E0 225: Homework 9

Deadline: 5 pm on January 2, 2021 (Saturday)

Problem 1. Review and succinctly (in, say, 3-4 lines) describe each of the following NP-complete problems.
A useful compendium is available at `https://www.csc.kth.se/~viggo/problemlist/compendium.html`

- **Graph Theory:** Max Clique, 3-Coloring
- **Network Design:** Max Cut
- **Sets and Partitions:** Set Cover, Subset Sum, Max 3-D Matching, Min Hitting Set
- **Sequencing:** Hamiltonian Cycle
- **Mathematical Programming:** Integer Linear Programming

Problem 2. In the Path Cover problem, we are given an undirected graph G and an integer k, along with a set of m shortest paths $\mathcal{P} = \{P_1, P_2, \ldots, P_m\}$. That is, each path P_i, for $i \in [m]$, is a shortest path between some pair of vertices in G. The objective of the problem is to determine where there exists at most k paths in $\mathcal{P}$ such that their union covers all the edge in G. Show that the Path Cover problem is NP-complete.