Sponsor Group Assignment at Pomona College as a Constraint Satisfaction Problem

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Motivation

The first year of college can be a life-changing experience, greatly affected by the people students meet, and especially the people they live with. At Pomona College, sponsor groups consisting of 10 to 20 freshmen who live in the same hall are an essential aspect of first-year culture. Roommates and sponsor groups are currently paired by Head Sponsors, who have to sift through hundreds of applications. If roommate pairs and sponsor groups could be generated by a computer, less manual work would be required and less time would be spent.

Introduction

Sponsor groups are created by first considering all individual students and matching them with a peer, thus creating roommate pairs. Next, each pair is matched with four to nine other pairs in order to form a sponsor group. Our project will focus on mimicking this process. We will determine reasonable constraints on roommates based on preferences they submitted on housing applications and use these to generate roommate pairs. We will then use joint preferences of roommate pairs to place these students within sponsor groups.

System Description

The problem of placing students into roommate pairs and sponsor groups will be configured as two separate constraint satisfaction problems. Students will first be placed into roommate pairs and will then be placed into sponsor groups. Each of these placements will use backtracking and each will return an assignment satisfying specified constraints.

Creating Roommate Pairs

The constraints for this problem will be based on maximization of similarity between the preferences of students within a roommate pair. The constraint for roommate pairs will be that paired students do not have any preference rankings that differ by more than some constant number. The constant will be determined by experimentation and will be the highest integer for which a successful assignment of roommate pairs can be found.

Every single individual has a list of preferences, which are the numbers 0 through 9, indicated how important a certain statement is. These statements are as follows:

1. Is serious about studying and will make studying a priority of our room.
2. Allows me to have visitors over as often as Id like and doesnt mind having people over in our room.
3. Will be my friend who confides in me and likes to do a lot of things together.
4. Doesnt let school take over our entire lives, and knows how to have a good time.
5. Shares responsibility for keeping our room neat.
6. Respects my need for privacy and will allow me some time to myself.**
7. Respects my property and doesnt borrow my things without asking.***
8. Has similar sleep habits (i.e. windows opened/closed, absolute quiet, no light, etc.)***
9. There are people who share backgrounds and cultures similar to my own.
10. People are aware of, sensitive to, and willing to discuss multicultural issues.

Backtracking will be used to solve these problems. Within this algorithm, we will select the next student to be assigned a roommate using the least-remaining values heuristic in order to reduce the running-time of backtracking. We will also use the AC-3 algorithm as the inference subroutine to guarantee arc-consistency with the current assignment after each addition to the assignment. Once a complete assignment is found of all students into roommate pairs, this assignment is returned as a success.

Creating Sponsor Groups

The constraints for this problem will be based on maximization of similarity between the preferences of roommate pairs within a sponsor group.

Backtracking will be used to solve these problems. Within this algorithm, we will select the next roommate pair to be assigned to a sponsor group using the least-remaining values

heuristic in order to reduce the running-time of backtracking. We will also use the AC-3 algorithm as the inference subroutine to guarantee arc-consistency with the current assignment after each addition to the assignment. Once a complete assignment is found of all roommate pairs into sponsor groups, this assignment is returned as a success.

Results

We aim to obtain groupings of students into sponsor groups after placing individual students in roommate pairs. The success of the constraint-satisfaction problem will be evaluated using K-means clustering. The students will be clustered into 30 sponsor groups based on their preferences. Those clusterings will then be evaluated using purity, where the label associated with each student is the sponsor group number assigned to them by the constraint satisfaction results. A higher purity will indicate that our constraint satisfaction has placed students in sponsor groups with other similar students.

Bibliography

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