Lab 0 - Stable Matching

Sep 4, 2025

Lab 0 instructions

In this lab you will:

1. Formalize an algorithm for deciding if a matching is stable
    a. Writeup in latex
2. Give a proof for termination and correctness
3. Discuss time analysis
    a. Worst case

Reference the algorithm writeup guidelines:
https://bmc-cs-340.github.io/algorithm_guidelines.pdf

Part 1: Formalize an algorithm for deciding if a matching is stable

- Input
  - A set of employers: E
  - A set of applicants: A
  - $|E| = |A| = n$
  - $2n$ preference lists, each of size n
  - How are the preference lists stored?
    - linked lists? arrays? hash maps? why?
  - M, a list/set of n pairs (the matching)
- Output: yes/no

Stability Definition

For every employer E and every applicant A who is not assigned to intern at E,

at least one of the following should be true:

- E prefers its accepted intern to A or
- A prefers her current internship over working for employer E

Individual self interest will lead to stability

Employer-Applicant Matching Example

Employers			Applicants		
Google(G)	Intel(I)	Apple(A)	Kate(K)	Clara(C)	Lisa(L)
K	K	L	A	A	G
C	L	K	G	I	I
L	C	C	I	G	A

Matching 1: (G, C), (I, L), (A, K)

Q:Is this stable?
A: Yes

Employer-Applicant Matching Example

Employers			Applicants		
Google(G)	Intel(I)	Apple(A)	Kate(K)	Clara(C)	Lisa(L)
K	K	L	A	A	G
C	L	K	G	I	I
L	C	C	I	G	A

Matching 2: (G, L), (I, K), (A, C)

Q:Is this stable?
A: No

Employer-Applicant Matching Example

Employers			Applicants		
Google(G)	Intel(I)	Apple(A)	Kate(K)	Clara(C)	Lisa(L)
K	K	L	A	A	G
C	L	K	G	I	I
L	C	C	I	G	A

Matching 3: (G, L), (I, C), (A, K)

Q:Is this stable?
A: Yes

Part 2: Runtime complexity

Discuss the runtime complexity of your algorithm in terms of the size of your input (n)

2.1 Data Structures: detail the data structures and how they relate to the time complexity of the algorithm

Part 3: Termination and Correctness

Include an argument that your algorithm will terminate and that it will output the correct value (YES/NO)

Signing Out

Complete your writeup in latex and submit your lab on gradescope

Due before next Lab (Sep 11)