1). Assume x is guaranteed to be the amount of coal loaded at index 0 of the optimal solution list.

Let L be the optimal solution list of amount of coal loaded by adding x to an optimal solution with train station location $S = \{S_2, S_3, \cdots S_n\}$

Suppose there is some solution L' that uses less amount of coal than L.

Since some optimal solution exists that uses x, we may assume L' uses x as well.

This means that $L' \setminus \{x\}$ uses less amount of coal than $L \setminus \{x\}$, defined to be the optimal solution to the problem with train station $S = \{S_2, S_3 \ldots S_n\}$.

However, $L' \setminus \{x\}$ is also a way to load minimum amount of coal, contradicting that the solution to the problem with train station $S = \{S_2, S_3 \ldots S_n\}$. is optimal.

2). $[2, 0, 2, 0]$ total time $= (2+2) \times 1 = 4$.

3). $[1, 1, 0.5, 1.5]$ total time $= (1+1+0.5+1.5) \times 1 = 4$.

4) when $C = 2$. $x = 25$, and $S = \{0, 10, 20\}$

Algorithm A: $[2, 0, 2]$ total time $= (2+2) \times 1 = 4$

Algorithm B: $[1, 1, 0.5]$ total time $= (1+1+0.5) \times 1 = 2.5$

The loading time of algorithm A is greater than the loading time of algorithm B.