CoE/EE 460
Spring 2001 : Lockwood

Homework #1: Due Wednesday January 31, 2001
at 5:00pm, in EE homework box

1. Prove that each of the following equations is true.
   Label each step of the proof with the rule name specified in:
   "CoE/EE460 - Spring 2001 Definitions, Theorems, and Postulates"
   which has been posted on the class homepage.
   The first proof is given as an example.

   (a) $(x+y)(x'+y)(x+y')(x'+y') = 0$

   Sample Solution:

=	$(y+x)(y+x')(y'+x)(y'+x')$	Communative(+)
=	$[y+(x\cdot x')][y'+(x\cdot x')]$	Distributive(+)
=	$(y+0)(y'+0)$	Complement($\cdot$)
=	$y\cdot y'$	Identity(+)
=	0	Complement($\cdot$)

   (b) $xy'z' + xy + x'yz = xz' + yz$

   (c) $y + x + xy = (x'y')'$

2. Use a four-variable K-Map to derive the minimal sum-of-products expression for each of the following functions. Show your work. The first solution (but not the work) is given as an example.

   (a) $f_0(w, x, y, z) = \sum(0, 4)$
   Sample Solution: $f_0(w, x, y, z) = w'y'z'$

   (b) $f_1(w, x, y, z) = \sum(0, 4, 6, 7, 9, 13, 14, 15)$

   (c) $f_2(w, x, y, z) = \sum(3, 4, 5, 6, 7, 11, 12, 13, 14, 15)$

   (d) $f_3(w, x, y, z) = \sum(0, 2, 5, 8, 10, 13)$

   (e) $f_4(w, x, y, z) = \sum(5, 7, 14, 15)$

   (f) $f_5(w, x, y, z) = f_2(w, x, y, z) + f_3(w, x, y, z)$

3. As the Vice-president of quality control at a superstitious semiconductor microprocessor fabrication firm, you have been asked to simplify the rules for accepting or rejecting integrated circuits as they pass through the testing process. You should *reject* if any of the following conditions are met.

   - Reject if the batch number is not equal to seven and the day of the month of fabrication was on the 13th.
   - Reject if the batch number was equal to seven, the day of the week of fabrication was on a Friday, and the day of the month of fabrication was on the 13th.
   - Reject if the day of the week of fabrication was not on a friday, the batch number is not 7, the day of the month of fabrication was not on a 13th, and the moon was full on the day the chip was fabricated.
   - Reject if the moon was not full on the day the chip was fabricated, the day of the week of fabrication was not on a friday, the batch number is not 7, and the day of the month of fabrication was not on a 13th.

   (a) Determine a set of independent variables that describes the criteria of the system. Create your own variables, as needed.

   (b) Simplify the expression to determine the criteria for rejecting the wafer in a minimal Sum of products form. Shown your work

   (c) Express this solution terms of the problem statement.

4. Consider the Relation, $\Re$, for $>$ on the set $A = 1, 2, 3, 4$

   (a) Draw the relation matrix

   (b) Draw the relation graph

   (c) Does the relation have Reflexivity?

   (d) Does the relation have Symmetry?

   (e) Does the relation have Antisymmetry?

   (f) Is the relation Transitive?

5. Consider a system that has the following sets defined:

   - $A = a, b, c, d$
   - $B = a, d, e$
   - $C = a, e, f$
   - $D = g, h$

   Determine the following:

   (a) What is the cardinality of $A \cup B$?

   (b) List the members of $A \cap (B \cup C)$

   (c) Find the complement of C in the Universe of $A \cup C$

   (d) Is B a proper subset of $A \cup C$?

6. The newsgroup for this class can be a useful resource.
   Consult the newsgroup to determine the solution to this question.