

CSE320 Fall 2014
Homework#1
Quiz in Lecture on Sept 9th

Problem 1: Use DeMorgan's Law to write an expression for F' where

- a) $F(x,y,z) = x(y' + z)$
- b) $F(x,y,z) = xy + x'z + yz'$
- c) $F(w,x,y,z) = xyz'(y'z+x)' + (w'yz + x')$

Problem 2: Functions F , G , and H are defined in the following way:

$$\begin{aligned}F &= A'C' + A'B'C \\G &= A'B' + A'C' \\H &= A'B'C' + A'C' + B'C\end{aligned}$$

Which of the functions are equivalent?

Problem 3: For each of the following functions:

$$\begin{aligned}J &= ((A' + B)' + C')' + DC' + AB' \\K &= x(y + w'z) + (w' + x' + z')'\end{aligned}$$

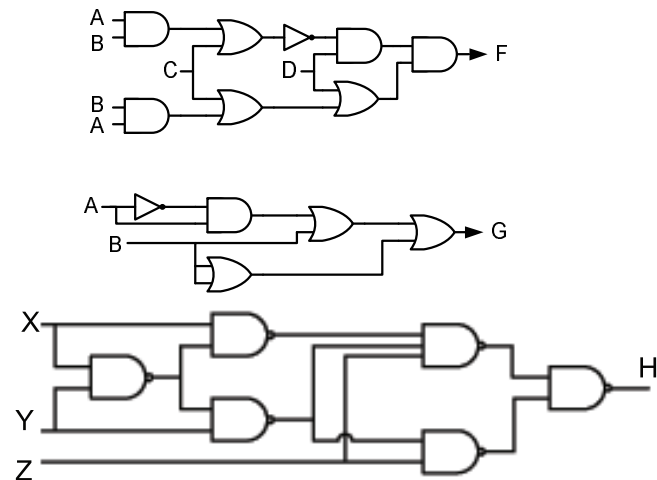
- a) Create the truth table for each expression.
- b) Name the minterms ($\Sigma m(?)$) and maxterms ($\Pi M(?)$) for each expression.
- c) **Simplify each expression using boolean logic.**
- d) Draw a 2-level gate network (AND-OR or OR-AND) for the expression in c), whichever form uses the fewest gates. DO NOT SIMPLIFY the expression first.
- e) **How many literals in each expression from (c)? How many terms in the expression from (c)?**
- f) Draw 2-level gate networks for the simplified expressions in NAND-NAND or NOR-NOR form.
- g) Write the Boolean expressions for the complement of each expression (eg. J') in product of sums form. DO NOT SIMPLIFY.

Problem 4: For each of the following functions:

x	y	z	P	Q
0	0	0	0	1
0	0	1	1	1
0	1	0	0	0
0	1	1	0	0
1	0	0	0	1
1	0	1	1	1
1	1	0	1	1
1	1	1	1	0

- a) Name the minterms ($m(?)$) and maxterms ($M(?)$) for P and Q .
- b) Draw a 2-level gate network (AND-OR or OR-AND). Do NOT simplify the expression first.
- c) Write the minterm and maxterm expression in boolean logic.
- d) Simplify each expression from (c) using boolean logic.
- e) Draw 2-level gate networks for the simplified expressions in NAND-NAND or NOR-NOR form.
- f) Write the Boolean expressions for the complement of each P and Q (ie. P' and Q') in product of sums form. DO NOT SIMPLIFY.

Problem 5: For the following diagrams, give boolean expressions. Simplify and redraw the system with fewer gates.



Problem 6: Convert the following truth table to a Boolean Expression and simplify the expression as much as possible using the Boolean Identities.

x	y	z	F
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

Problem 7: Using the postulates of Boolean algebra, prove the following formulae:

- $x'y'z' + x'y'z + x'yz + xyz = x'y' + z$
- $ABC' + A'C'D + AB'C' + BC'D + A'D = AC' + A'D$
- $wxy + w'xy + x'(zw + zy') + z(x'w' + y'x) = xy + z$