00125

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	**: EEX3533/ ECX3233**
Academic Year	: 2019/2020
Date	: 02nd October 2020
Time	: 0930-1230hrs
Duration	: **3 hours**

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **five (5)** questions in **four (4)** pages.
3. Answer **four** questions including question 1.
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 four questions including question 1. Write your answers clearly. Write all relevant intermediate steps when answering question 2.

1)

a) One dimensional array data structure (1D-array), is a data structure consisting of a collection of elements (values), each identified by its position in sequence.

Consider an examination of a course having three written papers, all compulsory. Assuming that each candidate has either sat all three papers or been absent, a 1D-array of integers is formed to be used as the input for the result processing program. So, the array embodies any possible combination of blocks of integer numbers *(in the following two general forms)*, depending on the numbers of present and absent candidates.

Present:

ind	m_1	m_2	m_3

Absent

ind	*-1*

Where, ***ind*** represents index number of candidate *(ind; 101<=ind<=999)*,
m_i represents marks (%) for a particular paper

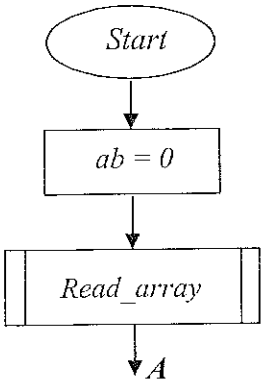
A sample pattern of the array will look like the following:

101	34	56	40			105	-1	202	48	65	33			1000

Assuming that the array ends with the special number *1000*, draw a flowchart to show the algorithmic logic of the program to perform the following tasks by processing the whole array:

i. Read numbers in the array sequentially, one at a time
ii. Count the number of absentees (*ab*)
iii. Calculate the total marks *(total)* and average mark *(avg)* of each present candidate, and display *ind, total* and *avg*
iv. Display the count of absent candidates at the last step of the algorithm.

Use the same set of flowcharting symbols accepted during your continuous assessment activities. Use the variable identifiers given within brackets as appropriate.
State assumptions if any.
Hint: You should start with the steps given in the following diagram and next construct looping mechanism(s) to complete the algorithm.



At each call, the pre-processor *Read_array*
- reads the current number from the array and outputs it as ***A***,
- increments the array index by *1*.

(28 Marks)

b) Consider an ISA of a hypothetical microprocessor with an accumulator and two registers R1, R2 and a FLAGS register [with zero flag(Z) and sign flag (S)]. Assume the values in R1, R2 be r_1, r_2 respectively. And initially, $r_1 > 0$, $r_1 <> r_2$. Write a piece of assembly codes with suitable comments to perform the following task.

Continue to repeat each of the following consecutive operations when satisfying the condition $r_2 > r_1$ (**Hint**: Check for $r_2 > r_1$ before doing each operation)

Operation 1: Replace r_1 by $2*r_1$

Operation 2: Replace r_2 by r_2-r_1

Use the following set of instructions when you are writing the assembly codes. You should start your codes with the instruction *MOV R2.*

Instruction	**Description (Acc: Accumulator)**	**Setting flags**
MOV R_i	Moves register_value R_i to Acc.	-
ADD R_i	Add register_value R_i to Acc_value	Z=1 when Acc_value=0, or otherwise Z=0. S=0 when Acc_value>0, or otherwise S=1.
SUB R_i	Subtracts register_value R_i from Acc_value	Z=1 when Acc_value=0, or otherwise Z=0. S=0 when Acc_value>0, or otherwise S=1.
HLT	Halt the operation	-
STO R_i	Writes Acc_value in to register R_i	-
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	-

(12 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. 83 *(01 Mark)*

ii. 0.350 (Truncate answer at 4th bit after binary point) *(02 Marks)*

b) Perform the following binary arithmetic operations:

i. 110001 - 11011 *(show the borrow bits clearly)* *(02 Marks)*

ii. 10010110 ÷ 110 *(perform long division)* *(03 Marks)*

c)

i. Calculate the decimal equivalent of 101110.11_2 *(02 Marks)*

ii. Calculate the value of y in the following equation
$51_8 + 123_y - 111111_2 = 10_H$ *(03 Marks)*

iii. Convert $B79_H$ to its octal equivalent *(02 Marks)*

d) Perform -7-12 by using 2's complement techniques. *(05 Marks)*

3)

a) Sketch the following table and fill its cages briefly to compare and/or contrast the two network technologies Ethernet and Token ring. *(08 Marks)*

	Ethernet	Token ring
Topology		
Access method		
Speed		
Cost		

b) Explain the terms (i) circuit switching and (ii) packet switching with suitable examples. *(04 marks)*

c) What is the connecting device that overcome attenuation and pulse distortion through a computer network? Sketch a diagram to demonstrate how it is connected. Does it increase the bandwidth or speed of data transmission? *(04 marks)*

d) Suppose that you have to subnet your class C network 192.168.1.0 with a subnet mask of 255.255.255.240. *(04 marks)*

i. Calculate the number of networks,
ii. Calculate the number of hosts per network.

4)

a)

i. Explain the concept of *virtual machine* used in computer technology. *(04 Marks)*

ii. Write three major characteristics (or components) that a virtual machine offers to build much easier and tractable work environment for the user. *(04 Marks)*

b)

i. Write what the input and the output of a compiler are. *(02 Marks)*
ii. Name four main phases of the compilation process. *(04 Marks)*

c) Define a 2D array in *Pascal* format to represent the telephone call data in following table, and assign the data shown in Bold (i.e 105) to appropriate array element.

	Phone1	Phone2	Phone3
toMobitel	52	6	22
toDialog	3	17	**105**
toLand	10	88	16
IDD	2	1	5

(06 Marks)

5)

Consider a typical radio broadcasting system.

a) Draw a complete block diagram showing the communication system from the input point of the voice signal at the studio to the output of a radio receiver. Label the blocks and state the use of each block. *(4 Marks)*

b) List two advantages and two disadvantages of FM modulation over AM modulation.

(4x1 Mark)

c) Assuming a single tone sinusoidal input signal as specified below, draw the signal waveforms at following points when amplitude modulation (AM) is used.

(4x2 Marks)

i. Before feeding in to the AM modulator of the communication system.
ii. Output of the modulator, at the input to the wireless channel.
iii. At the output of the channel, before inputting to the demodulator.
iv. The output of the AM demodulator.

[Assume a single tone sinusoidal source signal with +1V peak amplitude and 100Hz frequency; assume a sinusoidal carrier signal with +1V peak amplitude and 1kHz frequency]

d) Let the output power of the modulator is 1W, power loss in the channel is 2dB and the transmitter and receiver antenna gains are 6dB and 3dB respectively. Assuming all the unmentioned components to have a negligible effect on the power budget, find the receiver antenna's output power. *(4 Marks)*