

Homework 1
EECS150, Fall 2012
Due Friday, 6 pm, August 31, outside 125 Cory

1. How many rows are there in a truth table with 2 input variables? How many possible functions are there of 2 variables?

Fill in the following table, and label each column

A	B	F ₀	F ₁	F ₂	F ₃	F ₄	F ₅	F ₆	F ₇	F ₈	F ₉	F ₁₀	F ₁₁	F ₁₂	F ₁₃	F ₁₄	F ₁₅
0	0	0	0	0													1
0	1	0	0	0													1
1	0	0	0	1													1
1	1	0	1	0													1
		zero	AND	A/B													one

2. Write the formula for the number of rows in a truth table of N variables, and the number of different functions of N variables.
3. You have made an ALU (arithmetic/logic unit) that performs 16 different functions on two 32 bit inputs. You have a test machine that can test your ALU by supplying it with any desired inputs, specifying one of the 16 functions, and checking the output. The tester can do this in 1ns. Your boss asks you to exhaustively test your ALU (i.e. test all possible combinations of inputs and function). How long will it take?
4. Is it possible to write two different Boolean expressions which have the same truth table? Is it possible to write two different truth tables which have the same Boolean expression?
5. Take a look at the TEM (transmission electron microscope) cross-section of the Intel 22nm FINFET in figure 8 of this link:
http://www.electroiq.com/blogs/chipworks_real_chips_blog/2012/04/intel-s-22-nm-trigate-transistors-exposed.html Now looking at my silicon crystal model, <http://www-bsac.eecs.berkeley.edu/~pister/crystal.pdf> you should be able to identify which face you're looking at just from the arrangement of the atoms. Estimate the width of the fin at the base, in atoms, and nanometers.