Project proposal

Stable matching algorithms and application

159.333 Programming Project Massey University

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**Background**

Stable matching is a significant theory for resource allocation. The application of this theory is so widely, whatever adjusting market or solving personal problems such as stable marriage these all need stable matching theory. Here is a simple question to explain stable matching: Match a single student with universities, assuming that each student has a universities-preferences and each university has a student’s-preferences then look for a stable match for every student and every university. What is stability in this condition? There are no person and university that would both rather have each other than their current one.

**Abstract**

We are working on a stable matching program, by achieving this program we wish it can solve some stable matching problems. One of useful algorithm is The Fundamental Algorithm, which allowing us to construct a stable matching will now be developed. This algorithm, in itself, constitutes a proof by construction of the existence of at least one stable solution. The fundament of our researches and theories is the book named “Stable and Its Relation to Other Combinatorial Problems”. To improve our program, we will continue to learn more algorithms and cases in this book but not only the book.

**Introduction**

We design a program to solve mutual choice of companies and applicants. The premise is the number of applicants and companies is same. Assume an applicant has preference of companies and he will choose the first one in his preference, companies are the side be selected but they also have preference of applicants and assume each company can only choose one applicant.

Our job is to find stable match for each applicant this also means companies get stable match. This is initial planning for the program and with more study of stable matching we may create more practical functions to improve our program.

**Methodology**

We are going to develop a program to solve the stable matching problem by using the visual studio for programming and the GitHub for version control for our program. We will implement two different algorithms in our program, the first one is fundament algorithm, the other one is non-recursive algorithm. We are going to use C++ programming language for our program. In the program We will be using C++ of the fundamental algorithm for N=6 people, and implement it using C++ vector/C++ sets and some of the C++ algorithms. Also, we will include some hash functions and C++ implementation in relation to the stable matching problem. The Input of the program is a 2D matrix of size (2\*6) \*6=72 where 6 is number of women or men. Rows from 0 to 5 represent an order of preference lists of men and rows from 6 to 11 represent an order of preference lists of women. Thus, men are numbered from 0 to 5 and women are numbered from 6 to 11. The output is consisting of two columns of the married pairs, the left column is the list of 6 man and the right column is the partner of each man after implement the stable matching algorithm. In addition, we will present the relation of stable matching with shortest path-C++ code to implement the algorithm.

**Presentation and report:**

For presentation, we will make a PPT to describe and explain stable matching, talking about the significance of stable matching to help others understand.

So, they know the means of stability then realize outputs of our program.

To show our program, we will design one group of data to input then we analysis output and explain why it is stable.

If we still have time, we will introduce more information about algorithms.

**Timeline**

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| --- | --- |
| Week | Topic |
| 1 | Choose topic |
| 2 | Prepare project proposal |
| 3 | Study of algorithms |
| 4 | Design program |
| 5 | Programming |
| 6 | Testing |
| 7 | Version control |
| Mid semester break |  |
| 8 | Advance program |
| 9 | Analysis |
| 10 | Report |
| 11 | Prepare presentation |
| 12 | presentation |

**Reference**

1. Knuth D.E.: Stable Marriage and Its Relation to Other Combinatorial Problems: An Introduction to the Mathematical Analysis of Algorithms, American Mathematical Society (1996)
2. *Stable marriage problem.* (n.d.). Retrieved from https://www.geeksforgeeks.org/stable-marriage-problem/