Diploma in Science in Laboratory Technology

EED3308 Introduction to Computer Systems

Department of Electrical and Computer Engineering
The Open University of Sri Lanka

Academic Year: 2023
Examination: Final Examination
Duration: 3 hours.

Date: 18th August 2024 **Time: 09.30 – 12.30**

Instructions:

- This question paper has four questions in four pages.
- **Answer all questions.**
- This is a closed-book type test.
- Do not use red colour pens for answering questions.
- Non-programmable calculators are allowed.

Q1.

I.

a) Briefly explain the terms: Control Unit, Arithmetic-Logic Unit, Accumulator, Data Bus, Address Bus, Instruction Register, Program Counter, Flags.

b) Draw the basic diagram of an **Accumulator Architecture** and explain how the above components work together in this architecture when executing the operation, " **5 + 8** ". Assume that both values, 5 and 8, are stored in memory.

(12 Marks)

II.

a) Briefly explain the Simple Instruction Format in computer architecture with the help of a diagram.

b) Briefly explain the term "Addressing Mode" and state four basic addressing modes.

(6 Marks)

III. Consider five numbers stored in memory locations: a, b, c, d, and e. You need to calculate the following expression using an accumulator architecture processor:

$$(2a + b - (c - d)) * e$$

a) Write down the step-by-step process to perform this calculation in an accumulator-based processor.

b) Write the corresponding assembly instructions to execute this operation. Refer *table 1* in **Appendix A** for assembly instructions.

Assume that the entire result of the multiplication operations can be stored in the registers/ memory locations.

(12 Marks)

Q2.

I. Compare the features of Von Neumann Model and Harvard Model using a table.

(3 Marks)

II. Briefly explain the characteristics and advancements of fourth-generation computers in computer history

(2 Marks)

III. Convert the following binary number to decimal. Show the immediate calculation steps.

a) Convert 10101.101_2 to its decimal equivalent.
b) Convert 101111001011101_2 to its hexadecimal equivalent.
c) Convert 381.37_{10} to its binary equivalent.

(5 Marks)

IV. Perform the following binary operations. Show the immediate calculation steps.

a) 101.01×101
b) $10011 \div 101$

(6 Marks)

V. Find the 'x' of the following equation by using the 2's complement method. Show the immediate calculation steps.

$$x = 37 - 72$$

(3 Marks)

VI. Convert -251.29_{10} number to IEEE 754 Single precision floating point format. Show the immediate calculation steps.

(6 Marks)

Q3.

I. Define the following terms in networking.

a) Domain Name Server (DNS)
b) Router
c) Protocol
d) Server
e) IP Address

(5 marks)

II. Explain the reason for using shielded twisted pair cables in networking instead of unshielded, untwisted pair cables.

(2 marks)

III. Name and briefly describe four fundamental network topologies.

(4 marks)

IV.

a) Briefly explain what OSI reference model is and describe how each layer functions in a computer network with the help of a diagram.

(5 marks)

b) With the help of a diagram, compare and contrast the TCP/IP model with the OSI reference model **in point form**, highlighting the key similarities and differences in their structure and functionality.

(3 marks)

V.

a) How do you know whether two IP addresses are on the same subnet? Explain using an example.

(2 marks)

b) Compare IP address Class A and Class C using a table, considering the following features: Decimal Range, Number of Networks and Hosts available, and Subnet Mask

(4 marks)

Q4.

I. Briefly describe the main steps you followed to assemble a personal computer from its components, **in point form**.

(8 marks)

II. Discuss the role of an operating system in managing hardware and software resources on a newly assembled computer.

(5 marks)

III. Describe how you set up a simple network between two computers using a network cable, in point form. Include the basic steps for configuring network settings.

(7 marks)

Appendix A

Table 1: Accumulator Architecture Instructions

Mnemonic	Syntax	Operation	Description	Add Mode	Flags affected
Arithmetic instructions					
ADD	ADD AM x	Addition	Acc ← Acc + op	#,&,default	ZF, OF, SF, PF =1
SUB	SUB AM x	Subtraction	Acc ← Acc - op	#,&,default	ZF, OF, SF, CF, PF =1
MUL	MUL AM x	Signed multiplication	Acc (16 bit) ← Acc(8 LSBs) * op(8 LSBs)	#,&,default	ZF, SF, PF =1, OF, CF=0
DIV	DIV AM x	Unsigned division	Acc ← Acc / op2	#,&,default	ZF, SF, PF =1, OF, CF =0
LOADacc	LOADacc AM d	Copy the operand to the accumulator	Immediate: Acc ← op; Direct: Acc ← memory (op)	#, default	none
STOREacc	STOREacc AM d	Copies the accumulator to the memory address	Direct: Memory (op) ← Acc Indirect: Memory (memory (op)) ← Acc	default, &	none

*Immediate operand is used as the jumping location.
**Contents of the implied return address is used as the jumping location
x- Memory Address or immediate value, d- Displacement

Addressing Modes -AM

Immediate	#
Direct	default (blank)
Indirect	&