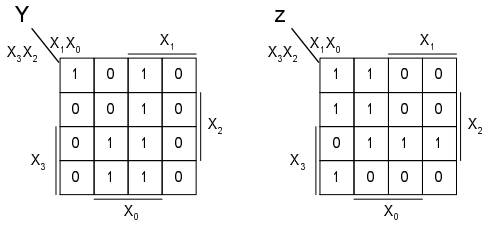
CSE320 Fall 2014
Homework#2
Quiz in Lecture on Sept 18th

Problem 1: Find the minimal sum of products and products of sums for the functions shown in the k-maps. Implement Y using a NAND-NAND network, and implement Z using NOR-NOR network.



Problem 2: A logic circuit realizes the function F(a,b,c,d) = a'b'+a'cd+ac'd+ab'd'. Assuming that a=c never occurs when b = d = 1, find a simplified expression for F. (Hint: When can Don't-Cares be used?)

Problem 3: Design a black box that has a 3-bit input x, and a 3-bit output y. The function of the unit is y = (5x) % 8. Create the truth table and implement with the minimal gate logic in NAND-NAND and NOR-NOR for each output.

Problem 4: Design a system that takes a two digit base 3 number as input and produces the corresponding binary value (Z). (Example input: $12_3 = 0101_2$). Create the truth table and implement the 2 most significant bits using the minimal number of 2-input multiplexors (selector is 1-bit).

Problem 5: Given two inputs $x = (x_1, x_0)$ and $y = (y_1, y_0)$, the output is the absolute value of their difference: $z = |2y - x|$. Use multiplexers (try different sizes) to implement the function.

Problem 6: A circuit will either subtract X from Y or Y from X, depending on the value of A. If A = 1, the output should be $|X - Y|$, and if A = 0, the output should be $|Y - X|$. Design a combinational system for the output using as few 2-input multiplexers as possible.

Problem 7: Implement the following expression using 2-input multiplexers (Only uncomplemented variables are given.

$$f = x_1'x_2' + x_3'x_2x_1' + x_1x_2'$$

Problem 8: Implement the following function using (a) an 8-input multiplexor (3-selector), (b) a 4-input multiplexor (2-selector) and NOR gates.

$$Z = a'b'c'd + a'bc'd' + a'b'cd + ab'c'd + abcd + abcd'$$