Problem	Points	Score
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
10	10	
Total	100	

# Name:

# Notes:

- 1. The exam is closed book / closed notes. Students are allowed a copy sheet only **one** side of **one** standard US-size (8.5" x 11") sheet of paper on which they can write relevant information such as theorems.
- 2.Please show ALL work. Incorrect answers with no supporting explanations or work will be given no partial credit.
- 3.If I can't read or follow your solution, it is wrong, and no partial credit will be given PLEASE BE NEAT!
- 4. Please indicate clearly your answer to every problem.
- 5. There is sufficient space after each problem to write your solution. In case you need extra paper please see the instructor.
- 6.Calculators of any kind are not allowed.

## Problem No. 1:

Convert the following number from decimal to octal, and then to binary.

957.3125<sub>10</sub>

## Problem No. 2:

Convert the following number from binary to hexadecimal, and then to decimal.

1010011.012

## Problem No. 3:

Perform the following binary division. Clearly indicate the quotient and the remainder in the space provided.

 $1010110 \div 110$ 

Quotient:

Remainder:

## Problem No. 4:

Perform the following subtraction in binary using a 5-bit 1's complement representation. Indicate clearly if there is an overflow.

(-12) - 7

## Problem No. 5:

Find the complement of F using the conversion procedure discussed in class. Do **not** simplify the expression.

$$F = (A + C)(A'E + B'C) + (A + BD')[(B + E')(C' + D) + 0]$$

#### Problem No. 6:

An electronics company wants to cut costs on a circuit being designed in its lab. It has organized a design competition for the students of ECE 3713 to simplify the following circuit and find the minimum expression for F. The winner has to draw a circuit diagram for this minimum form using at most two logic gates. Please send your entry for this competition.



#### Problem No. 7:

Assume that you have graduated and now run your own multi-billion electronics company. Your company needs to manufacture the following circuit —

 $(X \oplus Y)(X + Z) + (Y \equiv Z)(Y + X)$ 

As a smart engineer well-versed in Boolean algebra, your job is to simplify the above expression and design the network as a sum of two terms so that you reduce the hardware cost.

## Problem No. 8:

As the chief design engineer at Electronic Devices Inc., you assign your team to design a combinational network that performs the following task —

$$F = (P' + Q + R')(P + Q' + R)(P + R' + S)$$

Instead, your star protege Mr. Boolean Simplify turns in the following design -

$$G = Q'R' + PQ + QRS + P'RS$$

Verify if Mr. Simplify's design is equivalent to the specification, i.e. if F and G are equal.

#### Problem No. 9:

A combinatorial switching network has four inputs A,B,C and D; and an output X. The output X goes high if the binary number represented by ABCD completely divides 72, otherwise it is 0. Construct a truth table for this network and provide a minterm representation for X.

## Problem No. 10:

A combinatorial switching network has three inputs A,B and C; and two outputs X and Y. The output X equals 1 if no two adjacent bits in ABC are the same. Y equals 0 if the number of 0s in ABC is equal to 2, and is a don't care if the number of 1s in ABC is 2. Construct a truth table for this network and provide a maxterm representation for X. Also provide a minterm representation for Y.