

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



Study Programme	: Bachelor of Technology Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	: EEX3336 Communications and Computer Technology
Academic Year	: 2020/2021
Date	: 12 th February, 2022
Time	: 1400 - 1700 hrs
Duration	: 3 hours

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **four (4)** questions in **three (3)** pages.
3. Answer all **four** questions.
4. Answers for each question should commence from a new page.
6. This is a Closed Book Examination.
7. Answers should be in clear handwriting.
8. Do not use red colour pens.

Answer all four questions. Write your answers clearly. Write all relevant intermediate steps when answering question 2.

1)

- a) Consider the diagram given in Figure 01, which shows a general structure for performing arithmetic and logic operations in an accumulator based microprocessor. It has the following components: Arithmetic and logic unit (ALU), Control Unit (CU), an instruction register (IR), Accumulator (Acc), register R. The ALU performs the arithmetic and logic functions according to the signals (operations) given by the CU, based on the instruction loaded to IR.

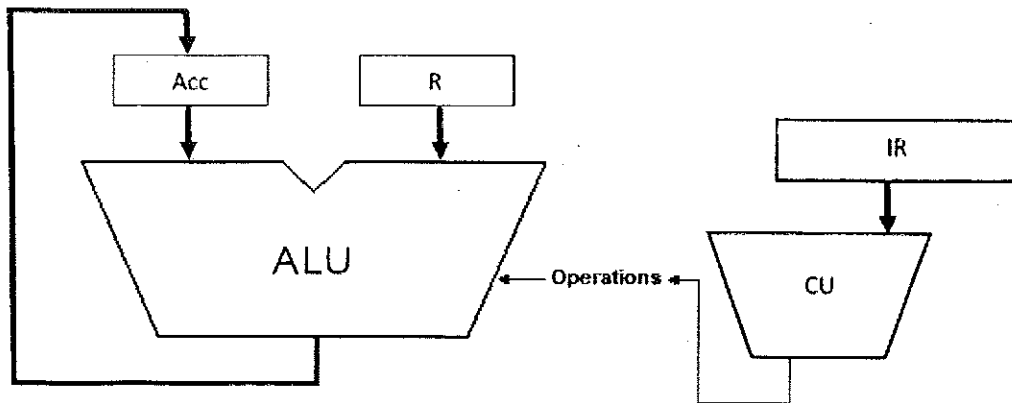


Figure 01: Integration of CU and IR with ALU

- Expanding the diagram in Figure 1, draw a complete diagram for Accumulator based hypothetical processor connecting with the memory module and other special-purpose registers (MAR, MDR, PC and Flag register). In your diagram, you must show the connectivity of these registers.
- Briefly describe the functionality of the registers MAR, MDR, PC and Flag register.
- Using your diagram, explain the Fetch execution cycle of a processor.

(25 Marks)

- b) A student suggests an ISA for the hypothetical microprocessor given in question 1)a) with a FLAGS register [including zero flag (Z), Carry flag (C), and sign flag (S)]. The set of instructions is given in the following table.

Instruction	Description (Acc: Accumulator)	Setting flags
MOV MA	Moves content of the memory address <i>MA</i> to the register R.	-
MOVI Data	Moves the value <i>Data</i> to the register R.	-
LOAD Data	Load the value <i>Data</i> to the Accumulator	-
LOADR	Load register_value R to the Accumulator	-
ADD	Add register_value R to Acc_value	Z=1 when Acc_value=0, or otherwise Z=0. S=1 when Acc_value<0, or otherwise S=0.

SUB	Subtract register_value R from Acc_value	Z=1 when Acc_value=0, or otherwise Z=0. S=1 when Acc_value<0, or otherwise S=0.
SHL	Shift the Accumulator left by 1 bit	C= bit shifted by Acc
SHR	Shift the Accumulator right by 1 bit	C= bit shifted by Acc
HLT	Halt the operation	-
STO MA	Writes Acc_value into the memory location MA	-
JMP label	Absolute branching to a given label	-
JS label	Branch will be taken if flag S=1	-
JZ label	Branch will be taken if flag Z=1	-

- i. As there are no instructions for multiplication and division operations, some students argue that the given ISA is incomplete. Is it possible to do multiplication and division operations using this ISA? Justify your answer.
- ii. You need to calculate the Continuous Assessment (CA) mark for a course having three activities using the following formula.

$$CA\ Mark = 0.5 * Act1 + 0.25 * Act2 + 0.25 * Act3$$

Act1, *Act2* and *Act3* are the marks obtained for 3 different activities. These marks are stored in the memory locations *m1*, *m2*, and *m3* respectively. Moreover, the CA mark will be stored in the memory location *m4*. Using the given ISA write a piece of assembly code with suitable comments to perform this task. You may consider the integer part of the value for every calculation.

(15 Marks)

2) Write all relevant intermediate steps when answering questions from (a) to (d)

- a) Convert the following decimal integer and fraction to binary.
 - i. 76 (01 Marks)
 - ii. 0.701 (Truncate answer at 4th bit after binary point) (02 Marks)
- b) Perform the following binary arithmetic operations:
 - i. $1011101 - 100110$ (show the borrow bits clearly) (02 Marks)
 - ii. $1011010 \div 101$ (perform long division) (03 Marks)
- c)
 - i. Calculate the decimal equivalent of 100011.101_2 (02 Marks)
 - ii. Write the number in above i, in binary floating point format (02 Marks)
 - iii. Calculate the value of *y* in the following equation
 $12_H - 11010_2 + 114_y = 122_4$ (03 Marks)
- d) Perform 6 -15 by using 2's complement techniques. (05 Marks)

3)

- a) Draw a block diagram of a general data communication network model, and clearly name each block. (03 marks)
- b) Describe the operation of a client-server network architecture using three (03) users' desktop computers, one (01) printer and one (01) server. Clearly draw an appropriate network diagram to support your answer. (03 marks)
- c) Describe the main functions, specific ports or relevant protocols used to establish connectivity and how each device is connected to the network of the following network devices.
i. Network interface card (NIC) ii. Modem iii. Router (06 marks)
- d) Consider a ring topology with six (06) users: A, B, C, D, E, F placed as shown in Figure 02. Suppose A has the token at time 't'. A (sender) wants to send a message to D (receiver). Explain the process of communication between A and D with suitable diagrams. In your answer, clearly explain how the token is released and how the message is passed from the sender to the receiver. (08 marks)

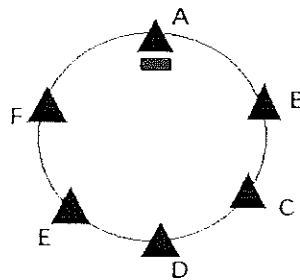


Figure 02

4)

- a) Show the structure of an IPv4 address explaining the functions of different parts of it. Clearly describe the IP address classes considering IPv4. (04 marks)
- b) Consider a signal that travels through a transmission medium. The Relationship between the input power (P_{in}) and output power (P_{out}) is $P_{in} = 1.5P_{out}$. Calculate the attenuation during transmission in dB. (03 marks)
- c) In a laboratory setup, it is observed that the amplitude modulated signal has $V_{max(p-p)}$ value read on the oscilloscope screen is 6.2 divisions and $V_{min(p-p)}$ is 1.5 divisions. Calculate the modulation index (m) ? (03 marks)
- d) Identify main categories of noise sources present in wireless communication systems and explain the consequences of presence of noise and interferences. (04 marks)
- e) Your friend has recently purchased a laptop computer. He has a stable WiFi connection to access the Internet. He wants to share a Microsoft Word Document and 30MB image files securely to another friend living in a different country using Google email (Gmail) or WhatsApp. What will be your suggestion to your friend in selecting security options to share the files? Give reasons. (06 marks)