

King Fahd University of Petroleum and Minerals
 Department of Electrical Engineering
 EE 200 Digital Logic Circuit Design
Dr. H. Ragheb
 HW No. 4 (Due Monday. April 2)

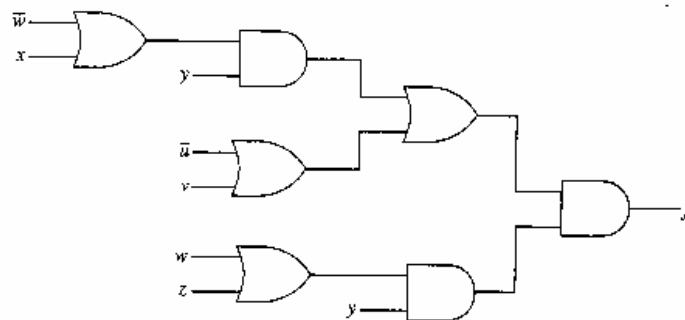
1- Using algebraic manipulations, obtain a logic diagram consisting of only NAND-gates for each of the following expressions. Assume the variables are available both complemented and uncomplemented.

- (a) $f(w, x, y, z) = \bar{y} + w\bar{x} + \bar{w}x\bar{z}$
- (b) $f(w, x, y, z) = (w + y)(\bar{x} + \bar{z})(\bar{w} + \bar{x} + \bar{y})$
- (c) $f(w, x, y, z) = \bar{w}(x\bar{y} + \bar{x}y) + z(x + y)$
- (d) $f(w, x, y, z) = (\bar{x} + y\bar{z})[w + (y + z)(\bar{y} + \bar{z})]$

2- Using algebraic manipulations, obtain a logic diagram consisting of only NOR-gates for each of the Boolean expressions in problem 1. Assume the variables are available both complemented and uncomplemented.

3-Convert the logic diagram shown below into a logic diagram consisting of:

- (a) only NAND gates
- (b) only NOR gates.



4- Implement the following expression using XOR and AND gates

$$F = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}B\bar{C}\bar{D} + A\bar{B}\bar{C}\bar{D} + \bar{A}B\bar{C}D$$