4 Boolean Logic and Truth Tables

You will be asked to derive the Boolean Equations for two 4-input logic functions, X and Y. Please use the Truth Table below for the following three questions.

Inputs				**Outputs**	
A_3	A_2	A_1	A_0	X	Y
0	0	0	0	1	0
0	0	0	1	1	0
0	0	1	0	1	0
0	0	1	1	1	0
0	1	0	0	1	0
0	1	0	1	1	1
0	1	1	0	1	0
0	1	1	1	0	0
1	0	0	0	1	0
1	0	0	1	1	0
1	0	1	0	1	1
1	0	1	1	1	0
1	1	0	0	1	0
1	1	0	1	1	0
1	1	1	0	0	0
1	1	1	1	0	0

(a) [15 points] The output X is *one* when the input does **not** contain 3 consecutive 1's in the word A_3, A_2, A_1, A_0. The output X is *zero*, otherwise. **Fill in the truth table on the previous page** and **write the Boolean equation in the box below** for X using the *Sum of Products* form. (*No simplification needed.*)

$$X = (A_3 + \overline{A_2} + \overline{A_1} + \overline{A_0}) \cdot (\overline{A_3} + \overline{A_2} + \overline{A_1} + A_0) \cdot (\overline{A_3} + \overline{A_2} + \overline{A_1} + \overline{A_0})$$

(b) [15 points] The output Y is *one* when no two adjacent bits in the word A_3, A_2, A_1, A_0 are the same (e.g., if A_2 is 0 then A_3 and A_1 cannot be 0). The output Y is *zero*, otherwise (for example 0000). **Fill in the truth table on the previous page** and **write the Boolean equation in the box below** for Y using the *Sum of Products* form. (*No simplification needed.*)

$$Y = \overline{A_3}A_2\overline{A_1}A_0 + A_3\overline{A_2}A_1\overline{A_0}$$

(c) [10 points] Please represent the circuit of Y using only 2-input XOR and AND gates.