

Tutorial 9, Design and Analysis of Algorithms, 2017

1. Let Π be an *NP Optimization* problem. Let $I \in D_{\Pi}$ be a valid instance of Π . Prove that the length of the optimal solution B is polynomially bounded by the size of I : $|B| = O(|I|)$.
2. Assuming that Π is an *NP Optimization* problem having the objective function integer valued, and given a polynomial-time algorithm $DCN(I, B)$ for solving the decision version of Π , using the result of (1) above, prove that you can use $DCN(I, B)$ to construct a polynomial-time algorithm $OPT(I)$ for finding the optimal solution of $I \in D_{\Pi}$.
3. Study Kwek's polynomial-time algorithm for optimal search for rationals. Show how you will search $\frac{22}{7}$ using Kwek's algorithm.
4. Assuming that Π is an *NP Optimization* problem having the objective function rational valued, and given a polynomial-time algorithm $DCN(I, B)$ for solving the decision version of Π , using the results of (1) and (3) above, prove that you can use $DCN(I, B)$ to construct a polynomial-time algorithm $OPT(I)$ for finding the optimal solution of $I \in D_{\Pi}$.