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

ECX3233 - Communications & Information Technology

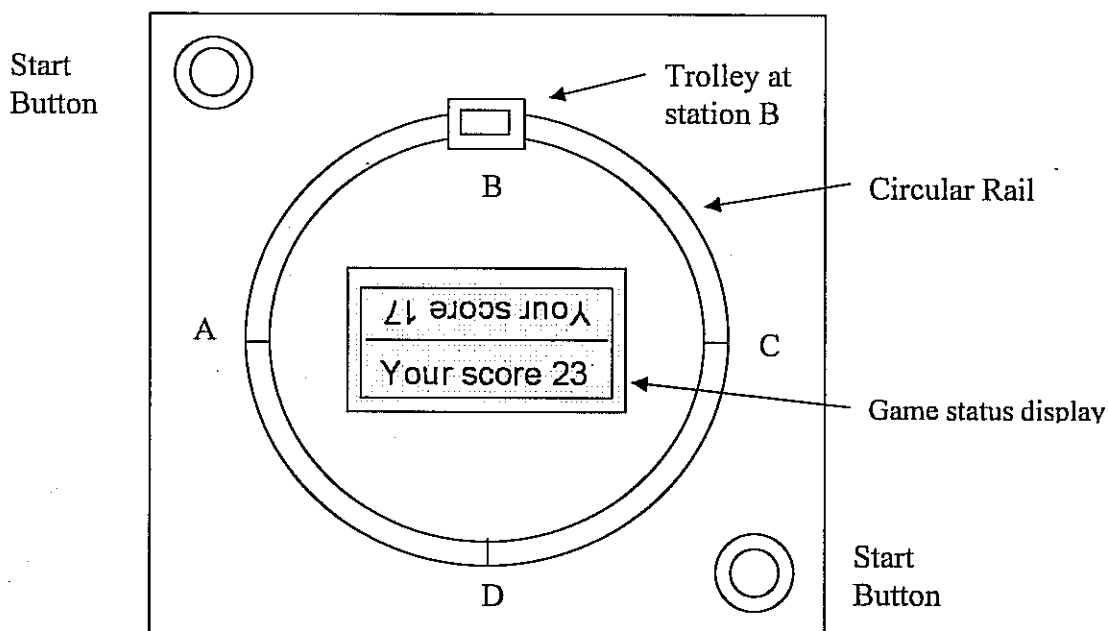**FINAL EXAMINATION   2011/12**

Date: 02nd March 2012   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)   KID 1

KID 2

2-PASS-WIN Game Board

Above figure shows an electronic trolley game board (2-PASS-WIN). Trolley can move along the circular rail clockwise. It is to be programmed and controlled by a microcontroller fixed underneath the board. On the rail, there are equally spaced four similar stations A, B, C and D. To start the game, the trolley must be kept at a station and a *Start* button should be pressed. Then it starts moving towards the next station.

The microcontroller sometimes issues a control signal "**pass**" at random times to the moving trolley. In case the trolley receives a pass signal, it passes the next station and continues moving to the other. If no pass signal is received, the trolley stops at the next station. In case, the trolley passes through 2 stations in one turn, it stops at 3rd station automatically.

When the trolley stopped at a station, the kid's total score is updated and displayed and next the turn changes to the other kid. Each will score points by launching the trolley for desired number of turns. The higher scorer will win the game.

Score criterion is shown below.

Stations passed in a turn	Points
0	0
1	2
2	5 .

a) Draw a block diagram of the design of this game board indicating the necessary hardware blocks in addition to the microprocessor. *(05 marks)*

b) Draw a flowchart using standard flowcharting symbols that you learned in the course to illustrate **the trolley's movement and displaying updated score for one turn of a player.** Use the following pre-programmed process in your flowchart;

MOVE: Moves trolley to the next station according to the "**pass**" signal. It will also give as output the number of *pass* signals received in current turn. Use the symbol;

(20 marks)

Write all assumptions that you make.

c) Write down a piece of assembly code for the following actions taken at the end of a turn of player 1.

If the player has scored more than zero points in current turn
   - Add current turn's points to the total
   - Store new total score
   - Display new score

Assume:

2-PASS-WIN Microprocessor ISA **includes** the following instructions.
It has an accumulator A, registers ($R_1..R_8$) and two ports P1, P2 for display.

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

Use of Registers

R1, R2:   Total scores of players respectively
R3:   Number of *pass* signals received in a turn.
Others: Allocated for the MOVE function.

(15 marks)

2

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

a) How many distinct binary values can we represent with 6 bits?
Justify your answer. *(02 marks)*

b) Convert the following decimal values to binary
    i.   209   ii.   14.654 (Truncate fraction at 4th binary digit)
    (03 marks)

c) Find the following
    i.   Decimal equivalent of 10111.01_2
    ii.   Decimal equivalent of hexadecimal value AC8
    iii.   Binary equivalent of $C5.2D8_{16}$ *(03 marks)*

d) Perform the following binary arithmetic operations
    i.   11100.011 - 1011.101   *(02 marks)*
    ii.   11100110 / 110   *(03 marks)*

e) Do the following conversions where MSB indicates the sign.
    i.   8 bit signed binary number 10101010 into a decimal value
    ii.   2's complement form 101011 into a decimal value.   *(02 marks)*

f) Subtract 15 from 2 using 2's complement technique (i.e Perform 2-15).
    (05 marks)

3)

a) Scenario

If the world crude oil price increases (**WCOPI**), **government** either **considers** or **withstands** the situation.
In case the local fuel price increases (**LFPI**), immediately the **people blame government** and two more events follow.
    i.   If a vehicle owner (**VO**), **he drives cost-effectively.**
    ii.   If bus fare increases (**BFI**), If passenger has enough money in the pocket (**PHEM**), **he travels by bus.** Otherwise **he goes on foot.**

Write down **nested if statements** for above scenario. Use abbreviations typed in bold.

Neglect the real situation in country with regard to increasing oil price.

(08 marks)

b) Compare and contrast the one-pass assembler and two-pass assembler referring to the following assembly code. No need to re-write the code.

```
        ORG    100h
        MOVE   A, B
        STA    TEMP
        MOVE   B, C
        LDA    TEMP
        MOVE   C, A
        HLT
TEMP:   DS     1
        END.
```

(04 marks)

c) Sketch a tree diagram to organize the following random list of entities in a UNIX file system with regard to login and access.

root, file1, file2, file3, dir1, bin, usr3, usr2, usr1, usr

where **usr** and **dir** stands for user and directory respectively. *(03 marks)*

d) Sketch the node arrangement to represent the following three data items in a linked list starting from memory address 200.

P at address 200, Q at 250 and R at 300.

What do you have to consider at the 3rd node in addition?

(03 marks)

e) Write a brief note on the concept of **encryption** in view of computer security.

(02 marks)

4)

a) An AM modulated signal is given by, $S(t) = \cos(800000t)(10 + 6\cos(4000t))$.

  i. State the carrier signal and the message signal.

(02 marks)

  ii. If this $S(t)$ signal is multiplied with a local carrier $C_L(t) = 10\cos(800000t)$, calculate the resultant signal $S(t)C_L(t)$ and state the frequencies of different component signals.

(08 marks)

b)

  i. What are the advantages and disadvantages of using FM, over AM?
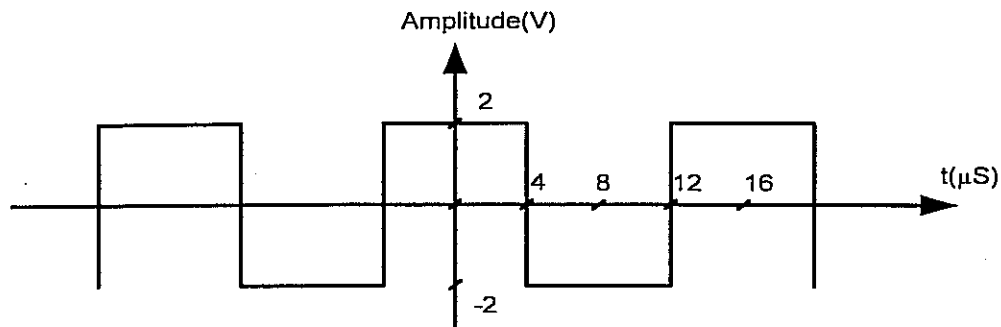
(04 marks)

  ii. Draw the FM modulated signal for the following situation.

(06 marks)

(State all the assumptions you make)

Carrier: $C(t) = 6\cos(1000000\pi t)$

Message signal: as shown in figure below.

Amplitude(V)

2

4 8   12 16   t(μS)

-2

5)

a) Based on the following, write two major reasons why we use computer networks.
Expensive computer resources, Workload

(02 marks)

b) Compare and contrast the two network models client-server & peer-to-peer.

(04 marks)

c) Expand the abbreviation **CSMA/CD** to its three major built-in concepts and write brief notes on each.

(03 marks)

d) Sketch a diagram to illustrate the layered form of data communication steps used in OSI reference model. Name the layers and clearly indicate by arrows how data transfer takes place.

(06 marks)

e) What do you mean by **"switching"** in relation to telecommunication networks?
What are the two different switching techniques used?
Describe the one where **virtual circuits** are involved.

(03 marks)

f) What is the technique used in **sub netting** with regard to IP addressing with TCP/IP ?

(02 marks)