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

ECX3233 - Communications & Information Technology

FINAL EXAMINATION 2012/13

Date: 02nd August 2013 Time: 09.30 hrs – 12.30 hrs

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

1)

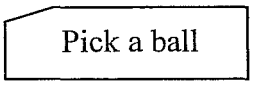
There is a bag full of a random mixture of rubber balls of different colours; Black, Green, Yellow and Red.

a) Organize an optimum algorithm and draw it as a flowchart to do the following tasks in order;

- Pick balls from the bag **one at a time** at random
- Put the balls into three initially empty bags depending on their colour. Bags are labelled as ***Red***, ***Green*** *and* **Discarded**. Black and Yellow ones are to be discarded.
- Display numbers of Red, Green and Discarded balls as the last step of your algorithm.

When drawing your flowchart, use the same standard set of symbols that you used in doing the assignments. Assume the number of balls in the bag as N. State any other assumptions clearly.

Hint: You are to apply a loop mechanism to process all N balls. Main input box of your algorithm may be the following;



(25 marks)

b) Suppose, you are given a new mixture of balls (again sized N) including white plastic balls in addition to rubber ones. And you require to process it so that you discard plastic balls as well, by adding a pre-processor "Ball_Type_Selector" to your algorithm. Pre-processor must have two conditional output paths when a ball is input.

Draw a separate diagram to show how you employ *Ball_Type_Selector* as a modification to your flowchart. No need to redraw the full diagram again, indicate the affected part only.

(05 marks)

c) Write down a piece of assembly code (routine) for the following function based on an ISA of a hypothetical machine with three registers R1..R3.

Function: Compare the values in *R1* and *R2*. If they are equal, set *R3* (R3 ← 1). Otherwise swap (exchange) the values in *R1* and *R2*. You are to use the following instructions only.

Instruction	Example Format	Description
LDAI	LDAI value	Load accumulator with immediate value
STA	STA X	Store value of accumulator to register X
LDA	LDA X	Load accumulator from register X
JMP	JMP Location	Jump to specific location
CMJ	CMJ X, Location	Jump to specific location if the value of accumulator equals to value of register X

Condition: You **must** use the two location labels *SET_R3* and *DONE,* where *DONE* is the end of routine.

(10 marks)

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

a) How many distinct binary values can we represent with 7 bits?
Justify your answer. *(02 marks)*

b) Convert the following decimal values to binary.
(i) 87 (ii) 10.725 (Truncate answer at 4^{th} digit after binary point)
(03 marks)

c) Find the following;
(i) Decimal equivalent of 110011.11_2
(ii) Decimal equivalent of octal value 765
(iii) Binary equivalent of $AC5.9_H$ *(03 marks)*

d) Perform the following binary arithmetic operations;
(i) 110100.011 - 11110.110 *(03 marks)*
(ii) 1101011 / 101 (Truncate answer at 3^{rd} digit after binary point)
(03 marks)

e)
(i) Represent -49 in 8 bit signed binary notation.
(ii) Subtract 13 from 5 by using 2's complement technique,
i.e. perform 5-13. *(06 marks)*

3)

a) Scenario:
People watch weather forecast on television at night.
If Meteorology Department forecast thunder showers tomorrow (MDFTST), two events follow;

(i) **Some people** accept it and take **care**
Worrika checks the **umbrella** in her office bag.
If she found it, **she does not worry** and if not **she tries to contact Borrowika**;
If she could contact Borrowika, **she blames Borrowika.** Otherwise **she complains to her sister** *(Borrowika's friend).*
Further, **she borrows mother's umbrella** and **she hopes no rain tomorrow**.

(ii) **Some do not care** about weather forecast at all.

Write down a **nested-if** statement to demonstrate the logic of the above scenario.
Condition:
You **must** make use of the text typed underlined and abbreviations typed in bold, in writing *conditions* and *statements* respectively.
Neglect the real situation among people with regard to weather forecast on TV.

(08 marks)

b) Write a piece of Pascal code (or Pascal-like pseudo code) that adds corresponding elements of two 1-D arrays A & B and to store the answer in a third 1-D array C. In defining A,B and C, assume them all to be integer type and of size 10.

(04 marks)

c) Sketch two diagrams to represent (and compare) the following programming approaches with respect to three major development steps; **design, code, test.**

(i) Traditional phased programming (all-in one approach)
(ii) Top-down programming (step-by-step approach)

(04 marks)

Write the first basic principle of top-down programming.

(02 marks)

d) Write a brief note on the concept of restoring data in view of computer security.

(02 marks)

4)

a)

(i) What do the following abbreviations stand for in computer network terminology? WAN, LAN and MAN.
(ii) Arrange, in ascending order (*smallest the first*), the above three with respect to their spanning area on the ground of location.
(iii) Which is correct; *"a LAN is a node of a WAN"* or *"a WAN is a node of a LAN"* ?

(03 marks)

b) Sketch a diagram to represent *Ring* topology of five PCs in a LAN. Write a brief note on the performance of *Ring* topology in terms of *Duplex.*

(03 marks)

c)

(i) Write the three common types of medium access control (MAC) protocols used in computer networks.

(ii) Write a brief note on what collision is, how it happens on a network.

(iii) Write which protocol manages collision and how it is done?

(05 marks)

d) Sketch two network diagrams and thereby describe function of each of the following. Clearly indicate the limitations/ constraints in using them.

(i) Repeater (ii) Bridge

(05 marks)

e)

(i) Which is correct; IP/TCP or TCP/IP ? Justify your answer with reference to OSI protocol stack.

(ii) Write the function of each of the IP and TCP.

(04 marks)

5) Consider the following modulated signal waveform.

$$S(t) = -10 \sin^2\pi[2 \times 10^6 + 2 \sin 1000t]t + 5$$

a)

(i) Is this modulation AM or FM? *(02 marks)*

(ii) State the carrier signal and the information signal. *(04 marks)*

(iii) Assuming an information signal with unit amplitude, what is the modulation index? *(04 marks)*

(iv) If a super-heterodyne receiver is employed with 455 kHz intermediate frequency to receive this signal, what should be the local oscillator frequency? *(04 marks)*

b) The periodic signal shown in the figure below is FM modulated to a 1 kHz sinusoidal carrier with peak amplitude of 500mV. Draw the resultant waveform. (Clearly show the important values in your diagram)

(06 marks)