The Traveling Salesperson Problem

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Abstract

Here we present and solve the TSP.

1 Introduction

In the project, we solve the Traveling Salesperson Problem (TSP) with a branch and cut method...But first some notation. We are given a graph $G = (V, E)$. We denote $V(G)$ to be the vertices or nodes of graph G, and $E(G)$ to be the edges or arcs of graph G.

Given an $\mathcal{S} \subset V(G)$, we denote the set of edges with both ends in $\mathcal{S}$ as $\gamma(\mathcal{S})$. We denote the set of edges with only one end in $\mathcal{S}$ as $\delta(\mathcal{S})$. This is equivalently called a *cut* of $\mathcal{S}$.

1.1 Problem Formulation

Let $\mathcal{S} \subset V(G)$. Assume we have n nodes and m edges. The problem can be expressed as the following IPP:

$$\min c^T x$$

$$\sum_{e \in \delta(i)} x_e = 2, \quad \forall i \in V(G) \tag{IO}$$

$$\sum_{e \in E(S)} x_e \leq |S| - 1, \quad \forall S \neq \emptyset, V(G) \tag{PF2}$$

$$x \in \mathbb{B}^n$$

where line (**??**) states that every node must have exactly two arcs attached to it. Thought more generally, that every node has a path in and a path out.

2 Computational Implementation

In this section we describe our approach to designing a program to solve the TSP.

2.1 Pseudo Code

The general framework behind our algorithm.

2.2 Computational Results

We were given such and such dataset, we fed it into our program, here's our solution.