



**EE 4142/ EE5190 LABORATORY - DIGITAL SYSTEMS DESIGN II Spring 2022: January 31st/
Friday 1st Lab Sessions
Lab #1. – XOR implemented with NAND gates**

Objective

The purpose of this lab is to continue to become familiar with the implementation, testing and verification of simple circuits using a computer-aided design tool. In addition, you will learn how to create a schematic symbol and use instances of it to implement your design.

Prelab (20%) *Due WHEN LAB STARTS

Using **solely two-input NAND gates**, implement a two-input XOR function in a **modular** manner.

- **1)** First, create an inverter using a NAND gate and **show resulting circuit**.
- **2)** Then, create AND and OR gates using only NAND gates and the inverter module that you created in the first step. **Show resulting circuit**.
- **3)** Finally, using the AND, OR and the inverter modules created above, implement the XOR function in the form of sum-of-products.
Note: You **should not use De Morgan's theorem** by simply converting AND-OR network to NAND-NAND network. This is not what you are requested to do.

In lab session (Schematic 20%, Simulation 20%, Quiz 10%) –

- **(1)** Implement your modular design using Xilinx Schematic capture (You will need to create new schematic symbols)
- **(2)** Simulate your design and demonstrate proper behavior of your simulated waveforms to your TA
- **(3)** Remember to obtain screen images along the way to create your report (Schematics, simulation waveform)
- **(4) Demonstrate your work to your TA before the end of the session**