ECE 130 HW#6 – Due Thursday, March 25

1. Consider the following truth table where the four-bit number A (A3, A2, A1, A0) is input and X is output:

A3	**A2**	**A1**	**A0**	**X**
0	*0*	*0*	*0*	1
0	*0*	*0*	*1*	0
0	*0*	*1*	*0*	1
0	*0*	*1*	*1*	1
0	*1*	*0*	*0*	0
0	*1*	*0*	*1*	0
0	*1*	*1*	*0*	0
0	*1*	*1*	*1*	0
1	*0*	*0*	*0*	1
1	*0*	*0*	*1*	1
1	*0*	*1*	*0*	1
1	*0*	*1*	*1*	1
1	*1*	*0*	*0*	0
1	*1*	*0*	*1*	0
1	*1*	*1*	*0*	1
1	*1*	*1*	*1*	0

a. Convert the truth table into a K-Map.

A1A0\A3A2	00	01	11	10
00	1	0	0	1
01	0	0	0	1
11	1	0	0	1
10	1	0	1	1

b. Use the K-Map to develop a ***minimized sum-of-products*** equation for the output X.

from red: X = A3*A2’ + A2’*A1 + A3*A1*A0’ + A2’ *A0’

c. Use the K-Map to develop a ***minimized product-of-sums*** equation for the output X.

from green: X = (A2’ + A1)(A2’ + A0’)(A3 + A2’)(A3 + A1 + A0’)

d. State the number of inputs used for each of the two equations. Based on these numbers, which equation is more efficient? Why?

SoP: 13 inputs

PoS: 13 inputs. Go with PoS since both expressions have same number of inputs.

e. Implement the more efficient equation using either NAND-NAND or NOR-NOR two level logic. Draw your circuit below. You can use the complemented and uncomplemented forms of all of the variables.