Homework 2

Due at the beginning of your scheduled lab period

Last Name (Printed): _____ **Lab Div:** _____ **Date:** _____

E-mail: __ __ __ __ __ __ __ __ **@**purdue.edu **Signature:** _____

*Printed copies of these pages along with your original (**hand-annotated**, **not photocopied**) written solution in the space provided (unless otherwise indicated) are required in order to receive credit. NOTE: The purpose of homework is to provide an opportunity for practicing the kinds of problems you will be asked to solve on quizzes and exams – **copying the work of someone else does not accomplish this.***

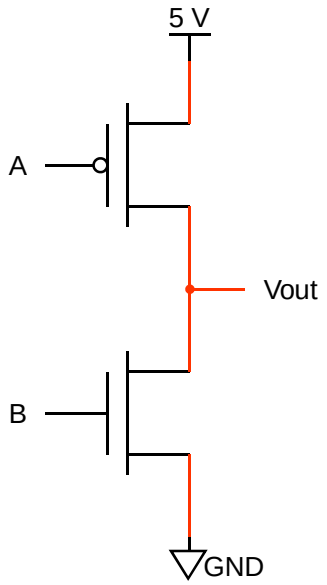
1. [8 pts] Show a MOSFET-level diagram for a 6-input AND gate realized using a 6-input NAND gate followed by an inverter gate. Label the inputs $I_0 \ldots I_5$ and the output F. Be sure to show the power (Vcc) and ground (GND) connections as well. Determine the total number of N- and P-channel MOSFETs required for this realization (LO 1-10).

2. [8 pts] Show a MOSFET-level diagram for a 6-input AND gate realized using two 3-input NAND gates on the first level and a (single) 2-input NOR gate on the second level. Label the inputs $I_0 \ldots I_5$ and the output F. Determine the total number of N- and P-channel MOSFETs required for this realization. Be sure to show the power (Vcc) and ground (GND) connections as well (LO 1-12).

3. [4 pts] Read the section on *Fan-In* (5th Ed., pp. 741-742 or 4th Ed., pp. 92-93) in the course text. Based on this material, list the tradeoffs between the two 6-input AND functions realized in problems 1 and 2, from a practical point of view. Then provide rationale for which realization would be preferable, based on the tradeoffs you have enumerated.

4. [8 pts] Given that the P-channel device in the circuit below has **ON** and **OFF** resistances of **50 Ω** and **1 MΩ** (respectively) and that the N-channel device has **ON** and **OFF** resistances of **20 Ω** and **2 MΩ** (respectively), complete the table listing the **output voltages** obtained for each input combination as well as the **power dissipation** (in ***milliwatts***). *Show your calculations* (LOs 1-10 and 1-11).

A	B	V_{out}	Power Dissipation
0V	0V		
0V	5V		
5V	0V		
5V	5V		



Score: _____ / 28