Name: ______________________________

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**	

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.

$$831.5625_{10}$$

Problem No. 2:

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

$$1100101.11_2$$

Problem No. 3:

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

$$1101010 \div 101$$

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.

$$(-9) - 13$$

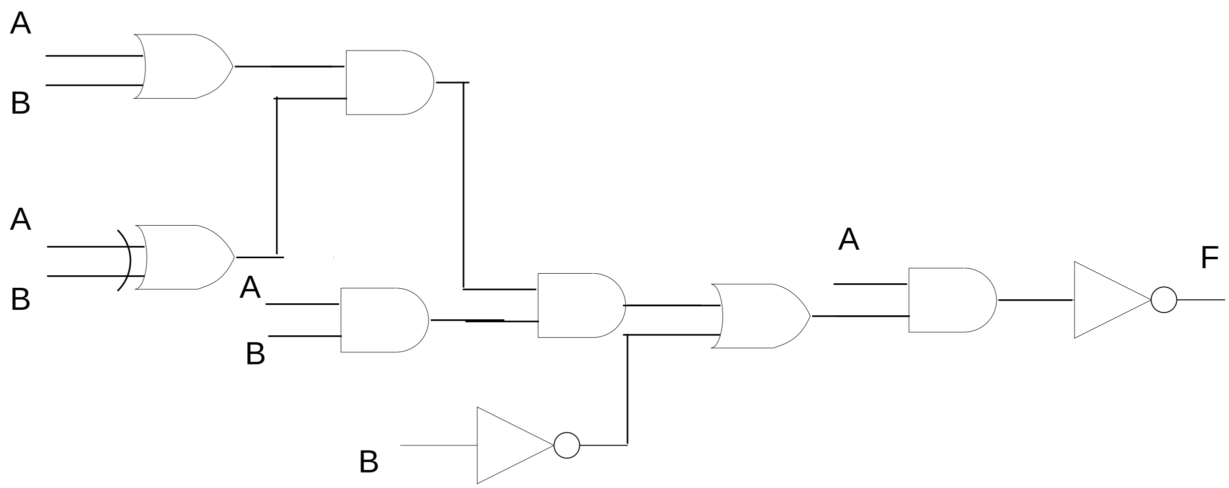
Problem No. 5:

Find the dual 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 —

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

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 —

$$F = PQR + P'R'S' + P'QS' + PRS$$

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

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

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 42 or 45, otherwise it is 0. Construct a truth table for this network and provide a maxterm 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 0 if no two adjacent bits in ABC are the same. Y equals 1 if the number of 1s in ABC is equal to 2, and is a don’t care if the number of 0s 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.