American University of Beirut

Course: EECE 312L

Assignment 1: Digital Design (myDAQ)

Instructor: Dr. Sara Khaddaj

Due Date: Wednesday, November 11th, 2:00 pm

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1. Introduction:

During the past decades, Electrical Engineering has experienced major advancements in terms of circuit and digital design. The evolution of circuit design has given rise to an important field which is circuit simulation. This field in particular has helped engineers vastly during their design processes in which it has provided a safer and more practical way of testing the design without having to build the real circuit on the spot as a start, but rather check its validity and possibility through software simulation translated to a breadboard on which the electric components rest after the simulation is believed to be successful, and this in turn has provided a more economical way of designing circuits since the only outcome of a bad design would be repeating the software simulation with a modified, corrected design before even translating the simulation to the breadboard.

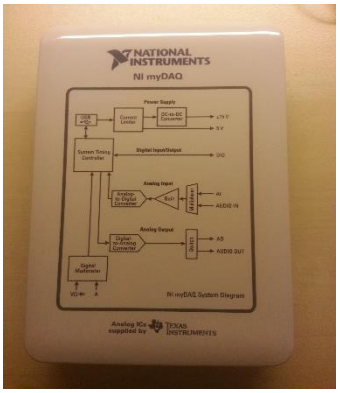
In this assignment, the main goals were to:

1) Build a digital circuit using an IC
2) Use myDAQ acquisition board and LabVIEW instrument launcher
3) Use the 5V DC output of the myDAQ board
4) Use myDAQ digital I/O to read output for inputted test vectors

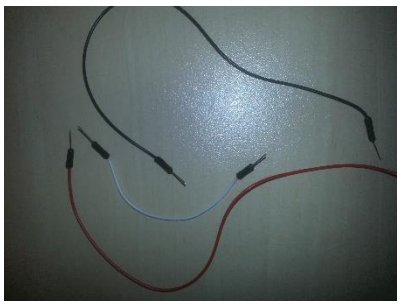
2. Description of Hardware setup:

a. Components used:

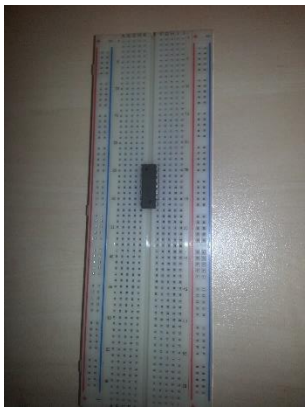
1) myDAQ



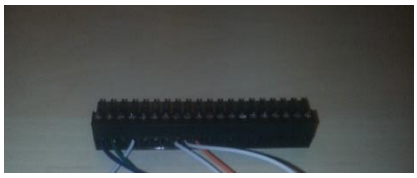
2) Jumper wires



3) Breadboard and IC



4) Terminal Connector



5) USB Cable

b. , c. and d. (Circuit connections, Connections between myDAQ acquisition board and the circuit, Input and output lines used)

(We have to note that the DIO part of the DAQ was used for the inputs and the output).

As a start, upon connecting the DAQ by the USB cable to the PC, we get a constant 5V DC voltage from terminals "5V and DGND", and this was indeed needed in order to power the IC. Therefore, we connect the DGND to pin 7 of the IC and 5V to pin 14 of the IC.

Considering the circuit we were required to build shown below:

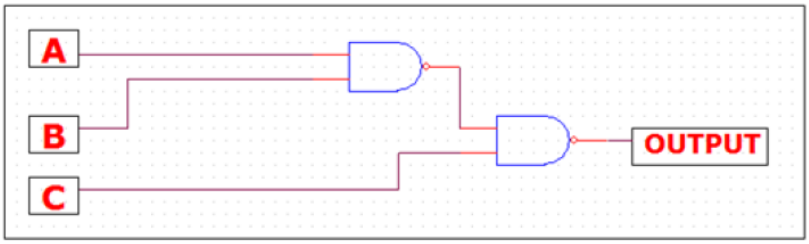


Figure A-1

We needed 3 input lines from the myDAQ to the breadboard and 1 output line from the breadboard to the myDAQ in order to read the output.

The 3 input terminals are represented as A, B, and C, thus, A was the connection from DIO 1 to pin 1 of the IC, B was the connection from DIO 0 to pin 2 of the IC, and C was the connection from DIO 2 to pin 5 of the IC.

As for the outputs, the output from NAND gate A of the IC was connected to the input terminal of NAND gate B of the IC using a jumper ***(from pin 3 to pin 4)***, then the final output resulting from NANDing output of NAND A with C was represented as a connection from pin 6 of the breadboard to DIO 6 of the DAQ. ***The latter is what the software will read.***

Photos depicting hardware setup and connections:

The figure below is a schematic of the connections (drawn in paint):

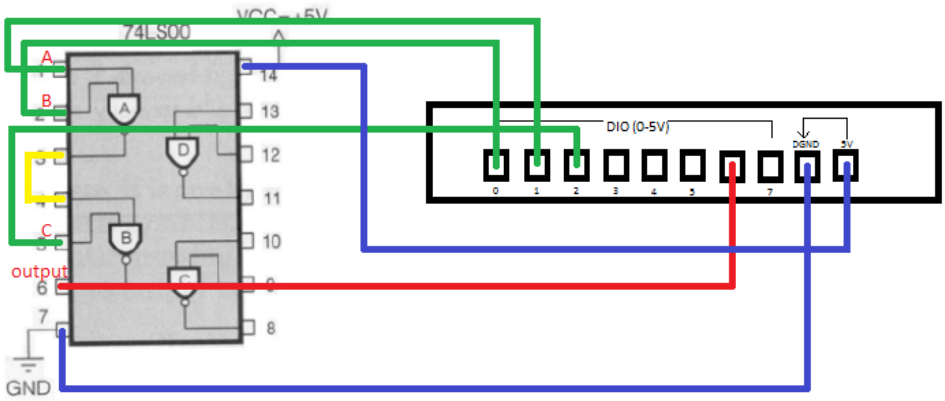


Figure (a): Schematic of overall connections

Real circuit:

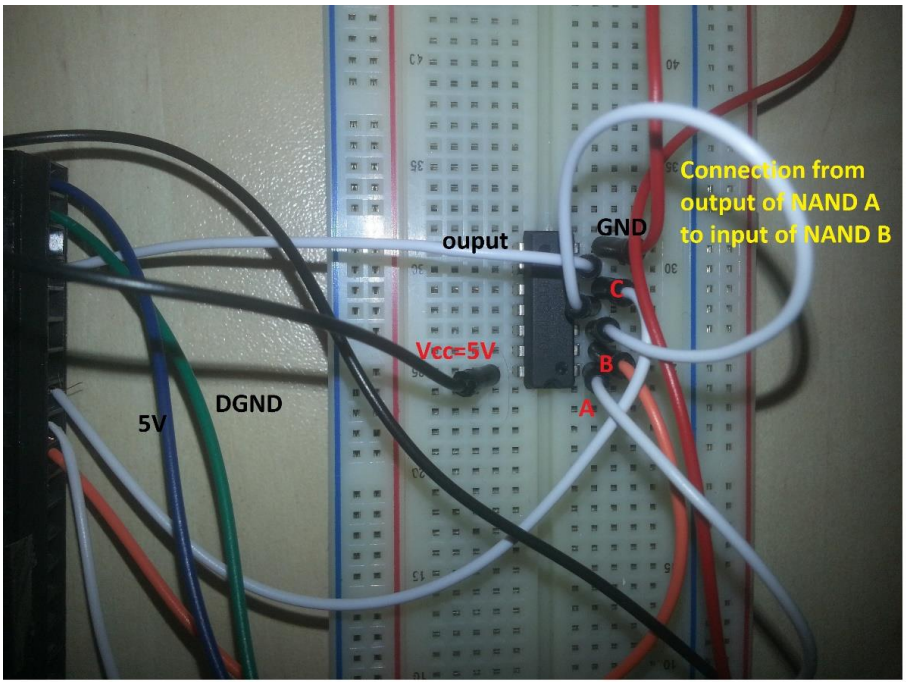


Figure (b): Breadboard Connections

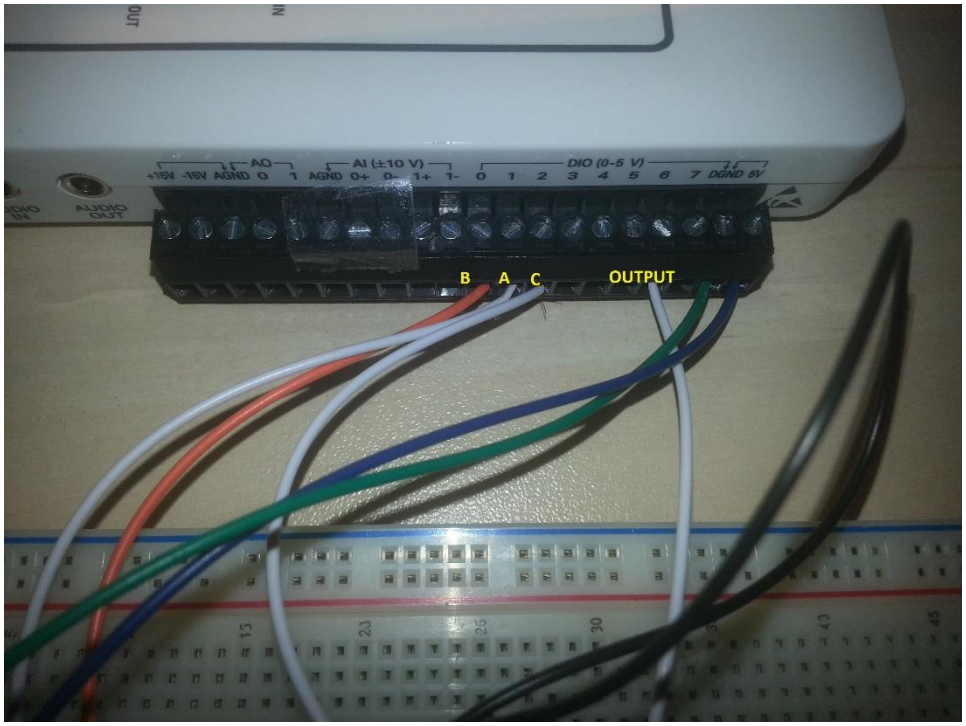


Figure (c): Terminal Connections

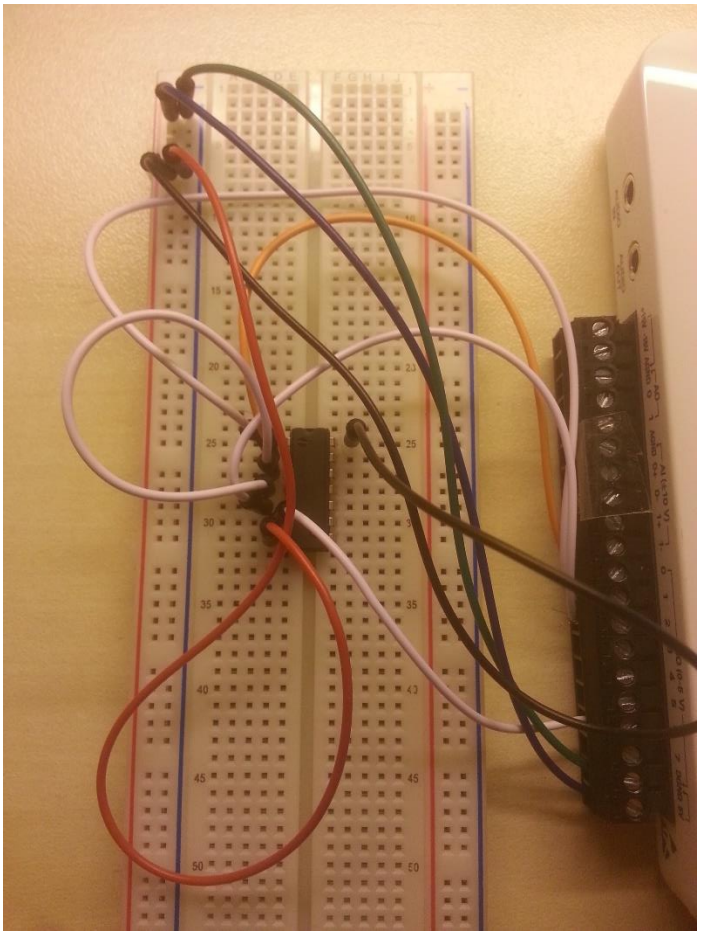


Figure (d): Overall view

3. Description of software setup:

a. Modules used and configurations:

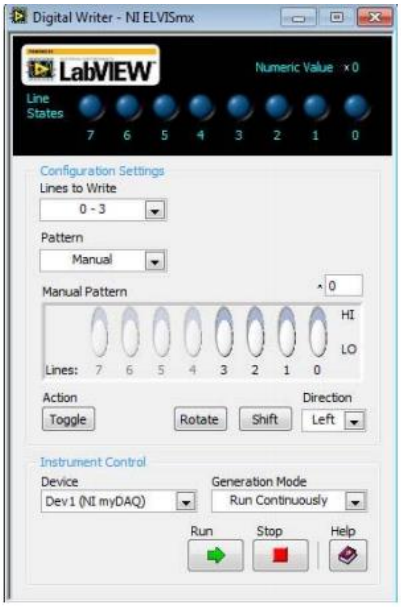
For this assignment, the number of modules and configurations used was limited in which we only used the Digital Reader and Digital Writer.

- **Digital Reader (retrieved from Assignment description):**

  The Digital Reader reads digital data from the NI MyDAQ digital input lines. Hence, digital input lines of MyDAQ will be used as outputs from the circuit design built on the breadboard. This means that at least one digital line should be configured as input line to MyDAQ board in order to allow the user to read the output generated from the built circuit. Since lines 0-3 are configured as digital outputs. We need to configure the other lines as input by choosing from the digital reader options lines (4-7).

- **Digital Writer (retrieved from Assignment description):**

  The Digital Writer interface on the computer updates the NI MyDAQ digital output lines with user-specified digital patterns. Hence, digital output lines of MyDAQ will be used as inputs to the circuit design built on the breadboard. This means that at least three digital lines should be configured as output lines from MyDAQ board in order to allow the user to set different input test vectors. Choosing from the digital writer options lines (0-3) will set the first 4 digital lines (lines 0 to 3) as digital outputs.



4. Testing:

a. Choosing two rows from the truth table:

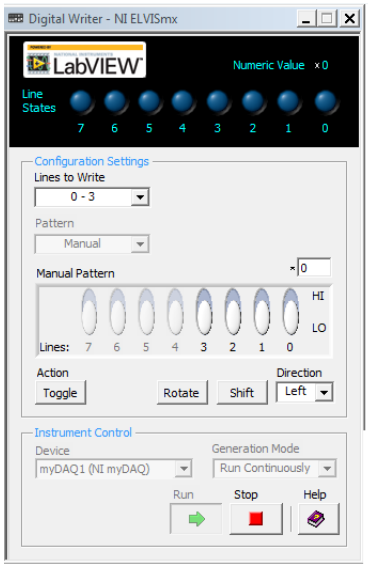
- I've chosen rows 0 and 1 as my rows of interest.

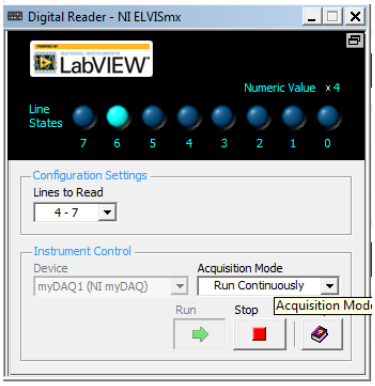
b. Theoretical Truth Table:

Row number	A	B	C	Output
0	0	0	0	1
1	0	0	1	0
2	0	1	0	1
3	0	1	1	0
4	1	0	0	1
5	1	0	1	0
6	1	1	0	1
7	1	1	1	1

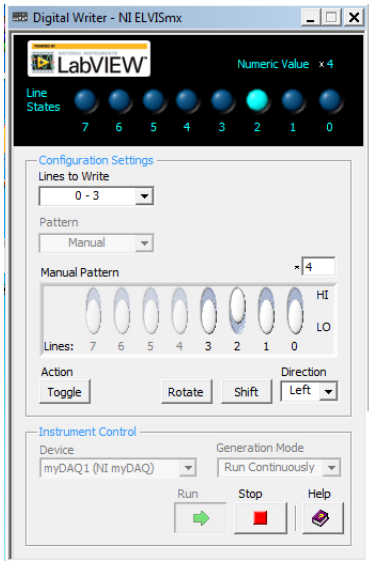
c. **Snapshots showing the inputs and outputs for each test vector to validate the implementation of the designed circuit by running the digital reader and digital writer modules from the instrument launcher:**

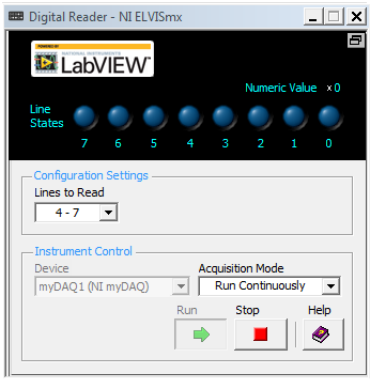
For Row 0:





For Row 1:





5. Conclusion:

After performing the above experiment, it is evident to us that the matching of theoretical and experimental results is very essential for any design no matter what the nature of the experiment was (electrical, mechanical, etc…). Hence, simulation and experimentation are two essential processes that prove the validity and evaluate the wellness of any design.

References:

- Assignment description posted on Moodle (pdf file)