Cpr E 281 HW04
ELECTRICAL AND COMPUTER ENGINEERING
IOWA STATE UNIVERSITY

Minimization and Karnaugh Maps
Assigned Date: Fourth Week
Due Date: Sep. 21, 2015

P1. (10 points) Design the simplest circuit that implements the function
$f(x_1,x_2,x_3)= \Sigma m(3,4,6,7)$ using:

a) NAND Gates
b) NOR Gates

P2. (10 points) Design the simplest circuit that implements the function in the following truth table using:
a) NAND Gates
b) 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

P3. (25 points) Use a K-map to find the simplest SOP form for the following function:
(a) f(a) = Σ m(0,1)
(b) G(a,b) = Σ m(1,2)
(c) f(a,b,c) = Σ m(0,3,5,6)
(d) H(a,b,c) = Σ M(1,3,4,5,6)
(e) f(a,b,c,d) = Σ m(0, 1, 2, 4, 5, 6, 8, 9, 10, 12, 13)
(f) f(a,b,c,d) = Σ m(1,7,9,10,11,12,13,15)

P4. (15 points) Use a K-map to find the simplest SOP form for the following function:
(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)

P5. (20 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) (5 points) Draw the truth table for this function
(b) (15 points) Derive the simplest possible POS expression using a K-Map.

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P6. (20 points) For the following truth table find the following:

a	b	c	d	f
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

(a) Use a K-map to derive the simplest SOP expression for this function.

(b) Use a K-map to derive the simplest POS expression for this function.

(c) Compare the costs of the circuits implementing the expressions in part (a) and part (b) in terms of the total number of gates plus the total number of inputs.