Index Number:

UNIVERSITY OF COLOMBO, SRI LANKA

FACULTY OF TECHNOLOGY

LEVEL II EXAMINATION IN TECHNOLOGY – Semester I – 2019

IA 2003 – Computer Architecture I

Answer **All Questions**
Time: **Two (02) hours**
No. of Pages: **14**
Total **100 marks**

Important Instructions to Candidates

- This paper consists of 04 questions. Answer all questions.

- If a page or a part of this question paper is not printed, please inform the supervisor immediately.

- Enter your Index Number on all pages in the answers script.

- **STRUCTURED ESSAY TYPE: Write the answers to these questions in the space provided in the question paper.**

- Electronic devices capable of storing and retrieving text, including electronic calculators, dictionaries and mobile phones are not allowed.

Question	Marks
1	
2	
3	
4	
Total	

1. a). Explain each of the following terms in your own words.

   (i). Digitization

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   …………………………………………………………………………..................

   (1 mark)

   (ii). Character code

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   …………………………………………………………………………..................

   (1 mark)

   (iii). Mantissa

   …………………………………………………………………………..................

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   (1 mark)

   (iv). EPROM

   …………………………………………………………………………..................

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   (1 mark)

   (v). Opcode

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   (1 mark)

b). What are the two major approaches to store real numbers in modern computing?

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(2 marks)

c). (i). What are the ranges of 16-bit and 32-bit integers in 2's complement "unsigned" and "signed" representations?

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(4 marks)

(ii). Give the values of +127, 0, -127 in 8-bit sign-magnitude and 8-bit 1's complement signed representation.

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(6 marks)

d). Convert the fractions given in Table 1.1 appropriately.

Table 1.1

Binary		Octal		Decimal		Hexadecimal	
10.11_2		(i). ………………		(ii). ………………		(iii). ……………..	
(iv).		13.1463_8		11.20_{10}		(v). ……………..	
(vi). ……………		(vii). ………………		(viii). ………………..		$AB.11_{16}$	

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(4 marks)

e). Express the following numbers in IEEE 32-bit floating point format.

(i).   -7

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(2 marks)

(ii)   2.5

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(2 marks)

2. a). Draw the circuit diagrams for the following Boolean functions using only NAND gates.

    (i). $F(X,Y) = \overline{(X + Y)} + (\overline{X} + \overline{Y})$

(2 marks)

    (ii). $F(X, Y, Z) = X.Y + \overline{Z}.Y$

(2 marks)

(iii). $F(X, Y, Z) = X.\overline{(Y + Z)} + \overline{Y}.\overline{X}$

(2 marks)

b).   Evaluate the following Boolean function and Boolean expression respectively.

(i). $F(A, B, C) = (\overline{A.C} + B).C$

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(3 marks)

(ii). $\overline{(A + B)} = \overline{A}.\overline{B}$

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(3 marks)

c). Typically, the sequential circuits rely on feedback in order for retaining their state values and, the feedback in digital circuits occurs when an output is looped to the input.

(i). What is the most basic sequential logic component?

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(2 marks)

(ii). Draw the circuit diagram for the above mentioned component using appropriate logic gates and show the corresponding truth table.

(4 marks)

(iii). What are the applications of sequential logic circuits in computers?

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(2 marks)

d). Illustrate the function of the logic circuit shown in Figure 2.1.
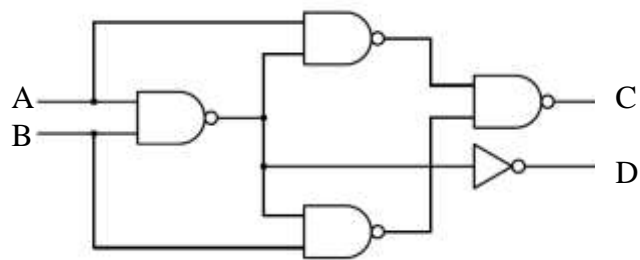
Figure 2.1

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(5 marks)

3. a). (i). What is the main idea of von Neumann microcomputer design?

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(2 marks)

   (ii). Discuss the difference/s between von Neumann and Harvard architectures using suitable block diagrams.

(4 marks)

b). A computer memory unit stores binary information in groups of bits called words.

(i). Illustrate a computer memory unit using a block diagram.

(2 marks)

(ii). When consider the computer memory, what is the role of a floating gate transistor (FGT)?

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(3 marks)

(iii). What are the write mechanism and the erasure of RAM?

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(2 marks)

c). Programmable Logic Device (PLD)s are used to design combination logic together with sequential logic and, it can be categorised into three main groups; ROM, PLA, and PAL.

(i). What are the limitations of ROM?

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(2 marks)

(ii). Give the meanings of "PLA" and "PAL".

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(2 marks)

(iii). Explain the significant difference/s between PLA and PAL systems.

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(2 marks)

(iv). Implement the PLA system given in Table 3.1.

Table 3.1

X2	X1	X0	Z1	Z2
0	0	0	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	1	0
1	0	0	1	1
1	0	1	0	0
1	1	0	0	0
1	1	1	0	1

(6 marks)

4. a). (i). Illustrate the structure of IAS (Institute of Advance Studies) computer which was the first-generation computer found in 1946.

(4 marks)

(ii). What are the IAS memory formats for a number word and an instruction word?

(4 marks)

(iii). What are the main stages of the processor instruction cycle?

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(3 marks)

(iv). Draw the state diagram of processor instruction cycle.

(4 marks)

b). Describe the following instruction set operations.

   (i). Move

   …………………………………………………………………........................

   …………………………………………………………………………………..

   (1 mark)

   (ii). Negate

   …………………………………………………………………........................

   …………………………………………………………………………………..

   (1 mark)

   (iii). Pop

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   …………………………………………………………………………………..

   (1 mark)

c). (i). Describe the function of "Data Multiplexing".

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   (1 mark)

   (ii). Compare and contrast Frequency Division Multiplexing and Wavelength Division Multiplexing.

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   (2 marks)

d). Three computers which have different data transferring rates are connected to a multiplexer and their information are illustrated in Table 4.1.

Table 4.1

Computer	Data transferring speed/Mbps	Data label
A	30	a
B	0	0
C	20	b

Give the output data streams from the multiplexer, if the system supposed to use following multiplexing techniques.

(i). Synchronous Time Division Multiplexing

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(2 marks)

(ii). Statistical Time Division Multiplexing

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(2 marks)