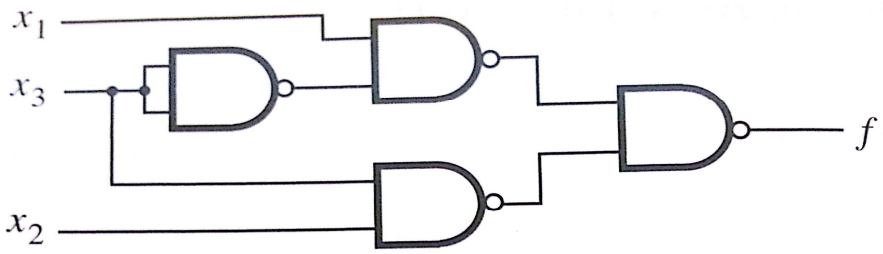
Cpr E 281 HW04 SOLUTION

ELECTRICAL AND COMPUTER ENGINEERING
IOWA STATE UNIVERSITY

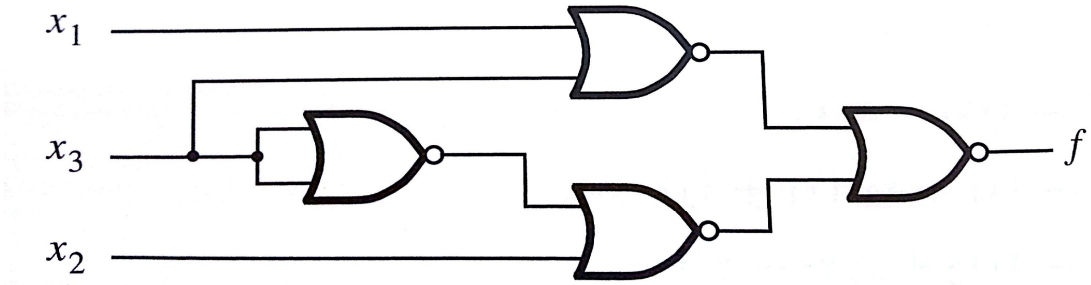
Assigned Date: Fourth Week
Due Date: First class of 5th week

P1.

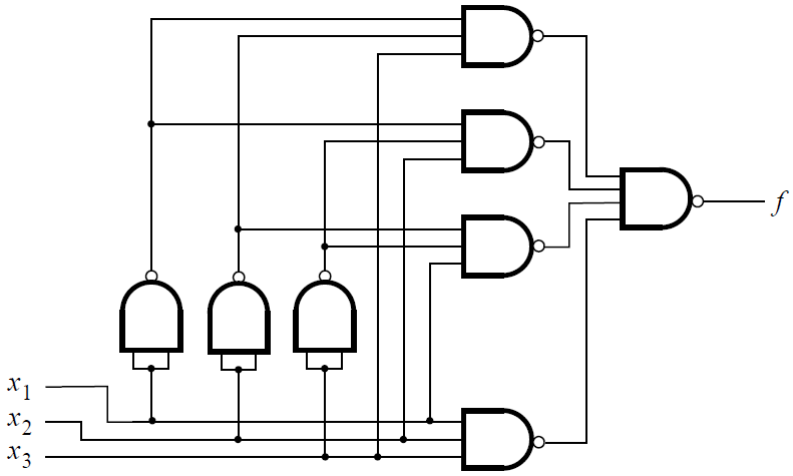
a)



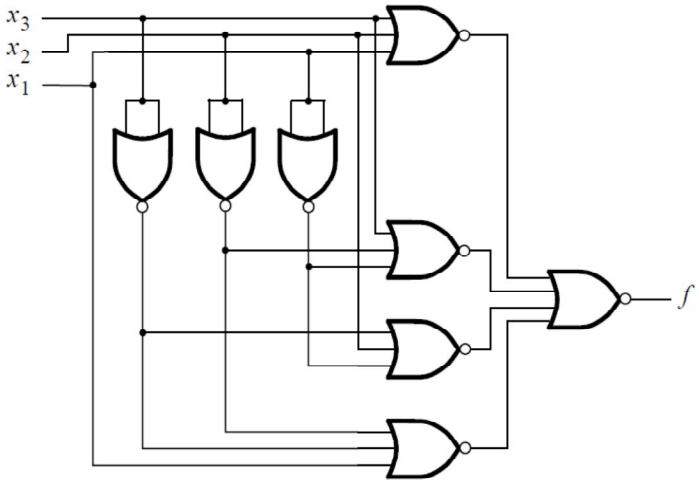
b)



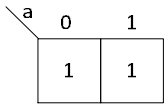
P2. a) To implement the function using only NAND gates, we can first write the canonical SOP expression for the function. Then by drawing its K-map, we can see that this SOP is already the simplest one. By using De Morgan's theorem to replace the ANDs and OR by NANDs and by implementing the NOT gates by NAND gates, we can obtain the following circuit:



b) To implement the function using only NOR gates, we can first write the canonical POS expression for the function. Then by drawing its K-map, we can see that this POS is already the simplest one. By using De Morgan's theorem to replace the ORs and AND by NORs and by implementing the NOT gates by NOR gates, we can obtain the following circuit:

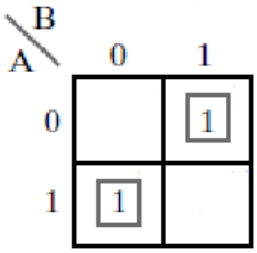


P3. a)



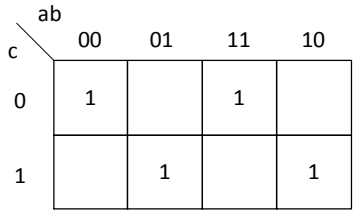
f = 1

b) No simplification



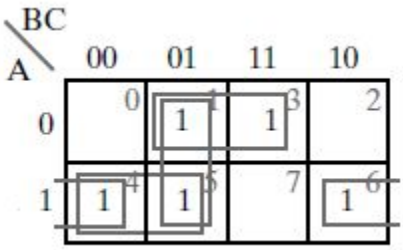
G(a,b)=a'b+ab'

c)



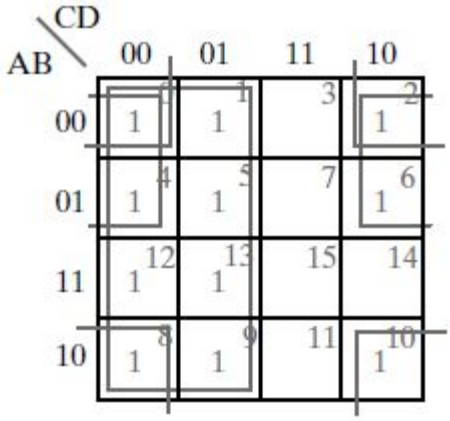
$f = \bar{a}\,\bar{b}\,\bar{c} + \bar{a}bc + a\bar{b}c + ab\bar{c}$

d)



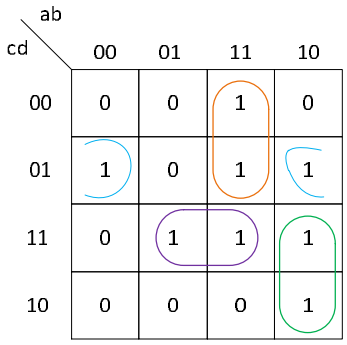
H(A,B,C) = A'C+AB'+AC'
H(A,B,C)= A'C+B'C+AC'

e)



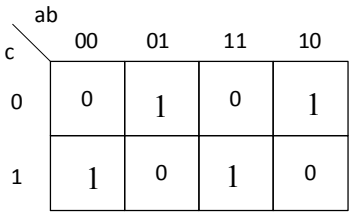
F = C'+A'D'+B'D'

f)



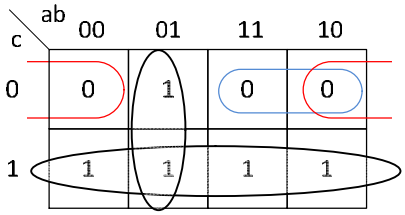
$$f = ab\bar{c} + a\bar{b}c + \bar{b}\bar{c}d + bcd$$

P4. a)



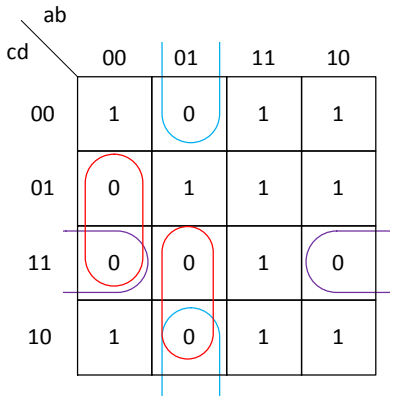
F= a'b'c+a'bc'+ab'c'+abc

b)



F=c+a'b

c)



$$F = b'd' + ab + ac' + bc'd$$

P5. (a) The truth table:

X1	X0	Y1	Y0	F
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

(b) By K-map, the simplest POS expression is

$f = (x_1+y_1').(x_1'+y_1).(x_0+y_0').(x_0'+y_0).$

P6. (a) f = abd + bcd + acd + abc

cd \ ab	00	01	11	10
00	0	0	0	0
01	0	0	1	0
11	0	1	1	1
10	0	0	1	0

(b) f = (a+b).(c+d).(a+c).(a+d).(b+c).(b+d)

cd \ ab	00	01	11	10
00	0	0	0	0
01	0	0	1	0
11	0	1	1	1
10	0	0	1	0

(c) For the expression in part (b), Cost = 21 (4 AND, 1 OR, 16 inputs).
For the expression in part (c), Cost = 25 (6 OR, 1 AND, 18 inputs)