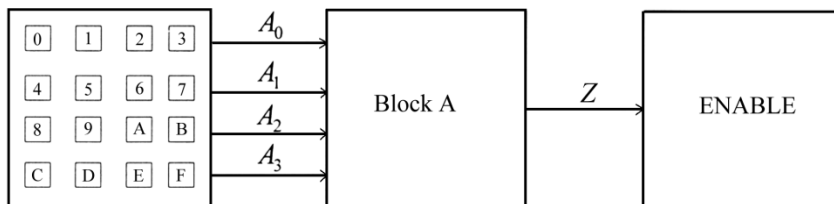


EE 2000 Logic Circuit Design
Semester B 2023/24

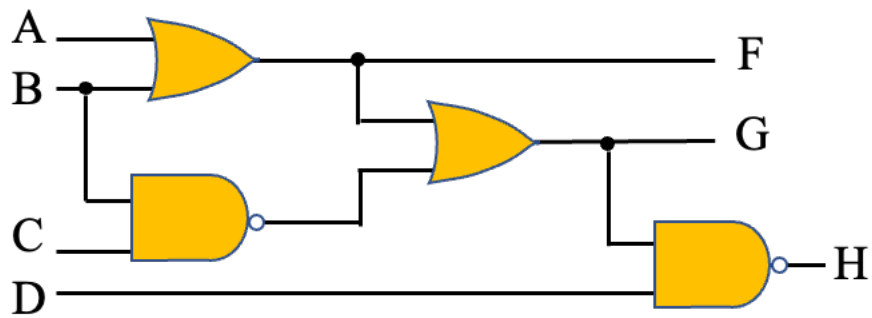
Tutorial 1

1. Simplify the following expressions using boolean algebra
 - (a) $f(w, x, y, z) = xy + \bar{w}\bar{y}z + \bar{w}x\bar{y} + wxy\bar{z} + \bar{w}yz + wz$
 - (b) $f(x, y, z) = (x + y + z)(x + y + \bar{z})(x + \bar{y} + z)(x + \bar{y} + \bar{z})$
 - (c) $f(a, b, c, d) = ab + bcd + ab'c' + abd + bc + abc'$
 - (d) $f(a, b, c) = (a + b + c)(a + \bar{b} + c)(a + \bar{b} + \bar{c})(\bar{a} + \bar{b} + \bar{c})$
2. Given a function $f(x, y, z) = \sum m(0, 2, 4, 6)$
 - (a) Show the truth table.
 - (b) Show the algebraic expression in standard SOP form.
 - (c) Show the minimum SOP expression and draw the circuit diagram.
 - (d) Show the algebraic expression in standard POS form.
 - (e) Show the minimum POS expression.
3. A simple locker system that has an output signal $Z = 1$ when the hexadecimal keypad input is either 0, 1, 2, 3, 7, 8, 9, A or E; otherwise $Z = 0$. Assume that $A_3 A_2 A_1 A_0$ represent a 4-digit binary number output from the keypad (A_3 as the MSB). Block A decodes these signals and outputs the signal Z .



- (a) Write down the truth table of Block A.
- (b) Find the SOP and POS expression of Block A.
- (c) Design the circuit of Block A using minimum number of 2-input AND, OR gates and NOT gates.

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



- (b) Hence, simplify and draw a new logic circuit.
- (c) Redraw the logic circuit with only 2-input NAND gates.