

## COMPUTER SCIENCE 355 FALL 2013

### ASSIGNMENT 1 DUE Thursday September 26 AT BEGINNING OF CLASS

1. Simplify the following expressions into sum of products form:

(a)  $(x + y)(x' + z)(w' + y)(w' + z')$

(b)  $(x' + y' + z)(w + y + z)(x + z')$

2. Design circuits as specified below. In each case you may assume that you have all variables available in both true and inverted form. Gates may have any fan-in up to 4. Marks will be awarded for keeping the total number of gates as small as possible.

(a) a two level circuit for  $a(b + a') + b'(c + d) + ab$  using only AND, OR gates;

(b) a circuit for  $a'bc + a'b'd + a'c$  using NOR gates only

(c) a circuit for  $ab'c' + a'cd + ab'c + abd$  using NAND gates only.

3. Simplify the following Boolean expressions (to the simplest sum of products form) using three variable maps:

(a)  $F(x,y,z) = x'y' + x'yz + xy'z'$

(b)  $F(x,y,z) = \sum m(3, 4, 6, 7)$

4. Simplify the following Boolean expressions (to the simplest sum of products form) using four variable maps:

(a)  $F(w,x,y,z) = \sum m(0, 2, 4, 9, 10, 12, 13, 14)$  (4 terms)

(b)  $F(w,x,y,z) = \sum m(0, 1, 5, 8, 10, 12, 13, 14)$  (3 terms)

(c)  $F(w,x,y,z) = \sum m(0, 1, 2, 8, 9, 10, 12, 14)$  (3 terms)

5. Given the function  $F(w,x,y,z) = (w' + x + y')(x + z)(x + y')$  :

(a) express the function as a sum of minterms, using the 'little m' notation

(b) express the function as a product of maxterms using the 'big M' notation.

6. Given the function  $F(w,x,y,z) = \sum m(1, 3, 7, 13) + d(4, 5, 9, 14)$ . Find:

(a) the minimum sum of products form for F

(b) the minimum product of sums form for F.

7. Construct a 16 to 1 multiplexer using five 4 to 1 multiplexers. Use block diagrams for the multiplexers.

8. Implement the function F with an 8 to 1 multiplexer. Use A, B, C as the selection (control) inputs for the mux.

$$F(A, B, C, D) = \sum m(0, 4, 5, 6, 9, 12, 13, 15).$$