

EE 2000 Logic Circuit Design
Semester A 2014

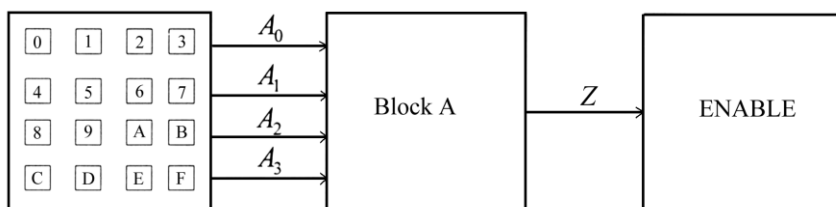
Tutorial 3

1. Implement the following expression with **2-input NAND gates** only:
 - (a) $ABC + DE$
 - (b) $ABC + D' + E$

2. Simplify the following expressions using k-map.
 - (a) $f = \bar{a}\bar{b}c + \bar{b}\bar{c}\bar{d} + bcd + ac\bar{d} + \bar{a}\bar{b}c + \bar{a}bcd$
 - (b) $f = wxy + yz + x\bar{y}z + \bar{x}y$
 - (c) $f(a,b,c,d) = \Sigma m(4,6,7,15)$
 - (d) $f(a,b,c,d) = \Sigma m(3,7,11,13,14,15)$
 - (e) $f(a,b,c,d) = \Sigma m(0,6,8,13,14) + \Sigma d(2,4,10)$
 - (f) $f(a,b,c,d) = \Sigma m(1,3,5,7,9,15) + \Sigma d(4,6,12,13)$

3. Map the following SOP expression on a K-map.
 $\bar{B}\bar{C} + \bar{A}\bar{B} + \bar{A}BC + \bar{A}\bar{B}CD + \bar{A}B\bar{C}D + \bar{A}BCD$

4. A simple locker system that has a output signal $Z = 1$ when the hexadecimal keypad input is either 0, 1, 2, 3, 4, 5, 8, 9, or A; otherwise $Z = 0$. Assume that $A_0 A_1 A_2 A_3$ represent a 4-digit binary number output from the keypad. Block A decodes these singals and outputs the signal Z.
 - (i) Write down the truth table of Block A.
 - (ii) Find the SOP and POS expression of Block A.
 - (iii) Design the circuit of Block A using minimum number of AND, OR and NOT gates.

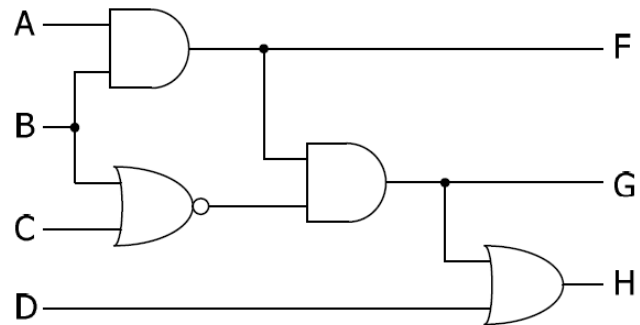


5. (a) Draw the logic circuit of the following Boolean function without simplification:

$$Y(A, B, C) = ABC + AB'(A'C)'$$

- (b) Simplify the logic function in (a) and, hence, re-draw the logic circuit.

6. (a) Derive Boolean functions to describe the operations of the logic circuit as follow:



- (b) Hence, simply and draw a new logic circuit.