

# Homework 1: Due Tuesday January 30<sup>th</sup> (10:30 am, beginning of class)

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Write your name at the top of each page.

- Start a **new page for each problem**.
  - **Order** and **staple** your pages.
  - Always complete the reading assignments *before* attempting the homework problems.
  - Show all of your work. Use written English, where applicable, to provide a log of your steps in solving a problem. (For numerical homework problems, the writing can be brief.)
  - A solution which requires physical units is *incorrect* unless the units are listed in the result.
  - Underline, circle or box your result.
  - Always write neatly. Communication skills are essential in engineering and science. If neither the TA nor the instructor can read it, you will receive zero points.
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## 1) Logic Gates

The following questions pertain to the parts and/or specifications found in the *ON Semiconductor* "LS TTL Data" data book (Rev. 6, Jan. 2000, "DL121/D"), which is available in PDF form from the resource section on the course web site.

- a) What is the minimum and maximum permissible supply voltage for the SN74LS260?
- b) How many gates are available in the SN74LS260 and of what type are they?
- c) How many inputs do the gates in the SN74LS260 have?
- d) What is the Voltage range that the SN74LS260 accepts as a logic '0' and what for a logic '1' on its inputs?
- e) What is the output Voltage range for a logic '0' and for a logic '1' of the SN74LS08?
- f) Is it possible to *drive* a SN74LS260 gate input with a SN74LS08 gate output?

## 2) Equivalent Representations

In class you have learned that a combinational circuit can be described in four different ways:

- Circuit Diagram,
- Truth Table,
- Boolean Algebra (formula),
- Hardware Description (VHDL)

In this question you will be given a combinational circuit in one of the four representations and you have to determine the other representations.

a) Boolean Equation:

Draw the circuit diagram, show the truth table, and write the VHDL code including entity and architecture statements.

$$f = x_1 \oplus (x_2 \cdot x_3)$$

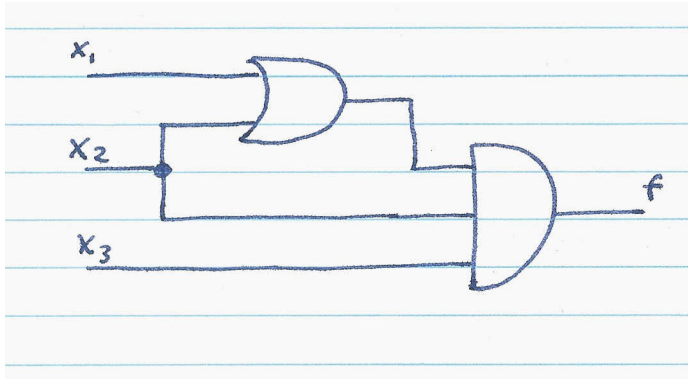
b) Boolean Equation

Draw the circuit diagram, show the truth table.

$$f = (x_1 \cdot x_2) + (\bar{x}_2 \cdot x_3)$$

c) Circuit Diagram:

Show the truth table and determine the boolean equation.



d) Truth Table:

Draw the circuit diagram and determine the boolean equation.

$x_1$	$x_2$	$f$
0	0	0
0	1	1
1	0	0
1	1	0

e) Truth Table:

Draw the circuit diagram and determine the boolean equation.

$x_1$	$x_2$	$x_3$	$f$
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

Hint: Compare  $x_2$  with the output. Then you will see one case where the output does not follow  $x_2$ .