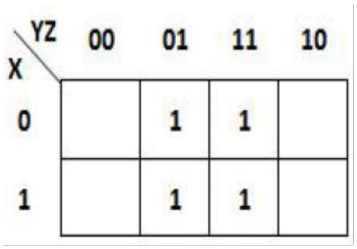
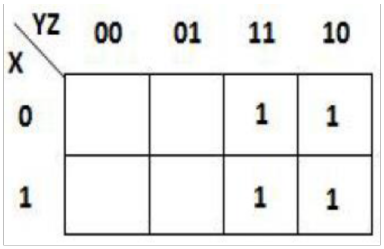
Cpr E 281 HW04
ELECTRICAL AND COMPUTER ENGINEERING
IOWA STATE UNIVERSITY

Minimization and Karnaugh Maps
Assigned Date: Fourth Week
Due Date: Sep. 18, 2017

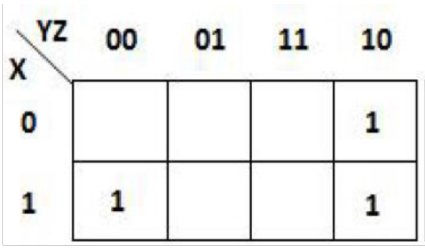
P1. (15 points) Obtain the canonical SOP, short form, and simplified expressions for the following K-maps:



(a)



(b)



(c)

P2. (15 points) Use a K-map to simplify the following SOP expressions:

a. F(X, Y, Z) = Σm (0, 1, 5, 7)
b. F(X, Y, Z) = Σm (1, 3, 4, 5, 7)
c. F(X, Y, Z) = m0 + m2 + m4 + m6
d. F = A'B'C' + ABC + A'B'C + AB'C'
e. F = A'B'C'D' + A'B'C'D + ABCD' + A'BCD + A'B'CD

P3. (15 points) Use a K-map to simplify the following functions as much as possible and write the results in POS form:

a. f(a,b,c) = Π M(0,3,5,6)
b. f(a,b,c) = a'bc' + a'b'c + a'bc + ab'c + abc
c. f(a,b,c,d) = Σ m(0,2,5,8,9,10,12,13,14,15)

P4. (10 points) Given the following minterm expansion:

F(A,B,C)= Σm (0,2,3,4,6)

a. Use K-maps to determine the minimum SOP expression
b. Find the cost of the expression that you got in part (a)
c. Use K-maps to determine the minimum POS expression
d. Find the cost of the expression that you got in part (c) and then compare this cost with the cost that you obtained in part (b). Which one is smaller?

P5. (10 points) Plot the following function on a K-map.

F(A,B,C,D) = A'B' + CD' + ABC + A'B'CD' + ABCD'

a. Find the minimum SOP expression
b. Find the minimum POS expression

Minimization and Karnaugh Maps
Assigned Date: Fourth Week
Due Date: Sep. 18, 2017

P6. (20 points) A four-variable function that is equal to 1 if any three or all four of its variables are equal to 1 is called a *majority* function.

a. Write the truth table for the majority function.
b. Use a K-map to derive the simplest SOP expression for this majority function.
c. Use a K-map to derive the simplest POS expression for this majority function.
d. Compare the costs of the circuits implementing the expressions in part(b) and part(c) in terms of the total number of gates plus the total number of inputs.

P7. (10 points) Design a circuit with output f and inputs x_1,x_0,y_1, and y_0. Let $X=x_1x_0$ and $Y=y_1y_0$ represent two 2-digit binary numbers. The output f should be 1 if the numbers represented by X and Y are equal. Otherwise, f should be zero.

(a) Show the truth table.
(b) Derive the simplest possible POS expression using a K-Map.

P8. (5 points) Design the simplest circuit that implements the function in the following truth table using:

a) Only NAND Gates
b) Only NOR Gates

x1	x2	x3	F
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1