Lecture 6

CSE 331

Sep 11, 2023

2^{nd} T/F poll up

poll @84 stop following **1 view**

Actions

2nd T/F poll

Is the following statement **true** or **false**:

In every Stable Matching problem instance where a man m and woman w have each other as their least preferred partner, the following is true. There is no stable matching for the instance where (m, w) are matched.

(Note by a stable matching problem instance, we mean both the set of men and women as well as all the $2n$ preference lists.)

- True
- False

Please select one option

Submit

You have **not yet** voted.

Revoting is **not allowed**. Select your vote and click submit to register your vote.

Your name will **not be visible to anyone**.

t/f_poll polls

Edit good poll | 0

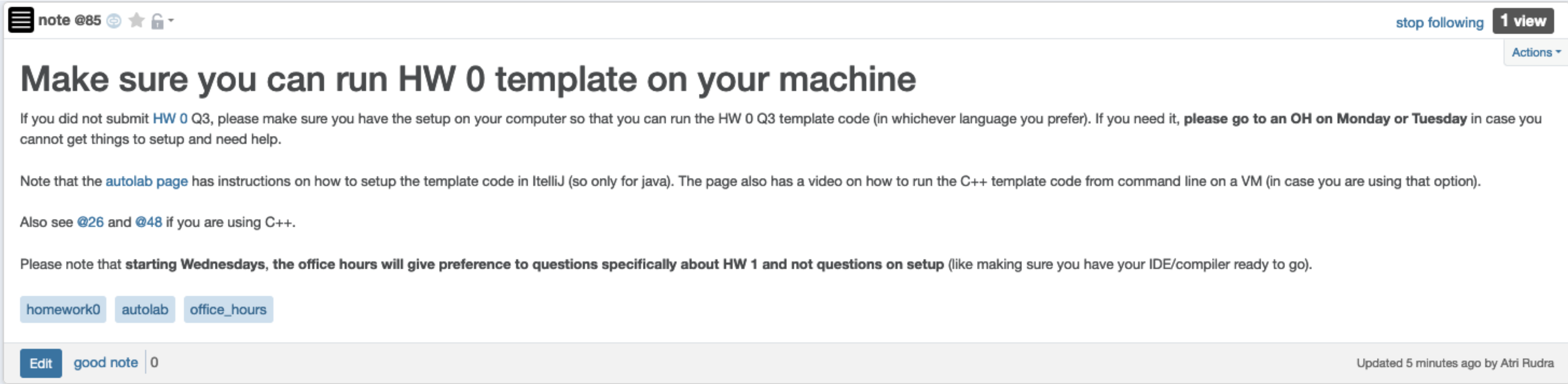
Updated 8 minutes ago by Atri Rudra

We’re not mind readers

If you need it, ask for help

NEVER apologize for asking a question!!!

Make sure you can run HW0 code


note @85

stop following 1 view

Actions

Make sure you can run HW 0 template on your machine

If you did not submit HW 0 Q3, please make sure you have the setup on your computer so that you can run the HW 0 Q3 template code (in whichever language you prefer). If you need it, **please go to an OH on Monday or Tuesday** in case you cannot get things to setup and need help.

Note that the autolab page has instructions on how to setup the template code in ItelliJ (so only for java). The page also has a video on how to run the C++ template code from command line on a VM (in case you are using that option).

Also see @26 and @48 if you are using C++.

Please note that **starting Wednesdays, the office hours will give preference to questions specifically about HW 1 and not questions on setup** (like making sure you have your IDE/compiler ready to go).

homework0 autolab office_hours

Edit good note 0

Updated 5 minutes ago by Atri Rudra

Register your project groups

Deadline: Friday, Sep 29, 11:59pm

CSE 331 | Syllabus | Piazza | Schedule | Homeworks | Autolab | Project | Support Pages | channel | Sample Exams

- Project Overview
- Group signup form

Forming groups

You form groups of size **exactly three (3)** for the project. Below are the various logis

- You have two choices in forming your group:
  1. You can form your group on your own: i.e. you can submit the list of EXACTLY three (3) groups members in your group.

     > **</> Note**
     >
     > Note that if you pick this option, your group needs to have **exactly THREE (3)** members. In particular, if your group has only two members you cannot submit as a group of size two. If you do not know many people in class, feel free to use piazza to look for the third group member.
     >
     > Also, if you form a group of size three, please make only **one submission per group**.

  2. You can submit *just your* name, and you will be assigned a random group *among all students who take this second option.* However, **note that if you pick this option you could end up in a group of size** 2. There will be at most two groups of size 2.

     > **</> Potential risk**
     >
     > Note that if you pick the option of being assigned a random group, you take on the risk that a assigned group might not "pull their weight." We unfortunately cannot help with such aspects of group dynamics. (Of course if a group member is being abusive, please do let Atri know.) Please note that a group member who does not do much work will get penalized on the individual component of the project grade.

- > **Submitting your group composition**
  >
  > Use this Google form to submit your group composition (the form will allow you to pick one of the two options above).

- You need to fill in the form for group composition by **11:59pm on Friday, September 30**.

- > **</> Deadline is strict!**
  >
  > If ... the form for group composition by the deadline, then you get a **zero for the entire project**.

ri/cse331/fall22/project/overview.html#

HW 1 gets released this Tue

Date	Topic	Notes
Mon, Aug 28	Introduction F23 F22 F21 F19 F18 F17	Syllabus Walkthrough: 1 2
Tue, Aug 29		**(HW 0 out)**
Wed, Aug 30	Let's do a proof! F23 F22 F21 F19 F18 F17	Week 1 recitation notes
Fri, Sep 1	Main Steps in Algorithm Design F23 F22 F21 F19 F18 F17 x²	[KT, Sec 1.1]
Mon, Sep 4	**No Class**	Labor Day
Tue, Sep 5		**(HW 0 in)**
Wed, Sep 6	Perfect Matchings F23 F22 F21 F19 F18 F17 x²	[KT, Sec 1.1] Week 2 recitation notes
Fri, Sep 8	Stable matching problem F23 F22 F21 F19 F18 F17 x²	[KT, Sec 1.1]
Mon, Sep 11	Gale Shapley algorithm F22 F21 F19 F18 F17 x²	[KT, Sec 1.1] *Reading Assignment:* Pigeonhole principle *Reading Assignment:* Asymptotic notation care package
Tue, Sep 12		**(HW 1 out)**
Wed, Sep 13	Gale Shapley algorithm outputs a stable matching F22 F21 F19 F18 F17 x²	[KT, Sec 1.1] *Reading Assignment:* Proof details of GS termination
Fri, Sep 15	Efficient algorithms and asymptotic analysis F22 F21 F19 F18 F17 x²	[KT, Sec 1.1] *Reading Assignment:* Worst-case runtime analysis notes *Reading Assignment:* [KT, Sec 1.1, 2.1, 2.2, 2.4]
Mon, Sep 18	Runtime Analysis of Gale-Shapley algorithm F22 F21 F19 F18 F17 x²	[KT, Sec 2.3]
Tue, Sep 19		**(HW 2 out, HW 1 in)**
Wed, Sep 20	Graph Basics F22 F21 F19 F18 F17 x²	[KT, Sec 2.3, 3.1]
Fri, Sep 22	Computing Connected Component F22 F21 F19 F18 F17 x²	[KT, Sec 3.2] *Reading Assignment:* Care package on trees *Reading Assignment:* BFS by examples
Mon, Sep 25	Explore Algorithm F22 F21 F19 F18 F17 x²	[KT, Sec 3.2]
Tue, Sep 26		**(HW 3 out, HW 2 in)**

Reading Assignment - I

note @86

stop following 1 view

Actions

Reading Assignment: Asymptotic Analysis

As one of the changes made in F19, we will assume that y'all are familiar with asymptotic analysis and not spend reviewing it in any detail during the lectures. In case you are not that comfortable with asymptotic analysis and/or want to review the material, please read through the asymptotic analysis care package:

http://www-student.cse.buffalo.edu/~atri/cse331/support/care-package/asymptotics/index.html

We will need this either the middle of lecture on Wednesday or in the Friday lecture.

lectures

Edit good note 0

Updated 5 minutes ago by Atri Rudra

Reading Assignment - II

note @87

stop following 1 view

Actions

Reading Assignment: Pigeonhole principle

Another reading assignment for this week (here is the other one: @86). Please go through this support page on **pigeonhole principle**--

http://www-student.cse.buffalo.edu/~atri/cse331/support/pigeon/index.html

It's actually a very simple result that turns out to be surprisingly powerful. We'll use this in the Mon/Wed (though more likely the Wed) lecture.

lectures

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Updated 5 minutes ago by Atri Rudra

Questions/Comments?

Stable Marriage problem

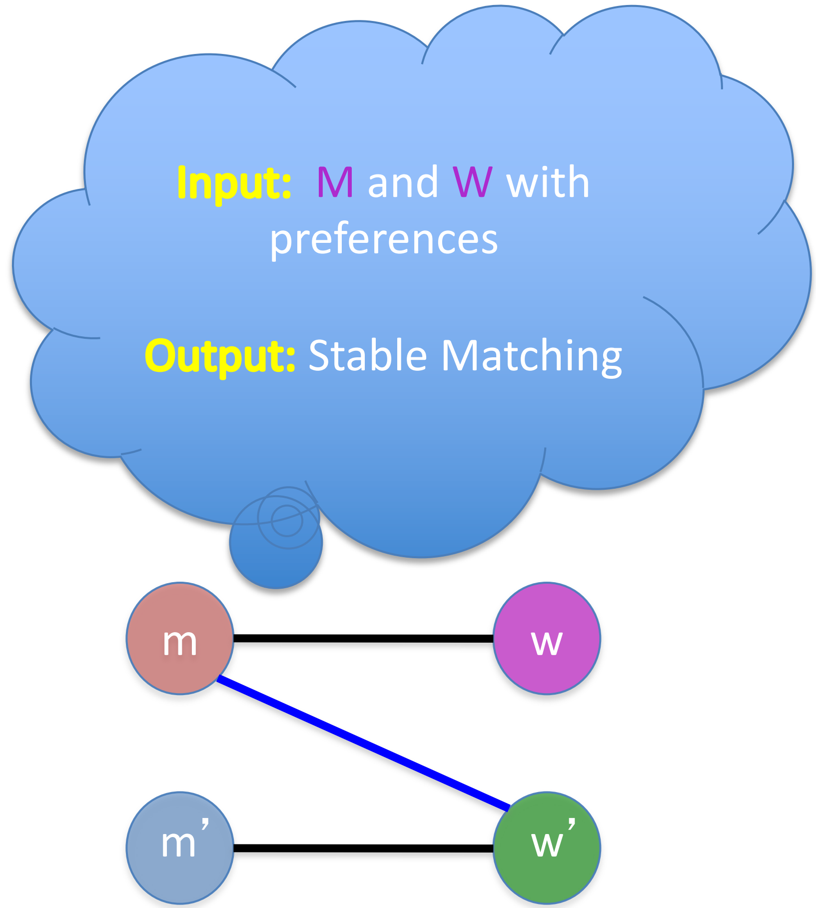
Set of men M and women W

Preferences (ranking of potential spouses)

Matching (no polyandry/gamy in M X W)

Perfect Matching (everyone gets married)

Instablity



Stable matching = perfect matching+ no instablity

Two Questions

Does a stable marriage always exist?

If one exists, how quickly can we compute one?

The naïve algorithm

Incremental algorithm to produce all n! prefect matchings?

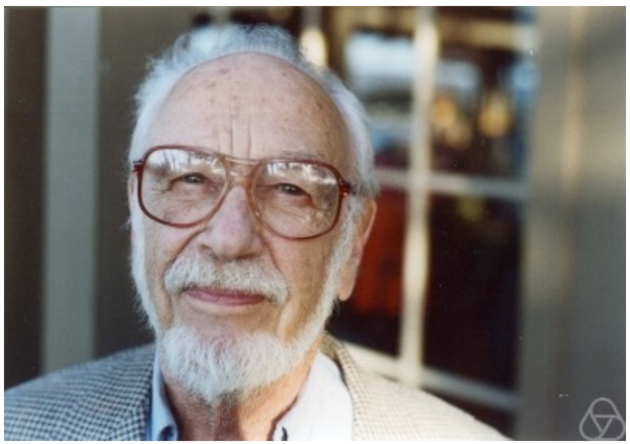
Go through all possible perfect matchings S

If S is a stable matching

then Stop

Else move to the next perfect matching

Gale-Shapley Algorithm

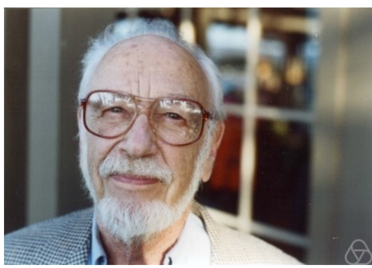


David Gale

Lloyd Shapley

$O(n^2)$ algorithm

Moral of the story…



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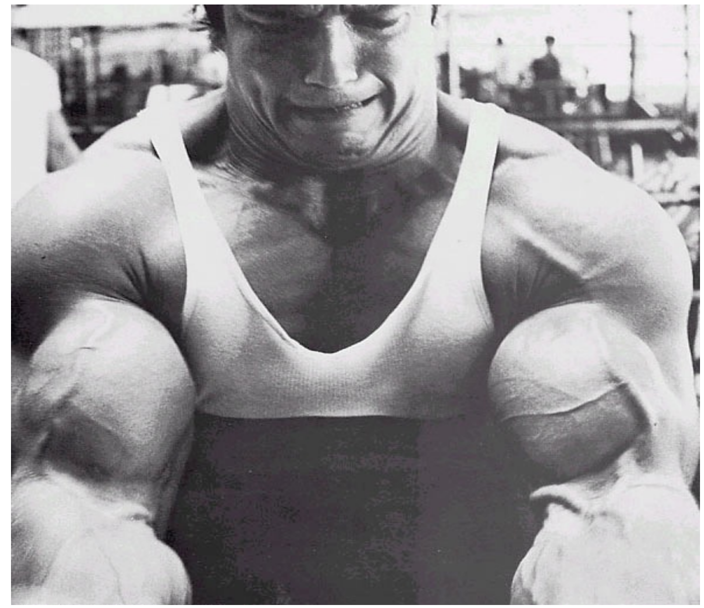


Questions/Comments?

Rest of today’s agenda

Gale Shapley (GS) algorithm

Run of GS algorithm on an instance

Prove correctness of the GS algorithm

Back to the board…

Gale-Shapley Algorithm

Intially all men and women are free

While there exists a free woman who can propose

Let w be such a woman and m be the best man she has not proposed to

    w proposes to m

    If m is free

        (m,w) get engaged

    Else (m,w’) are engaged

        If m prefers w’ to w

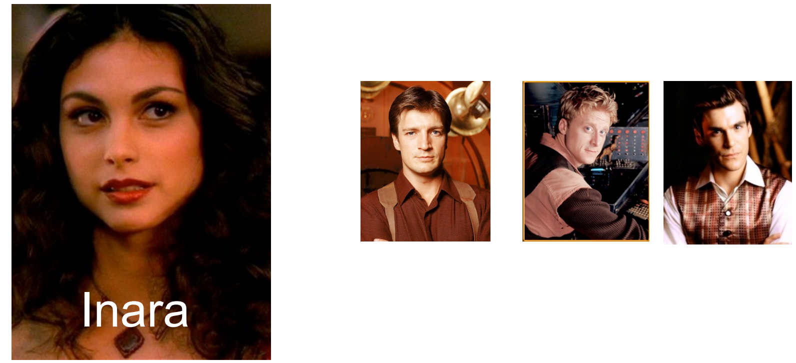
            w remains free

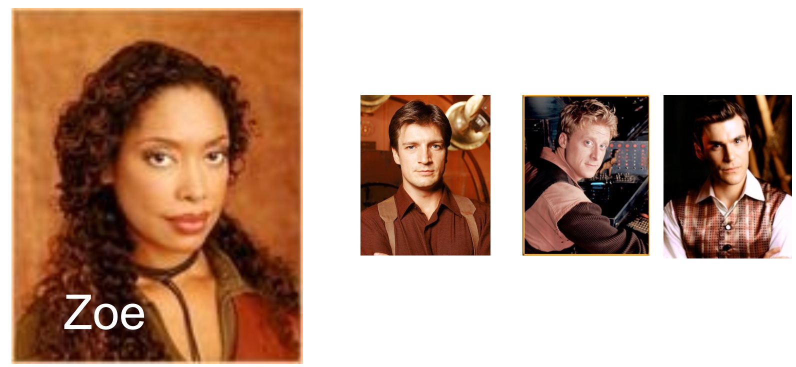
        Else

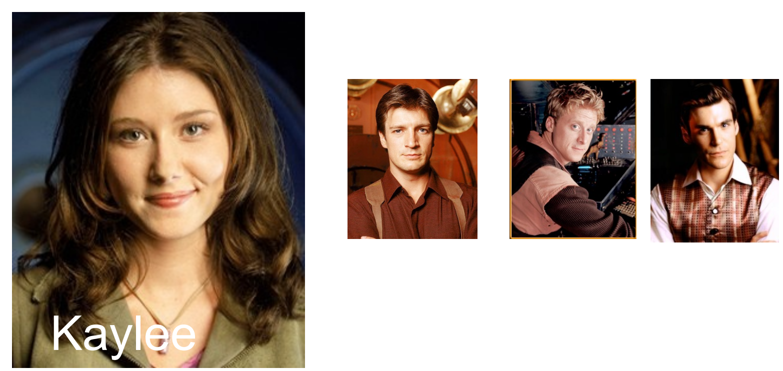
            (m,w) get engaged and w’ is free

Output the engaged pairs as the final output

Preferences







GS algorithm: Firefly Edition