Proof: The original problem has an unique optimal solution where the function value is zero.

Initialize

We have since is not an optimal solution of the original problem.

Solving LP we get

Case 1: If  and is not the optimal solution of the original problem.  > 0. With > 0, we have .

Case 2: = 0, note that . If is optimal, we have  and  = 0. Record this solution.