Digital Logic Design (CS1005)   **Homework I**   **Spring 2022**

Instructions:
You are required to solve the homework on A4 Paper only, in case you fail you will be rewarded with a zero weightage out of five.
Your homework solution must be hand written and you should be aware of plagiarism policy which I had announce in class.
Late submission will earn you negative bonus of 2 weightage.

Section 01

Convert
a. $(72376)_8$ octal to Decimal, Binary, Hexadecimal
b. $(2AC5D)_{16}$ Hexadecimal to Decimal, Octal, Binary
c. (101101) to Gray Code. Also Design which can convert any 8-bit binary number to graycode.
d. (10111) Gray Code to Binary. Design a circuit which can convert any 8-bit Graycode to binary.

Section 02

1. Why NAND and NOR gates are called universal gates? Illustrate with example?
2. Construct the basic gates using only Universal gates?
3. Prove Positive XOR is equivalent to Negative XNOR
4. Realize XOR Gate using only NAND gates?
5. Obtain XOR gate using AND-OR-NOT gates?
6. Realize the logic circuit diagram of expression $Y= (A+B)(A'+C)(B+D)$ using basic gates

Section 03

Design Problems

   i)   Sensors are used to monitor the pressure and the temperature of a chemical solution stored in a vat. The circuitry for each sensor produces a HIGH voltage when a specified maximum value is exceeded. An alarm requiring a LOW voltage input must be activated when either the pressure or the temperature is excessive and if both are exceeded. Design a circuit for this application.

   ii)   In the shipping department of a softball factory, the balls roll down a conveyor and through a chute single file into boxes for shipment. Each ball passing through the chute activates a switch circuit that produces an electrical pulse. The capacity of each box is 32 balls. Design a logic circuit to indicate when a box is full so that an empty box can be moved into position.

   iii) Develop the logic circuit necessary to meet the following requirements: A battery-powered lamp in a room is to be operated from two switches, one at the back door and one at the front door. The lamp is to be on if the front switch is on and the back switch is off, or if the front switch is off and the back switch is on. The lamp is to be off if both switches are off or if both switches are on. Let a HIGH output represent the on condition and a LOW output represent the off condition.

   iv)   You shifted to your new home in which there are 2 rooms. Each room have two windows and a door. Your parents asked you to design an intrusion detection system for each room in your house if any of the door or window is opened then your designed security system

activate the alarm. How would you design the logic expression and logic diagram for this system?

Section 04

1. Simplify
a. AB+A'+AB
b. x'y+ y[z'(z'+y)]
c. AB +AC + ABC(AB+C)
d. Y= Σm(3,4,5,7,9,13,14,15) using K-Map
e. F(A,B,C,D)=Σm(1,3,7,11,15), $\emptyset$=Σd(0,2,5)
f. Y=Σm(7,9,10,11,12,13,14,15) using K-Map
g. Y=Π(0,1,4,5,6,8,9,12,13,14) using K-Map
2. Obtain a reduced expression of the given expression and realized the function using NOR gate only. F(A,B,C,D)=Σm(0,1,2,8,10,11,14,15)
3. Obtain a reduced expression and realize the function using NAND gate only. F(A,B,C,D) = Σm(3,4,5,,7,9,13,14,15) + Σd(0,2,8)
4. Use the K-Map method to implement a following function and also draw a reduced circuit using NOR gate, F(A,B,C,D)= Σm(0,2,4,6,8,10,15), d=Σm(3,11,14)
5. Simplify F(A,B,C,D)= Π(0,2,5,8,10)+d(7,15). Write its standard SOP and implement the simplified circuit using NOR gate only.

Submission: 05 March 2022, Time: 11:59 pm