

Candidate Name

Candidate Number

Centre Name

Centre Number

Paper 1: Theory Fundamentals

For Examination December 2023

(1 hour 30 minutes)

You must answer on this question paper.

It is necessary to respond on the answer sheets provided alongside this question paper. Additionally, you must have a soft pencil (preferably of type B or HB), a clean eraser and a dark blue or black pen.

INSTRUCTIONS:

- You must write your name, candidate number, centre name and centre number on the answer sheets in the designated spaces.
- Attempt all the questions from using a dark blue or black pen.
- It is important to follow the instructions provided on the answer sheets.
- Do not use correction fluid.
- Avoid writing on any bar codes.
- Maximum Mark: 75

Q1.

- a. Add the binary numbers 0101+1101. Show your working. [1]

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- b. Convert **13.125** from a decimal to a fixed-point binary number. [2]

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- c. Name **one** benefit of increasing the number of bits after the point in a fixed-point binary number. [1]

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- d. To store a normalized floating-point binary number, 10 bits are given for the mantissa and 6 bits for the exponent. Find the decimal value of the binary number 1 010110000 000011. Show your working. [4]

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Q1 TOTAL: 8

Q2.

- a. Explain the difference between data privacy and data security. [2]

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- b. Describe **one** benefit and **one** drawback of using encryption. [2]

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- c. State **one** method to protect against phishing. [1]

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Q2 TOTAL: 5

Q3.

The administrator of a pizzeria plans to introduce a new automated system for processing orders and organizing pizza delivery.

- a. Describe **two features for each** of the following system development life cycle models that could be used to develop the new system:

[4]

Spiral:

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Waterfall:

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- b. The developer can use observation or a questionnaire to collect data before developing the new system.

- i. State one benefit of using a questionnaire [1]

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- ii. State one benefit of using observation. [1]

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- c. To order pizza customers need to fill out an online form. The order data is saved for further transfer to the operator. Draw a Level 1 Data Flow Diagram (DFD) to show this process. [4]

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- d. Give two advantages of automating the system. [2]

i.
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ii.
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- e. **Name** and **describe** one method of changeover that the developer can use to implement the new system.

[2]

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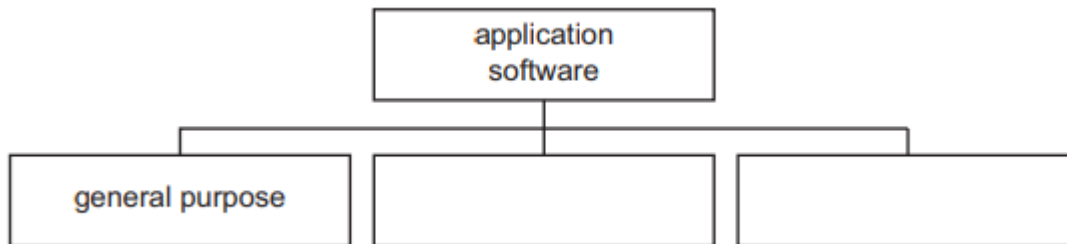
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Q3 TOTAL: 14

Q4.

- a. Complete the diagram to show the classification of application software. [2]



- b. The operating system provides a user interface.

State **two other functions** of the operating system [2]

i.

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ii.

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- c. Give one example of a situation in which the natural language interface is used. Explain why. [2]

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- d. Give one advantage and one disadvantage of using a gesture recognition interface. [2]

Advantage:

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Disadvantage:

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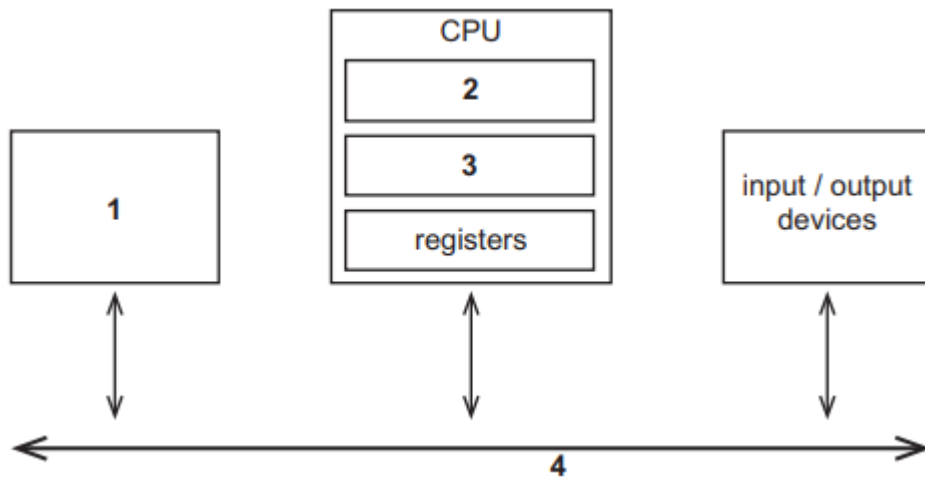
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Q4 TOTAL: 8

Q5.

a. Fill the gaps in the diagram.

[4]



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b. Explain the steps of the Fetch-Decode-Execute cycle using register notation:

PC, MBR, MAR, CIR.

[4]

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c. Describe the purpose of the data bus.

[1]

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cii. Identify the largest number the 9-wires width data bus can carry at one time.

[1]

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- d. State two ways to increase performance of PC. [2]

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Q5 TOTAL: 12

Q6.

A processor features a singular general-purpose register known as the Accumulator (ACC), accompanied by various specialized registers. The table below displays a portion of the instruction set designed for a processor equipped with 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 present contents of the primary memory and specific values from the ASCII character set are displayed.

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

- a. Create the trace table for the program presently stored in the primary memory. [6]

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

(a) Describe three differences between RAM and ROM. [3]

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2.
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3.
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b. State one advantage and one disadvantage of using virtual memory. [2]

Advantage:

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Disadvantage:

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c. Explain the purpose of the virtual machine [2]

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d. Describe **two** benefits of using biometric data to ensure information security. [2]

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e. The government collects biometric data of people.

Discuss potential ethical issues and security risks in this situation. You should include the following issues:

- security vulnerabilities for collection;
- security vulnerabilities for storage;
- personal freedom and democratic rights. [7]

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Q7 TOTAL: 16