THE OPEN UNIVERSITY OF SRI LANKA
Faculty of Engineering Technology
Department of Electrical & Computer Engineering

Bachelor of Technology Honors in Engineering

Final Examination (2016/2017)
ECX3233: Communications and Information Technology

Date: 19th November 2017 (Sunday) **Time: 9:30 am – 12:30 pm**

Answer four questions including question 1. Write your answers clearly. Write all relevant intermediate steps when answering question 2.

Q1.

a)

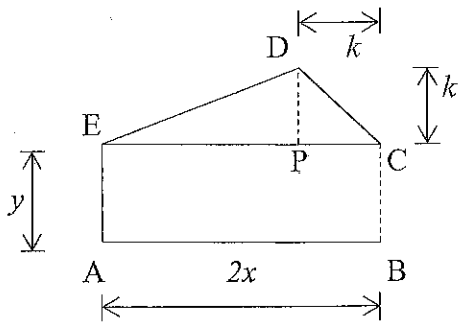

Figure 01

k and ***y*** are integers, each greater than 1.

Figure 01 shows five points A, B, C, D and E on a vertical plane that are initially fixed. When connected in alphabetical order, they form a polygon whose side AB is horizontal and ABCE is rectangular. P is a point on CE such that DP is vertical and DP=PC=*k*. Assume that the point D starts moving vertically down until D coincides with P. When D falls on P, D stops moving and instantly the point C starts moving vertically down until C coincides with B.
Consider that D and C move step-by-step, 1 unit in each step.

Construct an algorithm to demonstrate the above scenario and show it in a flowchart where you estimate and display the area of polygon ABCDE (***area***) in each step of D and C.

Condition: Implement the movements of D and C using a looping mechanism with a control variable ***i***, and estimate ***area*** using simplified expressions in terms of *x*, *k*, *i* and ***rect***, where *rect*=2*xy*.
Your algorithm should have an optimum number of steps.

Use the same set of flowcharting symbols that you used when doing your TMAs.
State all assumptions.

(28 Marks)

b) Consider a hypothetical microprocessor with an accumulator and three registers R1, R2 and R3. Given the Instruction Set Architecture (ISA) in Table 1, write a piece of assembly code to do the following tasks according to their order.

Task1: To repeat the following two consecutive functions, until R2 becomes less than or equal to R1 (by comparing R2's old value and R1's new value in each turn).

Function1: To add #3 to value in register R1

Function2: To store the value of [R2-R1] to register R2

Task2: To store the existing value in register R1 to register R3 and stop the operation.

Assume the initial values in registers R1 and R2 are positive integers.

Instruction	**Description (Acc: Accumulator)**
MOV R_i	Moves register_content to accumulator
STO R_i	Writes Acc_content in to register
SUB R_i	Subtracts register_content from Acc_content
ADD value	Adds immediate value to Acc_content
JMP label	Branching to given_label
JG label	Branching to given_label, if Acc_content is greater than zero
HLT	Halt the operation

Table 1: ISA 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. 99 ii. 0.704 (Truncate answer at 4th bit after binary point)

(3 Marks)

b)

i. Calculate the decimal equivalent of 110.101_2 *(2 Marks)*

ii. Expand the following equation to its positional notation and hence find the value of *m*.

$10111_2 + 110_m = 41H$ *(3 Marks)*

iii. Convert the hexadecimal value 28A to its octal equivalent *(1 Mark)*

c) Perform the following binary operations:

i. 10011011
00010111 +

(show the carry bits clearly)

ii. 1011
1101 x

(show partial products clearly)

(6 Marks)

d) Perform -14+8 using 2's complement technique. *(5 Marks)*

Q3.

a) Name two basic computer network models. By preparing a table, compare the two models in terms of centralisation and scalability.

(4 Marks)

b) Assuming two host computers ***Host A*** (sender) and ***Host B*** (receiver) communicating on a network, sketch and label the seven-layered architecture of ISO/OSI reference model. In your sketch, indicate using three arrows, how the data is transmitted from sender to receiver.

(8 Marks)

c)

i. What do the following abbreviations stand for?
NIC, HTTP, ADSL

ii. Write the access server type for each of HTTP, FTP.

(5 Marks)

d) Name the most secure but expensive type of connection used for WANs. Write two other alternative types of connections (*switching*) for WANs.

(3 Marks)

Q4.

a)

i. Sketch how block chaining is used in non-contiguous space allocation for a file on a disk. Consider three blocks of data only.

(4 Marks)

ii. Briefly explain why it is necessary for a two-pass assembler to read through the source code twice.
What is a *symbol table,* and what are the two fields in it?

(5 Marks)

iii. Write a brief note on the concept of **restoring data** with regard to computer security.

(3 marks)

b) An array type (2D) is defined as following in *Pascal* to represent 3x3 matrices.

Type arr = [1..3] of integer;

Write the rest of the code to fulfil the following tasks:

- Define two matrices using variables *m1* and *m2*
- Assign *1* for each element in *m1* and 2 for each in *m2*, using a repetition statement

(Note:- Full marks are given for complete code with correct syntax)

(8 Marks)

Q5.

a)

i. List three different types of wired communication media types and mention an advantage and a disadvantage of each. *(6 Marks)*

ii. A certain wire line in a communication system is fed with a signal having $P_t W$ of transmit power and the loss in the line is LdB per km. If the receiver threshold is $P_r W$ show that the maximum possible length of the wire is $\log_{10}\left(\frac{P_t}{P_r}\right)^{\frac{10}{L}}\ km$.

(4 Marks)

iii. Let transmit and the receiver threshold power values in above line be $1W$ and $10\mu W$ respectively. Loss of the wire is $12dB$ per km. Calculate the minimum required gain of the repeater if a single repeater to be employed at a suitable middle position of a $10km$ long wire. *(4 Marks)*

b)

A modulated signal is given by

$$S(t) = cos\,(990t) + 2cos\,(1000t) + cos\,(1010t).$$

Is this AM or FM? Justify your answer and find the carrier and information signals.

(6 Marks)