ECE 130 HW#5 – Due Tuesday, March 23

1. Consider the following truth table where the four-bit number A (A3, A2, A1, A0) is input and the four-bit number X (X3, X2, X1, X0) is output:

A3	**A2**	**A1**	**A0**	**X3**	**X2**	**X1**	**X0**
0	*0*	*0*	*0*	1	1	1	1
0	*0*	*0*	*1*	1	1	0	0
0	*0*	*1*	*0*	1	0	0	1
0	*0*	*1*	*1*	0	1	1	0
0	*1*	*0*	*0*	0	1	0	1
0	*1*	*0*	*1*	0	0	1	1
0	*1*	*1*	*0*	0	0	1	0
0	*1*	*1*	*1*	0	0	1	0
1	*0*	*0*	*0*	0	0	0	1
1	*0*	*0*	*1*	0	0	0	1
1	*0*	*1*	*0*	0	0	0	1
1	*0*	*1*	*1*	0	0	0	1
1	*1*	*0*	*0*	0	0	0	0
1	*1*	*0*	*1*	0	0	0	0
1	*1*	*1*	*0*	0	0	0	0
1	*1*	*1*	*1*	0	0	0	0

a. Write down the correct functional representation for each of the four outputs in the canonical sigma notation:

X3 (A3, A2, A1, A0) = Σ(

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X1 (A3, A2, A1, A0) = Σ(

X0 (A3, A2, A1, A0) = Σ(

b. Write down the correct functional representation for each of the four outputs in the canonical pi notation:

X3 (A3, A2, A1, A0) = Π(

X2 (A3, A2, A1, A0) = Π (

X1 (A3, A2, A1, A0) = Π (

X0 (A3, A2, A1, A0) = Π (

c. Expand the canonical sigma notation for X3 into a canonical sum-of-products equation (do not attempt to simplify)

d. Expand the canonical pi notation for X0 into a canonical product-of-sums equation (do not attempt to simplify)

e. Using Boolean algebra, simplify the canonical sum-of-products equation for X3 (from part c) into a sum-of-products equation that has the fewest possible literals and operators. (Note that there may be a more simplified form that is *not* sum-of-products.)

2. Prove Theorem Nine …

$$A * (A + B) = A$$

a. … using only other theorems (justify each step with the theorem number, *like T1*):

b. … using only postulates