Name: _____ ID# _____

Date Submitted: _____ Lab Section # _____

CSE 2441 – Introduction to Digital Logic   Fall Semester 2014

**Lab Number 5 -- A Basic Arithmetic Logic Unit (ALU)**

To be performed October 2-3, 2014

A BASIC ARITHMETIC LOGIC UNIT (ALU)

(100 POINTS)

PURPOSE/OUTCOMES: To design, implement, and test a basic four-bit, four-function ALU. By successfully completing this laboratory, you will have demonstrated an ability to design and implement an ALU.

BACKGROUND: In this lab you will design a basic four-bit ALU that can perform addition, subtraction, logical AND, and logical XOR as illustrated in the diagram below. The operation to be performed is specified using control inputs S1 and S0 as defined in the table. A two's complement number system will be used to represent signed numbers. The adder/subtractor circuit that you designed in lab 3 will be used as a component in the ALU. You will need to add the AND and XOR functions, OVR logic and control logic to the adder/subtractor.
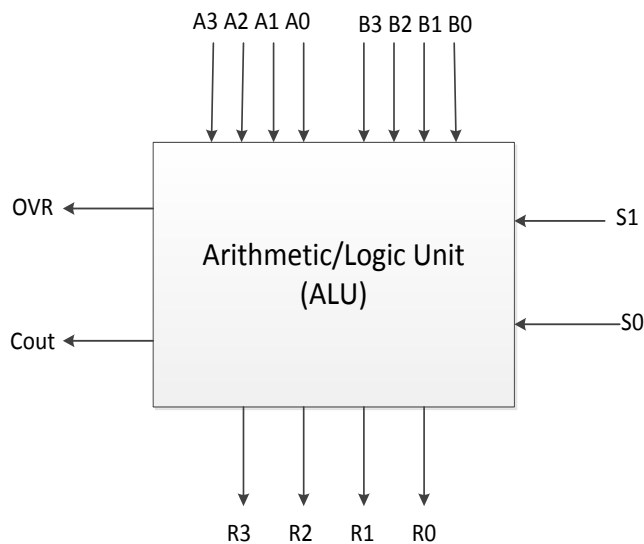
S1	S0	Operation
0	0	Add (A + B)
0	1	Subtract (A - B)
1	0	Logical AND (A·B)
1	1	Logical XOR (A $\oplus$ B)

PRE-LAB WORK (25 points): Design the ALU specified above. Capture and verify your design using Quartus II. Create a block symbol file for future use.

IN-LAB WORK (75 points): Realize your design on the DE1. Record your results in the table below.   Use the pin assignments given on the following page.

A	B	R = A + B	OVR	Cout(C4)	R = A - B	OVR	Cout(C4)	A·B	A $\oplus$ B
0110	0001								
0110	0010								
0010	1001								
1101	1111								
1100	1001								
1010	1110								
0110	1111								
1001	0111								

DE1 Pin Assignments

B0 → SW0   B0out → LEDR0
B1 → SW1   B1out → LEDR1
B2 → SW2   B2out → LEDR2
B3 → SW3   B3out → LEDR3

A0 → SW4   A0out → LEDR4
A1 → SW5   A1out → LEDR5
A2 → SW6   A2out → LEDR6
A3 → SW7   A3out → LEDR7

S0 → SW8   S0out → LEDR8
S1 → SW9   S1out → LEDR9

R0 → LEDG0
R1 → LEDG1
R2 → LEDG2
R3 → LEDG3

Cout → LEDG4
OVR → LEDG5