

# ECED 4260 IC Design and Fabrication

## Assignment #1

<http://myweb.dal.ca/~jgu/4260/assignments.html>

**Due date: Sept. 29 2011. Late submission will not be accepted.**

Assignment #1 contains the following problems:

- 1) Prove the following simplification theorems using the first eight laws of Boolean algebra. Explain each step

$$(X+Y)(X+Y')=X$$

$$X(X+Y)=X$$

$$(X+Y')Y=XY$$

$$(X+Y)(X'+Z)=XZ+X'Y$$

- 2) Simplify the following functions using the theorems of Boolean algebra.

$$f(X,Y)=XY+XY'$$

$$f(X,Y)=(X+Y)(X+Y')$$

$$f(X,Y,Z)=YZ'+X'YZ+XYZ$$

$$f(X,Y,Z)=(X+Y)(X'+Y+Z)(X'+Y+Z')$$

$$f(W,X,Y,Z)=X+XYZ+X'YZ+X'Y+WX+W'X$$

- 3) Design a mealy sequential circuit with one input and one output which detects instances of the patterns “101” and “001”, including overlapping patterns.
- 4) A finite state machine has one input and one output. The output becomes 1 and remains 1 thereafter when at least two 0's and at least two 1's have occurred as inputs, regardless of the order of occurrence. Assuming this is to be implemented as a moore machine, draw a state diagram. (8.13)

- 5) Reduce the number of states in the following state table to the minimum number required.

Present State	Next state		Output
	X=0	X=1	
S0	S5	S2	0
S1	S3	S5	0
S2	S7	S0	0
S3	S1	S6	0
S4	S6	S5	1
S5	S0	S6	0
S6	S4	S7	1
S7	S2	S4	0