Cambridge Assessment International Education

Done

Cambridge International AS & A Level

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COMPUTER SCIENCE **9618/11**

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.

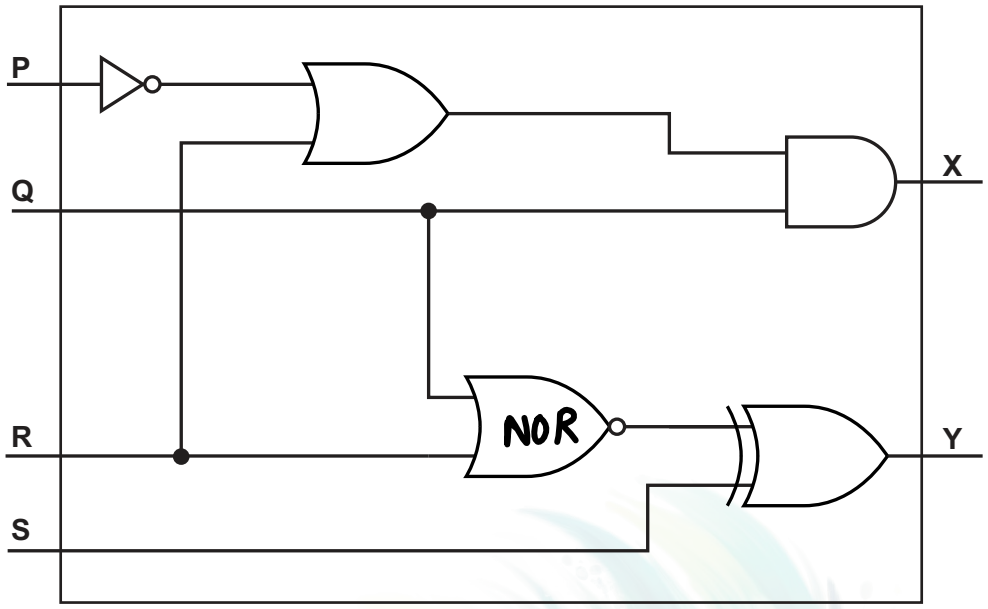
This document has **20** pages. Any blank pages are indicated.

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CH-3

1 **(a)** Write the logic expressions for the following logic circuit.



X = (NOT P OR R) AND Q

Y = (Q NOR R) XOR S

[2]

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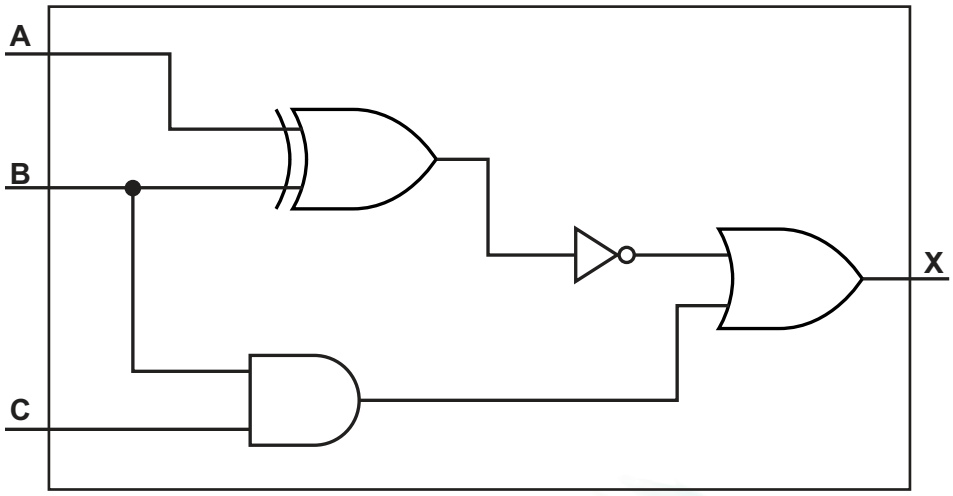
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(b) Complete the truth table for the following logic circuit.



A	B	C	Working space			X
			A ⊕ B	! A ⊕ B	B . C	
0	0	0	0	1	0	1
0	0	1	0	1	0	1
0	1	0	1	0	0	0
0	1	1	1	0	1	1
1	0	0	1	0	0	0
1	0	1	1	0	0	0
1	1	0	0	1	0	1
1	1	1	0	1	1	1

[2]

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2 Programmers in a software development company take part in live video conferences to discuss their work.

The live video conferences take place using real-time bit streaming. The video is compressed before it is transmitted.

(a) Explain how data is transferred using real-time bit streaming.

The video is transmitted continously because it is real-time bit streaming. Video is transmitted in a seriers! Video is uploaded to server and user can download from server. On download server send the data to a buffer on user's device. Buffer is used when there is a difference of speed b/w transmission and recipient. [4]

(b) **(i)** Explain the reasons why a video is compressed before it is transmitted using real-time bit streaming.

1) File size need to reduce in order to redure bandwith.
2) File size need to reduce in order to reduce buffering
3) Video is data intensive

[4]

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(ii) Identify whether the lossy or lossless compression method is more appropriate for real-time bit streaming. Justify your answer.

Compression method ..... lossy .....

Justification ..... It reduce file more than lossless. The buffering time is reduced. Data can be removed which cannot be seen. .....

[3]

(c) The video conference is accessed over the internet.

Complete the table by stating how modems **and** dedicated lines are used when data is transmitted over the internet.

Hardware	Use
modems	It convert digital to analogue for transmission down phone lines.
dedicated lines	Used to provide a private connection for faster transmision

[2]

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3 A computer stores images and text files.

(a) One of the images is a bitmapped image.

Complete the table by writing the answer for each statement.

Statement	Answer
the term for the smallest element that makes up an image	Pixel
the largest number of different colours that can be represented with a bit depth of 8 bits	256
the term for the dots per inch (dpi) when an image is displayed	Screen Resolution (screen)

[3]

(b) The text in the files is stored using the Unicode character set.

(i) Give **two** advantages of using the Unicode character set instead of using the ASCII character set.

1 A wider range of characters can be represented

2 more languages can be represented.

[2]

(ii) The Unicode character '❮' has the binary value: 0010 0111 0110 1110

Convert the binary value for the character '❮' into denary.

10,094 [1]

(iii) The Unicode character '∑' has the hexadecimal value 2140

Convert the hexadecimal code for the character '∑' into denary.

8512 [1]

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4 A shop installs a new system that allows users to purchase items without going through a manual checkout.

The new system:

- identifies customers when they enter the shop and matches them to their account
- prevents a customer from walking through the automatic barriers if they do not have an account
- automatically detects the items that a customer has taken from a shelf and charges these to the customer's account.

(a) The new system uses digital cameras and Artificial Intelligence (AI) to identify the customers.

Explain how the new system uses AI to identify each customer.

It uses image recognition. measures the distance between facial features values in a database of user information An image is captured using camera. AI identifies that the image is a face by analysing the pixels to final pattern. Facial feature are compared to database.

[4]

(b) The new system uses sensors to identify the items taken from a shelf.

Identify **one** type of sensor that can be used in this new system.

State how the sensor can be used to identify the items taken from a shelf.

Sensor Pressure

Use detects when the pressure of an item is removed from shelf.

[2]

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CH-8

5 A company builds and sells furniture to customers. The company stores data about customers, their payment cards and their furniture orders in a database.

The database, FURNITURE, has the following tables:

CUSTOMER(CustomerID, Name, Phone)

CUSTOMER_CARD_DATA(CardID, CustomerID, CardType, CardNumber, EndDate)

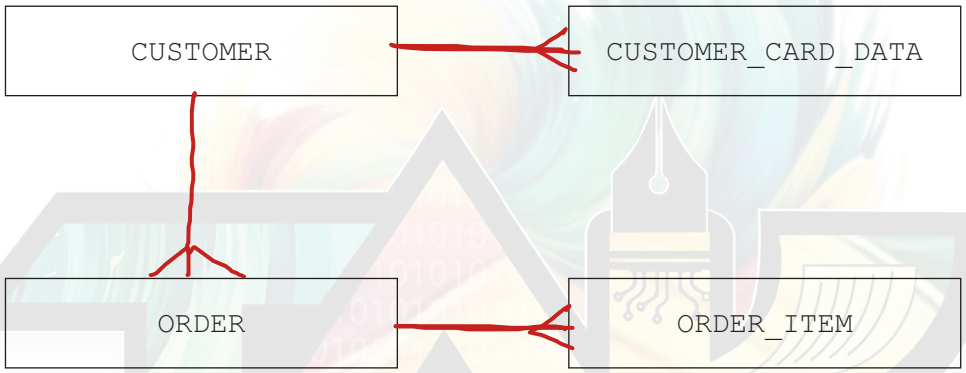
ORDER(OrderID, CustomerID, TotalCost, Paid, OrderDate, Complete)

ORDER_ITEM(OrderItemID, OrderID, Type, Height, Width, Depth, Details)

The primary keys are underlined in each table.

The attribute Complete in the table ORDER stores the Boolean value TRUE if the order has been built and FALSE if the order has not been built.

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



[3]

(b) Identify **one** attribute in the table CUSTOMER_CARD_DATA that could be a candidate key.

Card Number ..... [1]

(c) Identify **two** tables in the database that contain one or more foreign keys.
Give **one** attribute that is a foreign key in each table.

	Table	Foreign key
1	ORDER_ITEM	ORDER ID
2	CUSTOMER_CARD_DATA	Customer ID

[2]

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(d) Explain the reasons why the data in the table `ORDER_ITEM` cannot be stored in the table `ORDER`

It would not be in INF due to repeating group of attributes. Database should be normalised.

[3]

(e) Write an Structured Query Language (SQL) script to output the customer ID, the customer's name and the total cost of the customer's orders that have **not** been paid.

The output of the total cost must have an appropriate title.

```
SELECT CUSTOMER.CustomerID, CUSTOMER.NAME
       SUM(ORDER.TotalCost) AS TOTALX
FROM CUSTOMER INNER JOIN ORDER
  ON CUSTOMER.CustomerID = ORDER.CUSTOMERID
WHERE ORDER.Paid = FALSE
GROUP BY Customer.CustomerID,
```

[4]

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CH-3

6 A programmer is buying a new computer.

(a) The programmer is considering the following two computers:

Computer 1	Quad-core 2.2 GHz processor 16-bit architecture 1 GB Random Access Memory (RAM) 500 GB magnetic hard disk
Computer 2	Dual-core 3.8 GHz processor 32-bit architecture 2 GB RAM 500 GB solid state drive (SSD)

(i) Computer 1 has a magnetic hard disk.

HDD

Complete the description of the principal operation of a magnetic hard disk by writing the missing words.

The magnetic hard disk has one or more ..platters.. that can be magnetised. These are mounted on a ..spindle.. and rotate at high speed.

A ..read / write head.. is moved across the surface on an arm.

When data is read, the changes in the ..magnetic field.. produce a change in the electric current.

[4]

(ii) The two computers have different amounts of RAM.

Explain how different amounts of RAM affect the performance of a computer.

Slower Access time.
Less latency without need to use virtual memory.

[3]

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(iii) The two computers have different bus widths.

Explain how different bus widths affect the performance of a computer.

Wider data bus means more data can be transfered between components at a time. There is less delay.

[2]

(b) Both computers have an Operating System (OS).

Describe the purpose of an OS in a computer.

To provide a user interface so that the user is able to communicate with the hardware. To manage the memory so that data can be stored and accessed and multitasking is possible. To manage inputs and outputs from hardware. To handle processes to make sure each process has fair access.

[5]

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CH - 6

7 A banker stores personal data on their work computer.

(a) The banker needs to transfer confidential data across the internet.

Identify and describe **one** method of restricting the risks posed by an unauthorised person intercepting the data whilst it is being transferred across the internet.

Method Encryption

Description The data is encoded, if intercepted it cannot be understood without being decrypted using a key.

[3]

(b) The banker receives confidential data across the internet. The data includes a digital signature.

Explain how a digital signature can make sure the data has **not** been changed during transmission.

The sender hashes the document to produce a digest. The message and the signature are sent to the banker, receiver decrypts the signature to reproduce the digest. The receiver compares this digest with the one from the digital signature.

[5]

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(c) The data that is transferred can also be verified using a checksum.

Explain how data can be verified using a checksum.

The data is put through an algorithm so to create a checksum value. The receiver performs the same algorithm on the data if both checksums match the data is verified.

[3]

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8 **(a)** The following table shows part of the instruction set for a processor. The processor has two registers: 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
INC	<register>	Add 1 to the contents of the register (ACC or IX)
STO	<address>	Store the contents of ACC at the given address
ADD	#n/Bn/&n	Add the number n to the ACC
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX)
JMP	<address>	Jump to the given address
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
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

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The current contents of memory are:

address	Instruction
80	10
81	8
82	80
83	81
...	
200	LDD 81
201	INC ACC
202	STO 83
203	LDI 82
204	CMP 83
205	JPE 209
206	LDD 83
207	ADD #10
208	JMP 210
209	DEC ACC
210	STO 81
211	END

Trace the program currently in memory using the following trace table.

Instruction address	ACC	Memory address			
		80	81	82	83
		10	8	80	81
200	8				
201	9				
202					9
203	10				
204					
206	9				
207	19				
208					
210			19		

[4]

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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>
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 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		

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(i) Write the bit manipulation instruction that can be used to set the least significant bit to 1 in an 8-bit register. All other bits must remain unchanged.

The instruction needs to work on a register that contains any 8-bit binary number.

OR #1 ..... [1]

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

0	1	0	1	0	1	0	1

Write the result after the instruction `XOR &FE` is run.

1	0	1	0	1	0	1	1

[1]

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

0	1	1	0	1	0	1	1

Write the result after the instruction `LSR #5` is run.

0	0	0	0	0	0	1	1

[1]

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