1
0	1	1	0	0	1
1	0	0	0	0	1
1	0	1	1	1	0
1	1	0	1	1	0
1	1	1	0	0	1

[2]

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5 An online game has a database that stores data about users and the characters each user creates in the game. Each user can create multiple characters and purchase multiple items for each character.

The normalised database has the following design:

```
USER(Username, Password, DateOfBirth)

CHARACTER(CharacterName, CharacterID, Username, Level, Money)

ITEM(ItemName, MinimumLevel, Cost)

CHARACTER_ITEM(CharacterID, ItemName)
```

(a) Explain the purpose of the table `CHARACTER_ITEM` in the database.

It stores character ID of characters created in the game and helps to identify the specific character that has been created multiple times or not. [2]

(b) Underline the attribute, or attributes, that form the primary key in each of the tables.

```
USER(Username, Password, DateOfBirth)

CHARACTER(CharacterName, CharacterID, Username, Level, Money)

ITEM(ItemName, MinimumLevel, Cost)

CHARACTER_ITEM(CharacterID, ItemName)
```

[2]

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(c) A Database Management System (DBMS) provides data security.

(i) Identify **two** methods the DBMS can use to protect the data in the table `USER` from unauthorised access.

Explain how each method protects the data.

Method 1 views

Explanation Users can be given a view to the database that does not include the data in the table USER

Method 2 Encryption

Explanation The DBMS encrypts the data stored in the USER table even if an authorised user gains physical access to storage.

[4]

(ii) The DBMS also supports data integrity.

Give **two** ways that a DBMS can support data integrity.

1 Cascade update

2 Validation

[2]

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(d) (i) Write a Structured Query Language (SQL) script to count the number of items purchased by the user with the username "KAT123".

```
SELECT COUNT( Item Name)
FROM CHARACTER_ITEM, CHARACTER
WHERE CHARACTER.character ID = CHARACTER ITEM
                                .characterID
AND CHARACTER, USER Name = "KAT 123"))
```

[3]

(ii) The following changes need to be made to the character with the ID "0002":

- level changed to 3
- money changed to 10000.00

Write an SQL script to change the character's data.

```
UPDATE CHARACTER
SET LEVEL = 3, Money = 10000.00
WHERE character ID = "0002"
```

[3]

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CH-2

6 A company has multiple sites in different cities.
The company has drivers who deliver products to customers. Each driver can connect to the company's WAN (Wide Area Network) whilst out of the office using a smartphone.

(a) State **two** ways that a WAN is different to a LAN (Local Area Network).

1 The WAN can connect over a large geographical area. In LAN it connects over small geographical area.

2 A WAN uses external is not owned transmission media. The transmission media for LAN is company owned.

[2]

(b) The smartphones use the cell phone network to connect to the WAN.

Explain how data is transmitted using the cell phone network.

Each cell has a tower with an antenna which receives and transmits data. Data is transmitted between the tower and the phone and the data transmission is wireless using low power frequencies.

[4]

(c) Devices that connect to the WAN have an IP address.

Complete the following description of IP addresses by writing the missing words.

IPv4 is displayed as four groups of 8-bit numbers separated by full stops.

Each IPv4 address is 32 bits.

IPv6 is made of eight groups of 4 hexadecimal numbers separated by colons.

Multiple consecutive groups of zeros can be replaced with a double colon.

Each IPv6 address is 128 bits.

A dynamic IP address can change each time the computer connects to a network.

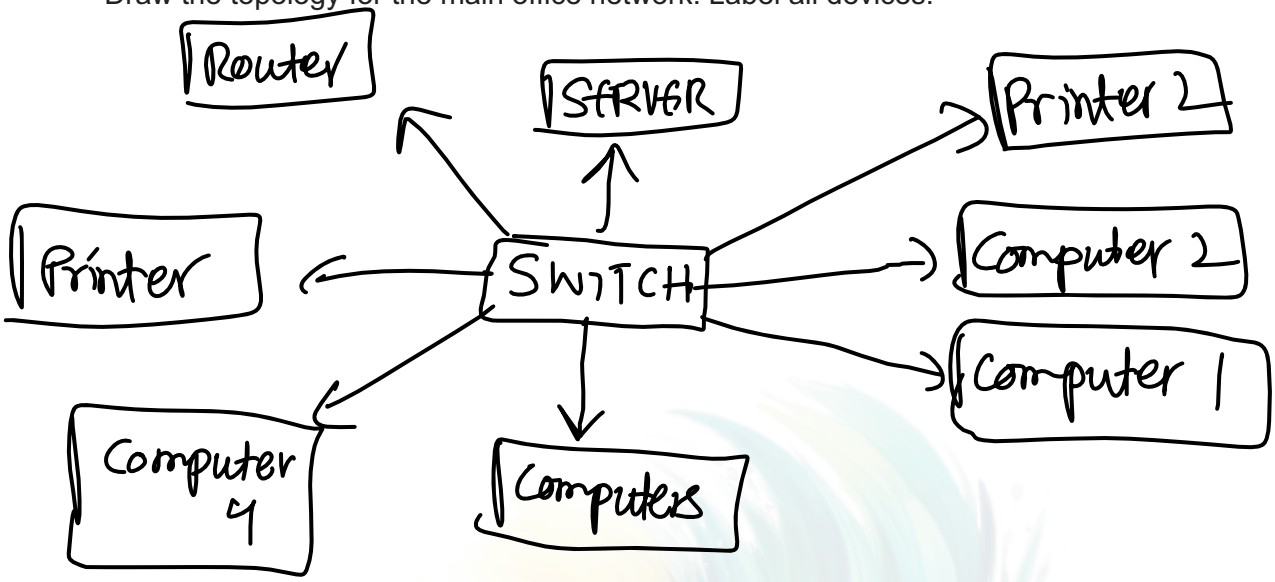
A private IP address can only be accessed by other devices in the same LAN and is assigned by the router within the LAN.

[6]

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(d) The main office for the company has four wired computers, one server, two printers, one central switch and a device providing a single point of access for the internet. The network is set up as a star topology.

Draw the topology for the main office network. Label all devices.



[4]

(e) Describe the role of a switch in a network.

In this it stores the MAC addresses of devices connected to it so to receive packets from devices. It also provide a central point of connection for network.

[3]

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7 **(a)** The following table shows part of the instruction set for a processor. The processor has one register: the Accumulator (ACC).

Instruction		Explanation
Opcode	**Operand**	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDM	#n	Immediate addressing. Load the number n to ACC
STO	<address>	Store the contents of ACC at the given address
ADD	#n/Bn/&n	Add the number n to the ACC
ADD	<address>	Add the contents of the given address to the ACC
INC	<register>	Add 1 to the contents of the register (ACC)
CMP	<address>	Compare the contents of ACC with the contents of <address>
CMP	#n	Compare the contents of ACC with number n
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JMP	<address>	Jump to the given address
END		Return control to the operating system

ACC denotes Accumulator
<address> can be an absolute or a symbolic address
# denotes a denary number, e.g. #123
B denotes a binary number, e.g. B01001010
& denotes a hexadecimal number, e.g. &4A

The current contents of memory are:

Address	Instruction
10	12
11	11
12	10
13	22
14	22
...	
100	LDD 10
101	ADD 12
102	STO 11
103	CMP 14
104	JPE 107
105	INC ACC
106	JMP 101
107	STO 10
108	END

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

Instruction address	ACC	Memory address				
		10	11	12	13	14
		12	11	10	22	22
100	12					
101	22					
102			22			
103						
104						
107		22				

[3]

(ii) State the effect of changing instruction `LDD 10` in address 100 to `LDM #10`

The number 10 will be loaded into ACC instead of 12.

[1]

(iii) Identify **and** describe **one** mode of addressing **not** given in the table of instructions in part **(a)**.

Mode of addressing Indirect

Description The operand points to the memory location that contains the address of data.

[2]

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(b) The table shows part of the instruction set for a processor. The processor has one register: the Accumulator (ACC).

Instruction		Explanation
Opcode	**Operand**	
AND	#n/Bn/&n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
XOR	#n/Bn/&n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n/Bn/&n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001010 & denotes a hexadecimal number, e.g. &4A		

(i) The ACC currently contains the following binary value.

1	1	1	1	0	0	0	0

Write the result after the instruction `OR B00001111` is run.

1	1	1	1	1	1	1	1

[1]

(ii) The ACC currently contains the following binary value.

128	64	32	16	8	4	2	1
0	0	0	1	1	1	0	1

Write the result after the instruction `XOR #30` is run.

128	64	32	16	8	4	2	1
0	0	0	0	0	0	1	1

[1]

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