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

Study Programme	: Bachelor of Technology Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	**: EEX3533/ ECX3233 Communications and Information Technology**
Academic Year	: 2017/18
Date	: 05th February 2019
Time	: 0930-1230hrs
Duration	: **3 hours**

General Instructions

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 (4)** questions including question 01. Write all relevant intermediate steps when answering question 2. Question 1 carries 40 marks. All other questions carry equal marks.
4. Answer for each question should commence from a new page.
5. Relevant charts/ codes are provided.
6. This is a Closed Book Test (CBT).
7. Answers should be in clear hand writing.
8. Do not use Red colour pen.

Q1. [Compulsory]

a) Consider that you are working as a Programmer cum Systems analyst for an established computer training institute where hundreds of students are doing a one-year diploma programme. These students are having four continuous assessment activities during the year- two written tests and two practical tests. All four activities are evaluated separately and given percentage marks; ***t1, t2, p1, p2*** respectively. Students are then grouped into four categories (of eligibility) based on above marks and conduct the final examinations and repeat examinations if necessary. You are assigned to build a computer program to analyse the activity marks and hence prepare the annual eligibility report. Eligibility criterion is given in the Table #1 below.

Criteria1: Average of best three marks (out of *t1,t2,p1,p2) >= 40*	**Criteria2:** Average mark for practicals (PA) *>= 40*	Status of Eligibility
Yes	Yes	Eligible for the final examination
Yes	No	Repeat both practical tests (*if p1 < 50*)
Yes	No	Repeat practical test2 only (*if p1 >= 50*)
No	Yes/ No	Repeat the course next year

Table #1: *Eligibility Criteria*

Assuming that the students' index numbers and activity marks are available as a ***data file***, construct an algorithm to demonstrate the logic of your program and show it as a flowchart using standard symbols.
Your program should output a record for each individual student in the following format where CA mark is the average of best three marks out of *t1, t2, p1, p2*.

Index number *Status of eligibility* *CA mark (if applicable)*

Condition: In case the PA>=40 and CA is *39*, such a student is also listed as eligible with a CA mark of 40, but indicated in the report as " ***40**** ".
In your algorithm, it is compulsory to use the following two pre-processors, one instance each.

Read marks	Reads the student's index number and 4 activity marks from the data file (one student at a time) and stores in variables ***ind, t1, t2, p1, p2*** respectively.
Find minimum	Outputs the minimum of *t1, t2, p1, p2* as ***min***

Hint: Assume the number of students be ***n*** *and construct a loop statement.*

(28 Marks)

b) Consider an ISA of a hypothetical microprocessor (Table #2) with an accumulator and two registers R1, R2. Assuming that R1> R2 in terms of their initial values, write an assembly code to perform the following task.

Task: To repeat the following function until the instance that the values in R1 and R2 become equal.
Function: Decrement the value in R1 and then increment the value in R2.

Instruction	Description (Where "Acc" is Accumulator)
MOV R_i	Moves register_content to Acc
SUB R_i	Subtracts register_content from Acc_content
STO R_i	Writes Acc_content in to register
INC	Increments Acc_content
DEC	Decrements Acc_content
JMP label	Branching to given_label
JZ label	Branching to given_label, if Acc_content is zero
HLT	Halt the operation

***Table #2**: Available set of instructions*

(12 Marks)

Q2. ***Write all relevant intermediate steps when answering questions from (a) to (d)***

a) Convert the following decimal integer and fraction to binary.
i. 102 ii. 0.602 (Truncate answer at 4th bit after binary point)
(03 Marks)

b)
i. Calculate the decimal equivalent of *110011.012* *(02 Marks)*
ii. Calculate the value of m where $51_{16} = 1m2_8 - 11001_2$ where m denotes 2nd position of the octal number *1m2* *(03 Marks)*
iii. Convert the octal number *5722* to its hexadecimal equivalent *(02 Marks)*

c) Perform the following binary arithmetic operations;
i. 110011 - 1101 *(02 Marks)*
ii. 1011011 ÷ 111 (perform long division) *(03 Marks)*

d) Perform *-3-15* by using 2's complement technique. *(05 Marks)*

Q3.

a) Compare and contrast the two LAN technologies Ethernet and Token ring in terms of topology, access method and speed. Write your answer in a table format.
(06 Marks)

b) Sketch how a PC is connected to an Ethernet hub in horizontal wiring. Label your sketch.
(02 Marks)

c) Write the two major responsibilities of the network layer in ISO/ OSI reference model.
(04 Marks)

d) Consider that *.112.8* and *.113.9* denote the 3rd and 4th numbers of two 32-bit IP addresses respectively.
Perform necessary binary conversions and operations to find out whether these IPs are on the same subnet. The subnet mask is *255.255.254.0.*
(Considering the last 16 bits is adequate when writing the answer)
(08 Marks)

Q4.

a) Regarding computer programming, write three important characteristics of an algorithm.
(03 Marks)

b) Write two strategies (storage schemes) used to map data structures in computer memory.
(02 Marks)

c) Which scheme in above (d) is prominent to be implemented using pointer concept in Pascal?
(02 Marks)

d) Write a piece of Pascal code (or Pascal-like pseudo code) that adds corresponding elements of two 1-D arrays p & q and stores the answers as corresponding elements of a third 1-D array r.
In defining arrays p, q and r, assume them all to be integer type and of size 10.
(08 marks)

e) Sketch the node arrangement to represent the following three data items (x,y,z) in a linked list starting from memory address 50.
x at address 100, y at 150 and z at 200.
At the 3rd node, what are you to consider in addition?
(05 marks)

Q5.

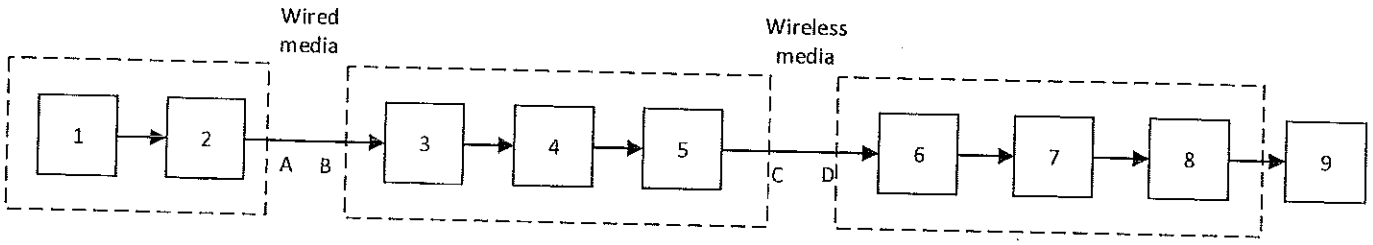

Figure Q5

Component List Q5

i. Amplifier with 12dB gain
ii. Antenna with 10dB gain
iii. AM Modulator with sinusoidal carrier $c(t) = 5\cos(10^6\,\pi t)$ and modulation index = 0.5.
iv. Envelope detection type AM demodulator
v. Speaker
vi. Microphone

Consider the cascaded voice communication system in Figure Q5 where AB wire length is 80m and CD distance is 2km.

a) List two advantages each in wired and wireless communication media. *(04 marks)*

b) Block 4 denotes the AM modulator given in Component List Q5 iii. Select the components from Component List Q5 for the blocks 1-3 and 5-9 in Figure Q5. [You may use the same component in the list for two blocks]

(8x0.5 marks)

c) If the input to the block 4 is given by $x(t) = 0.5\cos(2000\pi t)$, draw the waveform of the output of blocks 4, 6 and 8. *(03 marks)*

d) Find the power gain of block 4 for the input signal given in (c). *(04 marks)*

e) When the output power of block 2 is 0.1W and the signal in (c) is considered at block 4, output power of block 5 is 891W. Find the loss of the wire AB in dB/km. *(05 marks)*