The Travelling Tournament Problem

1 Introduction

At first glance, scheduling a sports competition appears to be easy. Simple algorithms exist to set up valid schedules for basic competition formats, such as knock-out tournaments and competitions where each team needs to play each other team. However, these techniques do not take into account any complications, such as the (un)availability of venues, or preferences of the competition organizers, such as a nice spread of popular games. In this project, you will look at one of more studied problems in sport scheduling, the travelling tournament problem. This problem is inspired by the American baseball competition, where teams play a very large number of games per season. The common competition format, where teams (almost) alternatingly play home and away games would result in unmanageable amount of travel. Instead, teams remain at their home grounds for a longer period of time, where they play multiple opponents for multiple games each. When they travel for away games, they travel directly between opponents. For example, a team from the East coast may play some games in Seattle, then travel to San Francisco, finishing in Los Angeles before returning home. By grouping away games against opponents in the same geographical region in this way, they again save on travel time. While, in the interest of travelling as little as possible, it would be best to have very long road tripes and homestands, this is not allowed for the benefit if the teams that do not want to be away form home for too long.

2 Problem Description

You must schedule a competition with N teams in a double round-robin tournament. This is a tournament where each team must play each opponent once at home, and once away. For this competition, there are $2(N-1)$ rounds, so every team must play in each round. You are given a graph $G(V, E)$. In the graph, each vertex $v \in V$ corresponds to a team in the competition. The edges (v, w) have an associated travel time, showing the travel time between teams v and w. You are also given a lower bound L and upper bound U, which is the minimum and maximum number of rounds teams may play consecutively at home or away. Teams are not allowed to play the same opponent in two consecutive rounds (so, it is not allowed that both teams play each other, both travel to the location of the second team, and play again). The goal is to schedule this competition with as little travel time as possible.

3 Data Files

This problem is a well studied problem, and many benchmark instances are available. These can be found at https://robinxval.ugent.be/RobinX/travelRepo.php. The tab "Specification" may give some additional information on the problem, as well as some variants. The tab "XML files" contains benchmark instances. The best known lower and upper bounds are given (i.e., values

which we know optimal solutions can not beat, and the values we known the optimal solution can not be worse than. Typically the later means a solution with this value is known). This should give you some indication of the quality of your solutions. While many instances are available, I strongly encourage to focus on the "NLx" instances.

Enjoy the puzzles!