

Computer Engineering 111
Test 1
February 22, 2010

Name _____

Eight problems, 100 points.

Closed books, closed notes, no calculators. You would be wise to read all problems before beginning, note point values and difficulty of problems, and budget your time accordingly. The order you should do the problems might be different than the order in which they appear.

Please do not open the test until I tell you to.

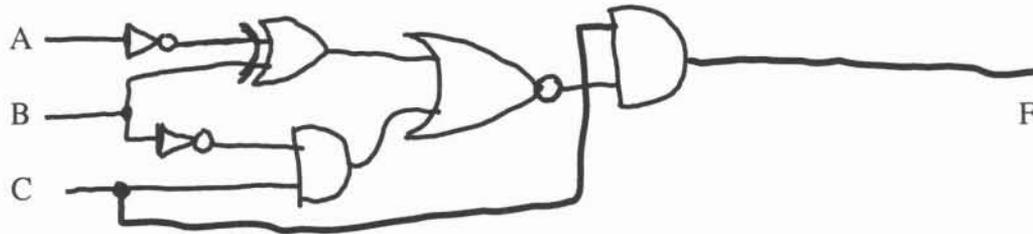


"This test sounds like fun!"

Good luck! Have fun!



1. (19 points) Consider the circuit below:



Write F the way the circuit is drawn:

F =

Now rewrite F in minimal SOP form. You can do this by brute force using the truth table and K-map provided, by simplifying and rearranging using the rules of Boolean Algebra, or by some combination of the two approaches. (Hint: I personally think this one happens to be faster using Boolean Algebra. But it's a matter of personal preference.) Show your work.

(minimal SOP) F =

ABC F
 000
 001
 010
 011
 100
 101
 110
 111

A \ BC	00	01	11	10
0				
1				

2. (25 points) Find the minimal and canonical SOP implementations of F as given in the truth table below. Use your choice of methods, but show your work. Then do the minimal and canonical POS form. Also do the minterm and Maxterm form below.

ABC F
 000 0
 001 1
 010 0
 011 1
 100 1
 101 1
 110 0
 111 0

A \ BC	00	01	11	10
0				
1				

The minimal SOP form of F is $F =$ _____.

The canonical SOP form of F is $F =$ _____.

The minimal POS form of F is $F =$ _____.

The canonical POS form of F is $F =$ _____.

Write F in terms of minterms, and again in Maxterms, i.e.:

$$F = \sum m(\quad)$$

$$F = \prod M(\quad)$$

3. (11 total points)

a) (2 points) convert to hex and binary:

53204 (octal) = (binary) = (hex)

b) (2 points) convert to decimal:

11001101001 (binary) = (decimal)

c) (5 points) convert to binary, octal and hex:

5161.6875 (decimal) = (binary)

4983.6875 (decimal) = (octal)

4983.6875 (decimal) = (hex)

d) (2 points) convert to octal and hex

1011110101001.1010111001 (binary) = (octal) = (hex)

4. (4 points) Write down the number "8" in the following codes:

"Natural" BCD: _____

XS3: _____

5. (10 points)

$F(w,x,y,z) = \sum m(1,2,4,5,9,11,13) + dm(0,6,15)$. d denotes don't care
 Give the minimal SOP expression and the minimal POS expression

Decimal	wxyz	F
0	0000	
1	0001	
2	0010	
3	0011	
4	0100	
5	0101	
6	0110	
7	0111	
8	1000	
9	1001	
10	1010	
11	1011	
12	1100	
13	1101	
14	1110	
15	1111	

wx \ yz	00	01	11	10
00				
01				
11				
10				

SOP

F = _____

POS

F = _____

6. (10 points) $F(w,x,y,z) = \prod M(0,2,3,12,13) + d(1, 6,7,9,10)$
 Give the minimal SOP expression and the minimal POS expression for F.

Decimal wxyz F
 0 0000
 1 0001
 2 0010
 3 0011
 4 0100
 5 0101
 6 0110
 7 0111
 8 1000
 9 1001
 10 1010
 11 1011
 12 1100
 13 1101
 14 1110
 15 1111

wx \ yz	00	01	11	10
00				
01				
11				
10				

SOP
 F = _____

POS
 F = _____

7. (12 points: 4 each for (a) and (d), 2 each for (b) and (c).) Replicate these operations, showing all steps, in binary:

a) $80.5 / 7 = 11.5$.

b) $9 \times 6 = 54$.

c) $37 + 13 = 50$.

d) (For this one, assume 8-bit 2's complement representation, i.e., subtract by adding): $88 - 33 = 55$.

8. (9 points)

Show that you can implement any circuit with only NAND gates. To do this, just redraw the AND, OR, and INVERTER (i.e., NOT) gates, in NAND logic.

This page is an extra sheet of scratch paper. Please don't use it for showing solutions, but refer to it on the problem page if you have work here that you are required to show on the problem, or that you otherwise believe needs to be considered in grading. You are permitted to tear off this sheet if there's nothing on here that you think needs to be considered.