Lecture 6

CSE 331

Sep 12, 2022

2^{nd} T/F poll up

poll @71 · stop following · 15 views · 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

Submit

You have **not yet** voted.

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

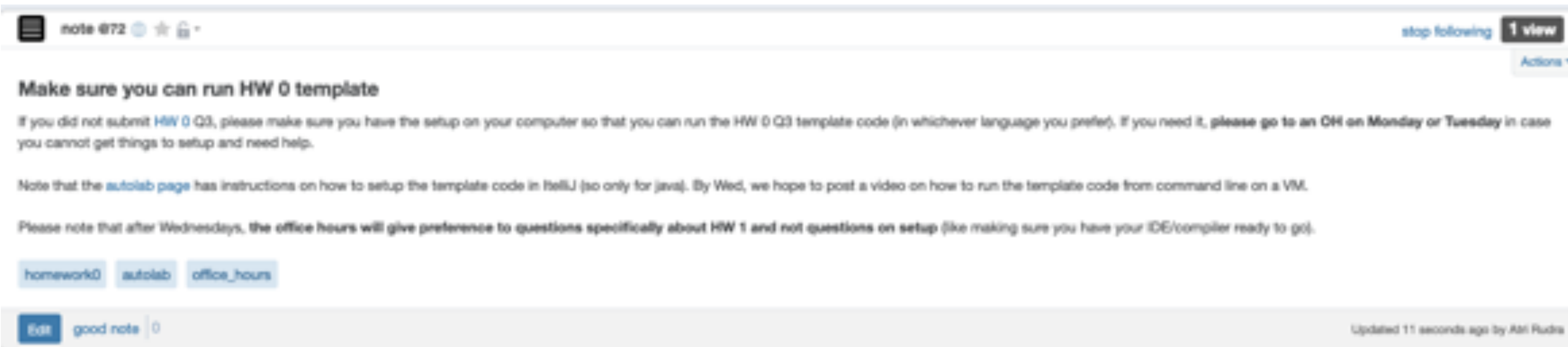
Your name will **not be visible to anyone**.

t/f_poll · polls

We’re not mind readers

If you need it, ask for help

Make sure you can run HW0 code



note @72

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Actions

Make sure you can run HW 0 template

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 IntelliJ (so only for java). By Wed, we hope to post a video on how to run the template code from command line on a VM.

Please note that after 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).

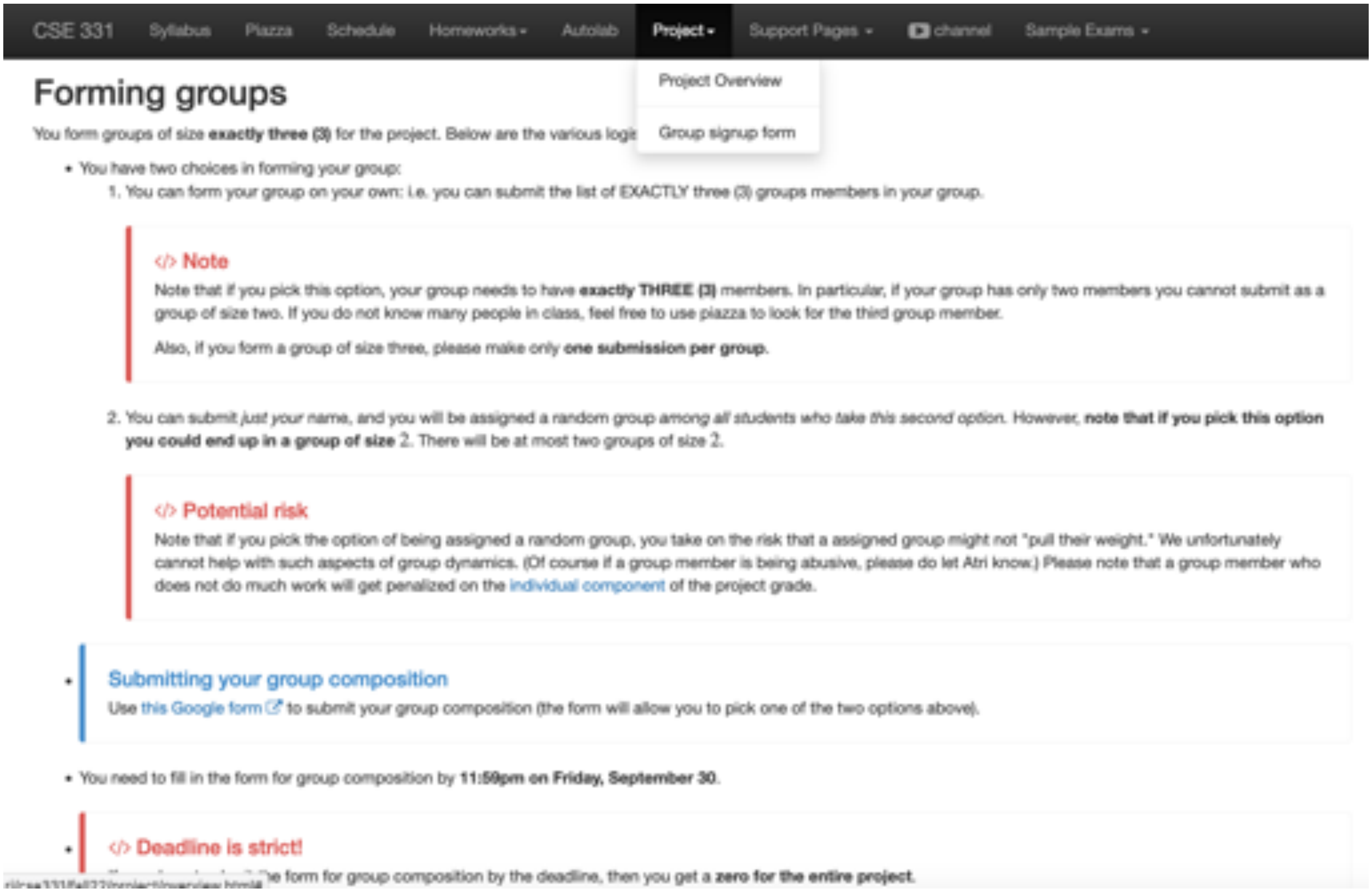
homework0 autolab office_hours

Edit good note 0

Updated 11 seconds ago by Atri Rudra

Register your project groups

Deadline: Friday, Sep 30, 11:59pm



HW 1 gets released this Tue

Mon, Sep 12	Gale Shapley algorithm F21 F19 F18 F17	[KT, Sec 1.1] *Reading Assignment:* Pigeonhole principle *Reading Assignment:* Asymptotic notation care package
Tue, Sep 13		**(HW 1 out)**
Wed, Sep 14	Gale Shapley algorithm outputs a stable matching F21 F19 F18 F17	[KT, Sec 1.1] *Reading Assignment:* Proof details of GS termination
Fri, Sep 16	Efficient algorithms and asymptotic analysis F21 F19 F18 F17	[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 19	Runtime Analysis of Gale-Shapley algorithm F21 F19 F18 F17	[KT, Sec 2.3]
Tue, Sep 20		**(HW 2 out, HW 1 in)**
Wed, Sep 21	Graph Basics F21 F19 F18 F17	[KT, Sec 2.3, 3.1]
Fri, Sep 23	Computing Connected Component F21 F19 F18 F17	[KT, Sec 3.2] *Reading Assignment:* Care package on trees *Reading Assignment:* BFS by examples
Mon, Sep 26	Explore Algorithm F21 F19 F18 F17	[KT, Sec 3.2]
Tue, Sep 27		**(HW 3 out, HW 2 in)**
Wed, Sep 28	Runtime Analysis of BFS algorithm F21 F19 F18 F17	[KT, Sec 3.3]
Fri, Sep 30	More graph stuff F21 F19 F18 F17	[KT, Sec 3.3, 3.6] **(Project Team Composition Due)** *Reading Assignment:* [KT, Sec 3.3, 3.4, 3.5, 3.6] *Reading Assignment:* Care package on topological ordering
Mon, Oct 3	Interval Scheduling Problem F21 F19 F18 F17	[KT, Sec 4.1]

Reading Assignment - I

note @73 stop following 3 views

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

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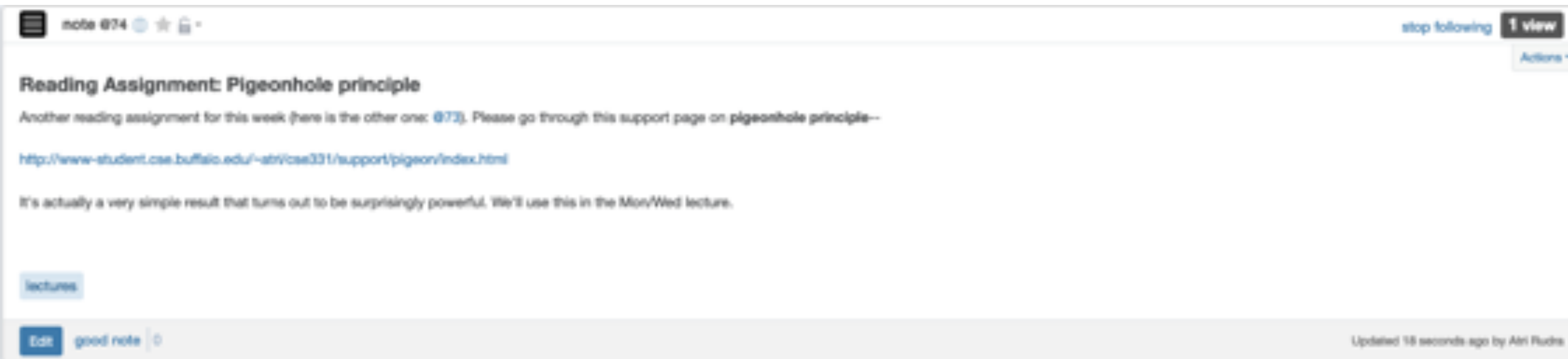
Updated 1 minute ago by Atri Rudra

Reading Assignment - II


note @74

stop following

1 view

Actions

Reading Assignment: Pigeonhole principle

Another reading assignment for this week (here is the other one: @73). 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 lecture.

lectures

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Updated 18 seconds ago by Atri Rudra

Questions/Comments?

Stable Marriage problem

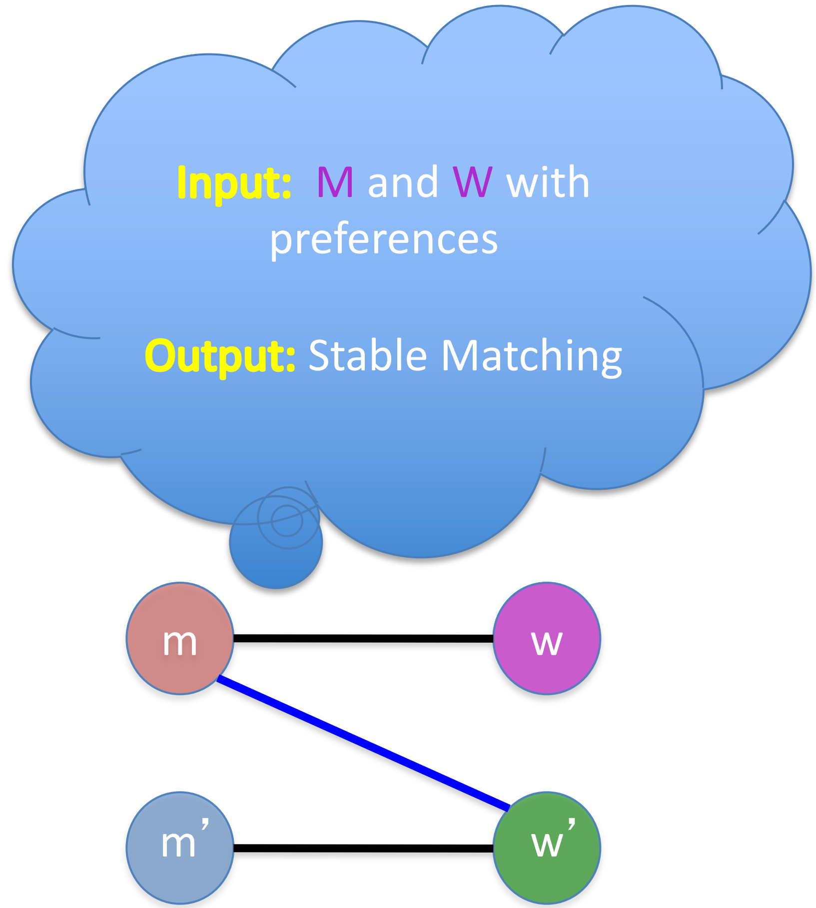
Set of men M and women W

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

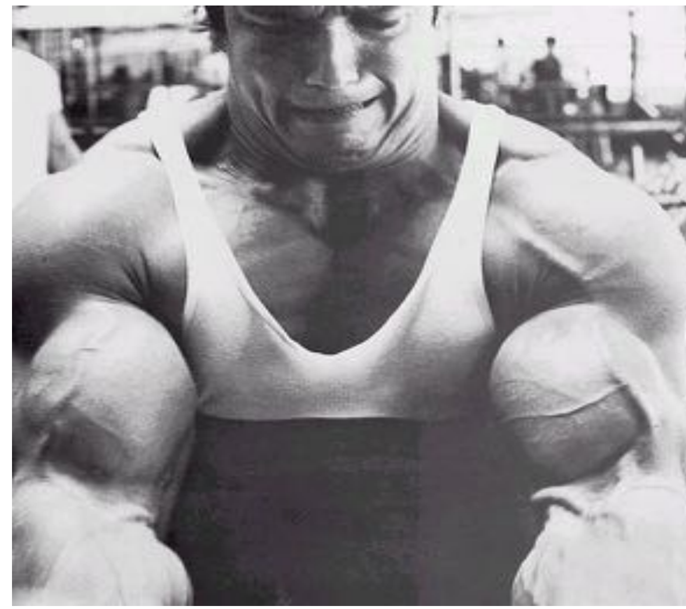
David Gale

Lloyd Shapley

$O(n^2)$ algorithm

Moral of the story…

>



Questions/Comments?

Rest of today's agenda

Finish off 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

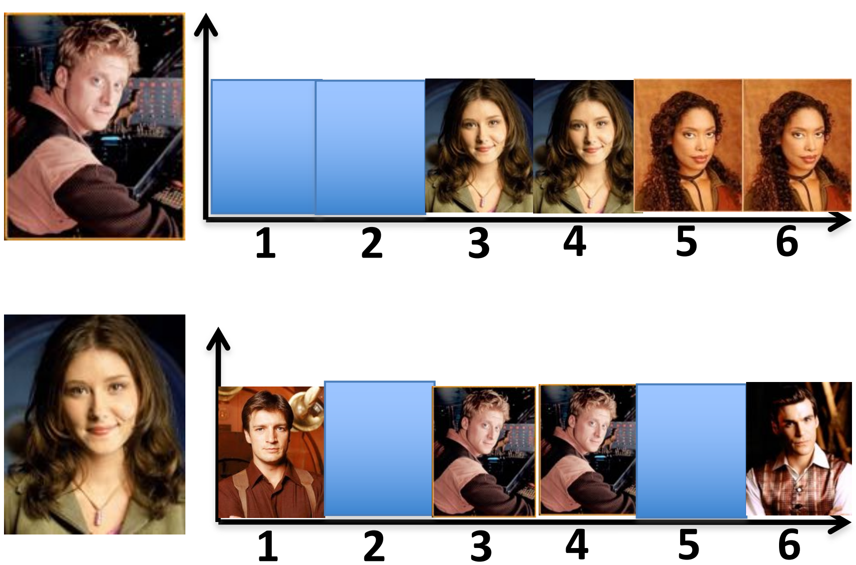
Else

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

Output the engaged pairs as the final output

Preferences

GS algorithm: Firefly Edition



Observation 1

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

Once a man gets engaged, he remains engaged (to "better" women)

Output the engaged pairs as the final output

Observation 2

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

If w proposes to m after m', then she prefers m' to m

Output the set S of engaged pairs as the final output

Questions/Comments?

Why bother proving correctness?

Consider a variant where any free man **or** free woman can propose

Is this variant any different? Can you prove it?

GS’ does not output a stable marriage