University of New Brunswick

CS 3853 Summer 2024

Lab 1

Wednesday July. 10, 13:00 – 15:50, ITD 415

Introduction to LogicWorks 5: Basic Logic Circuits

Submission deadline: July 17, before midnight

Pre-lab instructions:

- Complete and test the setup required for the remote access to the FCS labs: https://www.cs.unb.ca/help/LogicWorks web page:
  - Set up UNB VPN: https://unbcloud.sharepoint.com/sites/ITServices/SitePages/VPN.aspx
  - Set up SSH for the command line mode access: https://www.cs.unb.ca/help/ssh-help.shtml
  - Set up VNC for the remote desktop access: https://www.cs.unb.ca/help/remote-lab-gui-access.shtml
- Start a VNC session before the lab session

Reference Materials:

- LogicWorks 5, by Capilano Computing Systems, Benjamin-Cummings. Chapter 4, pages 21 to 33, provides a tutorial with advanced features.
- Sample LogicWorks tutorial online: https://www.cs.uregina.ca/Links/class-info/201/LW5/lecture.htm

General Instructions:

- Log in to Windows in the FCS lab.
- Using remote access to the FCS labs is recommended.
- Complete lab exercises and prepare a lab report.
- Group work is allowed, however, individual D2L submissions are required from each student.
- You may finish the lab on your own time.

Task 1:

In LogicWorks, build the following circuit in Figure 1. For the circuit, place the binary switches and the binary probe on the LogicWorks work screen, make connections between the circuit inputs and the binary switches, and then between the output and the binary probe. You should label the inputs and output signals and pins accordingly.

If you haven't clicked on any switches, notice that the binary probes currently display the letter "A" or "C". This means that no initial signals have been delivered to the outputs of the digital system. If you click on a binary switch, two things will happen. The switch will

change state from "0" to "1" or vice-versa. At the same time the value displayed on the binary probes will change from "C" to either "0" or "1".

- Verify the logic function of the circuit using binary switches and probes by constructing a function table that tabulates all possible switch positions and the resulting output values on the "X" and "Y" signal lines, as indicated by the binary probes. Check if the recorded outputs match the truth table from Table 1.

Output:

- Create a pdf file of the schematic you created.
- Add the recorded output tables and a statement if they match Fig. 1 in the same pdf.

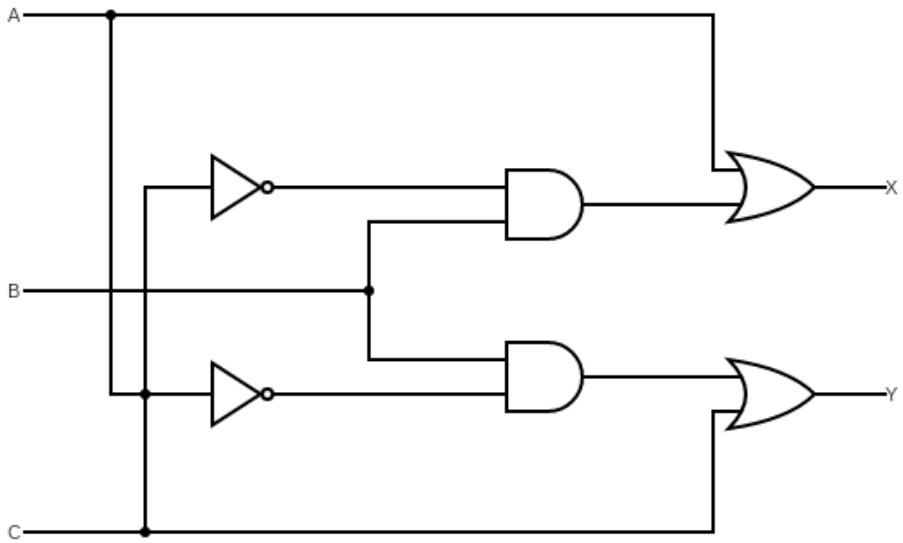

Figure 1: Lab Circuit 1

A	B	C	X	Y
0	0	0	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	0	1
1	0	0	1	0
1	0	1	1	0
1	1	0	X	X
1	1	1	X	X

Table 1: Truth Table for Lab Circuit 1

Task 2:

Use LogicWorks to simulate the circuit in Figure 2. Connect each given input to switches and the outputs to LEDs.

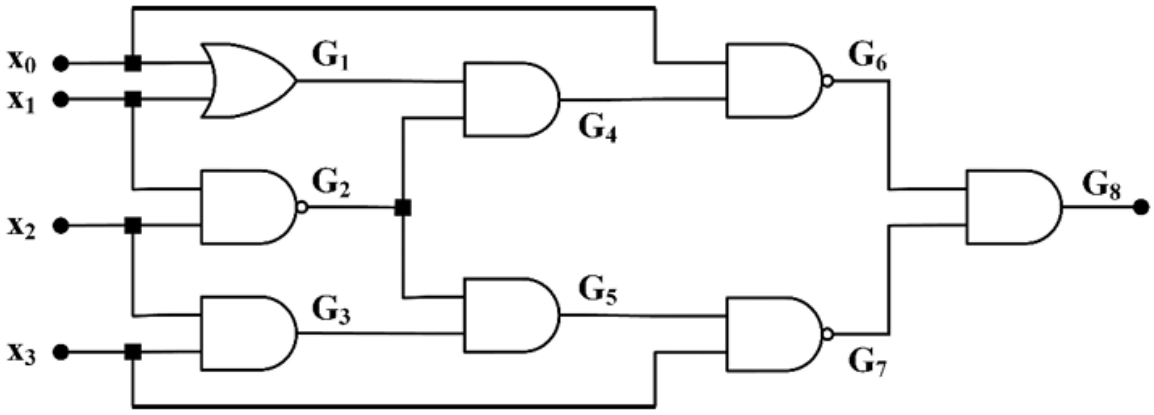

Figure 2: Circuit for Task 2

Output:

- Create a pdf file of the schematic you created.
- Create a truth table for the circuit.
- Create a pdf file of the schematic you created.
- Add the recorded output tables in the same pdf.

Task 3:

Use LogicWorks to construct a 4-bit adder using 1-bit adders. It contains 4 1-bit adders. Implement the adders using AND, OR and NOT gates. A full adder has 3 inputs: that represent 3 one-bit binary number. The output is the sum and a carry out. Simulate the inputs and outputs (also display the carry-out with a binary probe).

- Test the full adder
- Design a simpler full adder by allowing XOR gates

Output:

- Create a single pdf file of the schematic you created for each of the completed circuits

Submission Instructions:

- Submit the pdf files to the Desire2Learn dropbox.
- Submission deadline: July 17, before midnight.