CDA 3201L – Computer Logic Design Laboratory

Lab Exercise 3

Combinational Logic Circuits (III)

Multiplexers are not allowed to be used for this lab exercise.

Part A:

Show that you can read the data sheet to identify the inputs and outputs of an Adder IC (74LS83) by demonstrating the addition operation of two 4-bit numbers:

a) Assume that the two numbers are unsigned positive numbers
b) Assume that the numbers are in 2s complement form. Note that in this case the output is also 4-bit number in 2s complement form, i.e., the carry output will be ignored.

Part B:

You need to design a circuit that implements the functions in the following table:

S0	S1	Function
0	0	A + 1
0	1	A – B
1	0	A + B
1	1	A – 1

S0 and S1 are 1-bit control inputs to select the function of the circuit. Inputs A and B are 4-bit numbers in 2s complement form. The output is also a 4-bit number in 2s complement form. You are allowed to use only one TTL 7483 4-bit adder to implement all the functions. But any number of other components (except the adder) can be used.

HINT: Design a combinational logic circuit to modify the input B and the “carry input” of the adder depending on the control inputs S0 and S1.

Important: Lab grade will depend on the working of the circuit & will be checked of by your lab instructor.

Questions:

1. Is the output valid for the following input combinations:
    a. S0 = 0, S1 = 0, A = 7, B = 3?
    b. S0 = 0, S1 = 1, A = 7, B = 3?
    c. S0 = 1, S1 = 0, A = -4, B = -5?
    d. S0 = 1, S1 = 1, A = -8, B = 6?

2. What is the range of inputs (for both A and B) that will produce the valid output for all the functions?

References:

“Fundamentals of Logic Design”, 7th Edition, by Charles H. Roth Jr. and Larry L Kinney, 2014, ISBN-13: 978-1133628477 or ISBN-10: 1133628478, CENGAGE Learning, Stamford, CT, USA

Notes:

1. You can use http://en.wikipedia.org/wiki/List of 7400 series integrated circuits to find the TTL chip you need.
2. Datasheets of some commonly used TTL chips can be found at the following sites:
    - http://www.jameco.com
    - http://www.ti.com/sc/docs/psheets/databook.htm
    - http://www.datasheetcatalog.com/fairchildsemiconductor/1/