Quantum HW1 Problem 5

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$$a_1q_1 + a_2q_2 + a_3q_3 + b_{12}q_1q_2 + b_{13}q_1q_3 + b_{23}q_2q_3$$

State: (0,0,0) - satisfied automatically
State: (0,1,1) - $a_2 + a_3 + b_{23} = 0$
State: (1,0,1) - $a_1 + a_3 + b_{13} = 0$
State: (1,1,0) - $a_1 + a_2 + b_{12} = 0$

But, as a result, summing all equations, we can get the equation

$$2a_1 + 2a_2 + 2a_3 + b_{12} + b_{13} + b_{23} = 0$$

Here, as constraints, our a_i for $i = 1, 2, 3$ have to be bigger than 0. If one of them is smaller than or equal to 0, one of the states (1,0,0), (0,1,0), (0,0,1) will become a state which has minimum objective function value. Then, since $a_1 + a_2 + a_3 > 0$, $a_1 + a_2 + a_3 + b_{12} + b_{13} + b_{23}$ must be negative value. As a result, (1,1,1) state's objective value is smaller than 0. It means (0,0,0) state cannot be our target state.