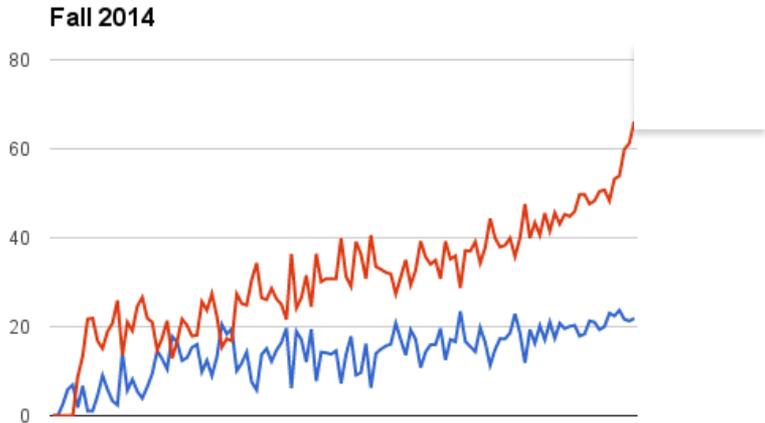
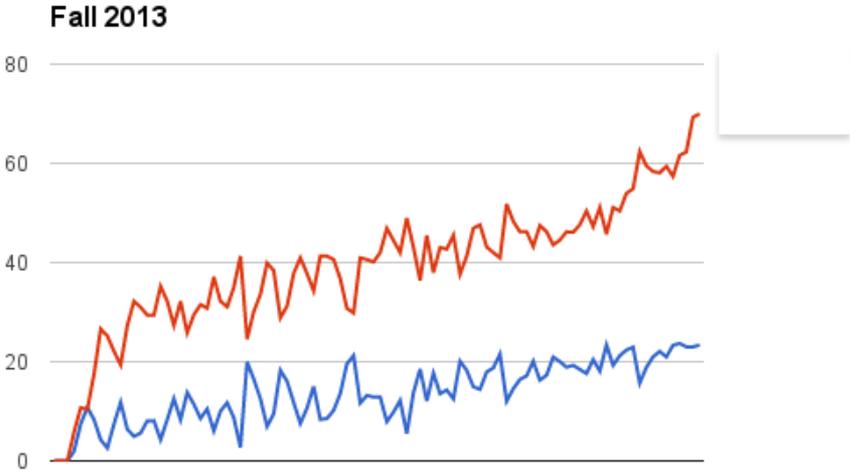
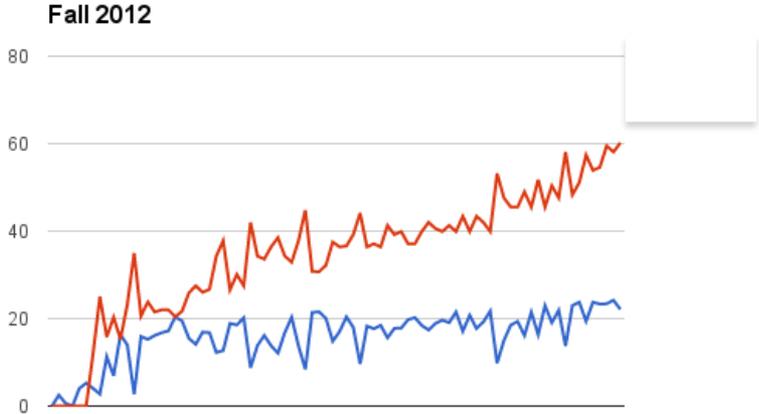


Lecture 5

CSE 331

Sep 8, 2023

Can you guess the correlation?



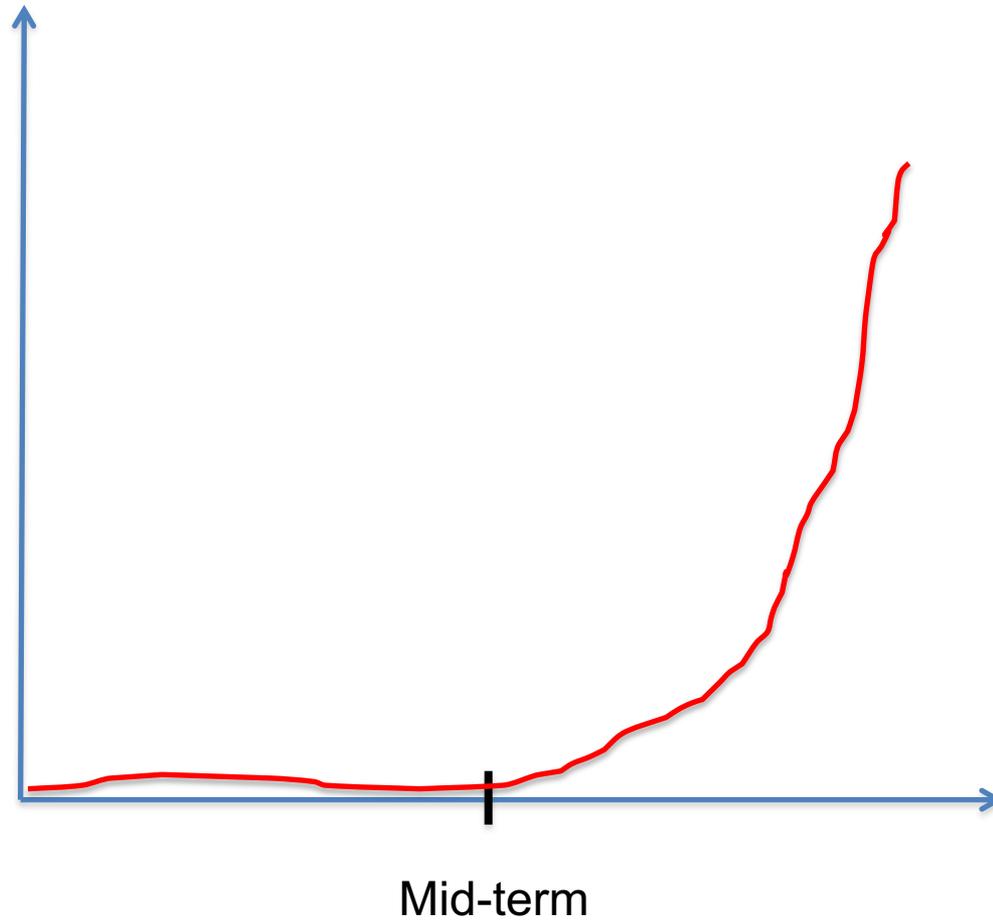
Another comment

Discomfort with proofs

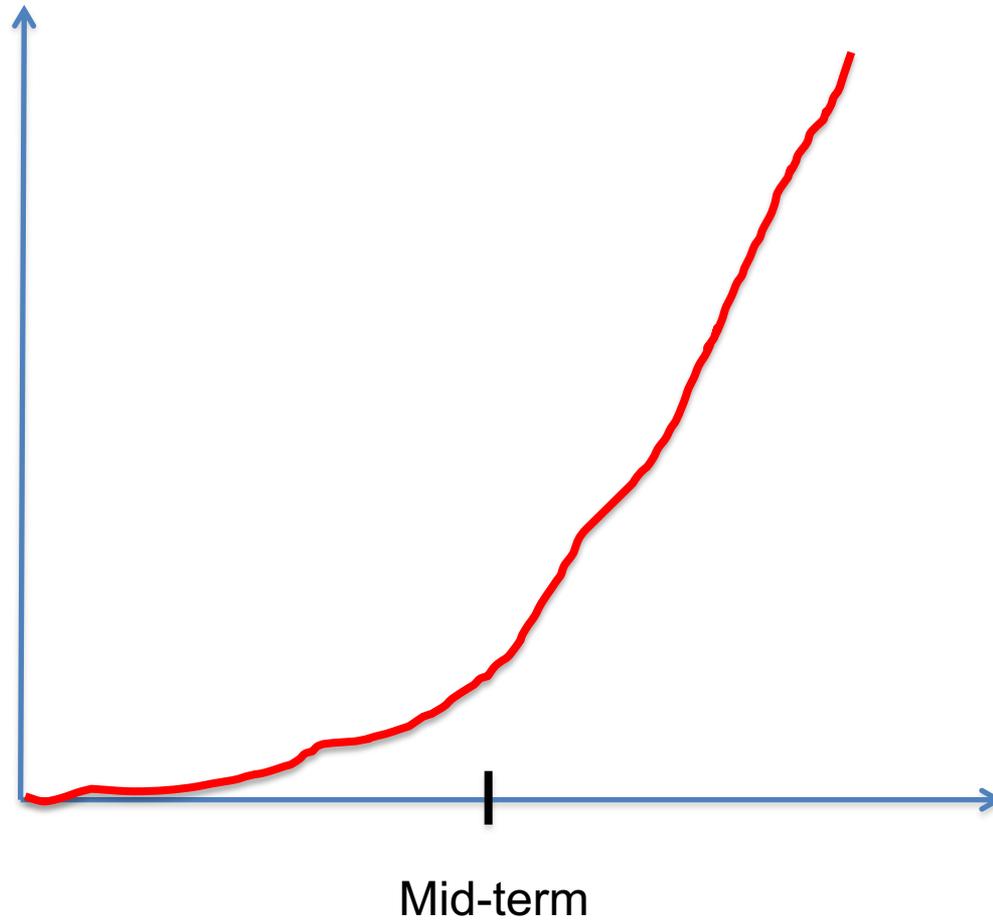
I will not cover proof basics in class anymore

Please read support pages and some utilize (next few) Office hours!

Lecture pace (until Fall 18)



Lecture pace



Register your project groups

Deadline: Friday, Sep 29, 11:59pm

CSE 331

Syllabus

Piazza

Schedule

Homeworks ▾

Autolab

Project ▾

Support Pages ▾

channel

Sample Exams ▾

Forming groups

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

Project Overview

Group signup form

- 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 you do not submit the form for group composition by the deadline, then you get a **zero for the entire project**.

Questions/Comments?



Questions to think about

1) How do we specify preferences?

Preference lists

2) Ratio of applicant vs employers

1:1

3) Formally what is an assignment?

(perfect) matching

4) Can an employer get assigned > 1 applicant?

NO

5) Can an applicant have > 1 job?

NO

6) How many employer/applicants in an applicants/employers preferences?

All of them

7) Can an employer have 0 assigned applicants?

NO

8) Can an applicant have 0 jobs?

NO

(Perfect) Matching

A matching $S \subseteq M \times W$ such that following conditions hold:

S is a **set** of pairs (m,w) where m in M and w in W

- (1) For every woman w in W , exist *at most* ^{exactly} one m such that (m,w) in S
- (2) For every man m in M , exist *at most* ^{exactly} one w such that (m,w) in S

Perfect matching

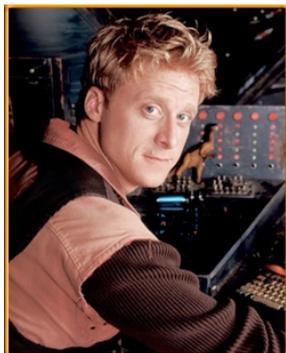
On matchings

Mal



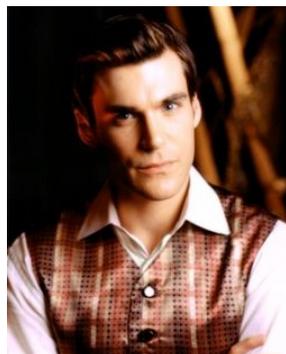
Inara

Wash

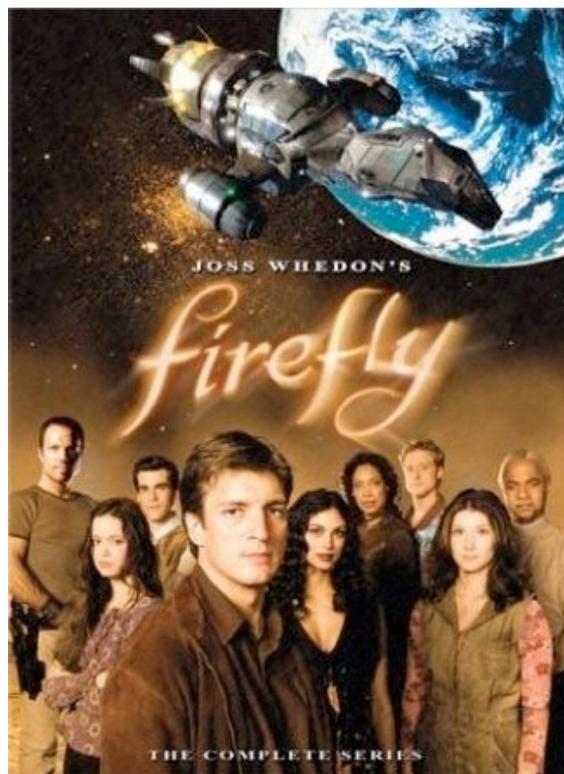


Zoe

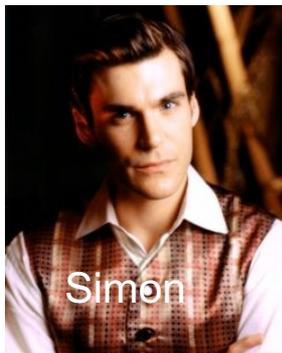
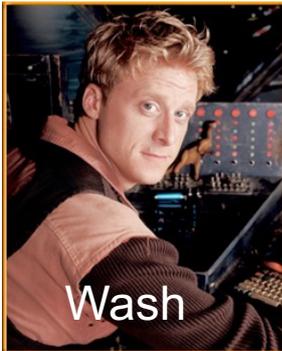
Simon



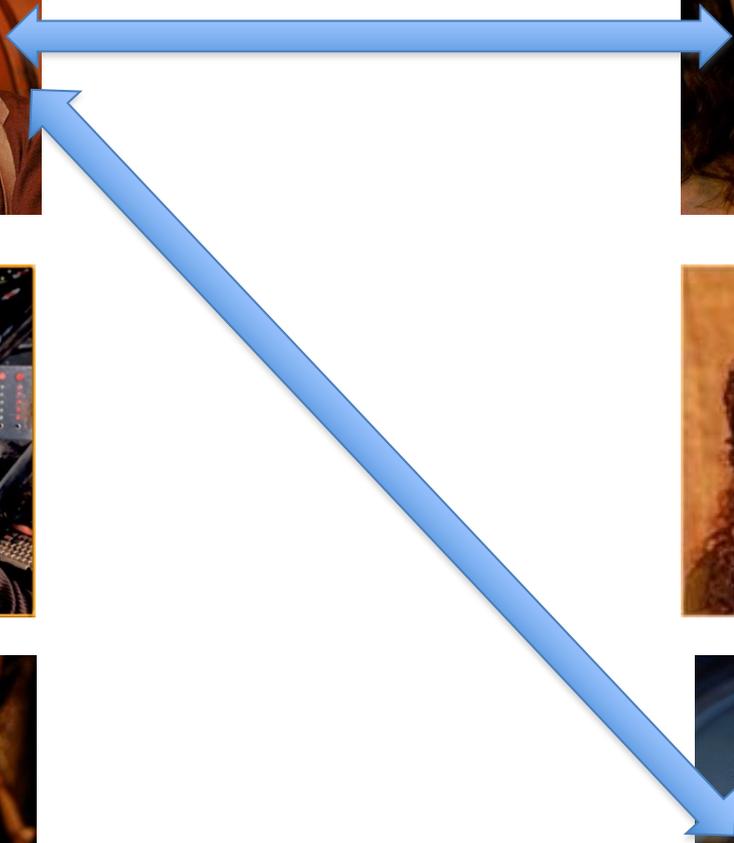
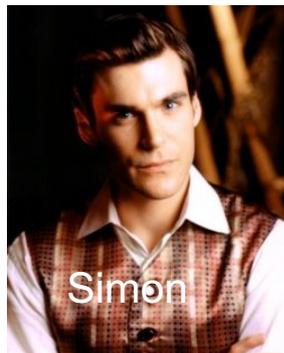
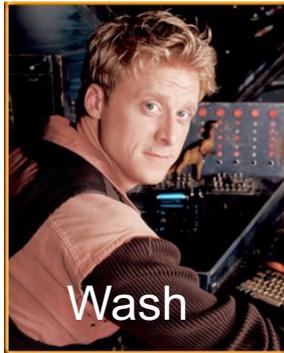
Kaylee



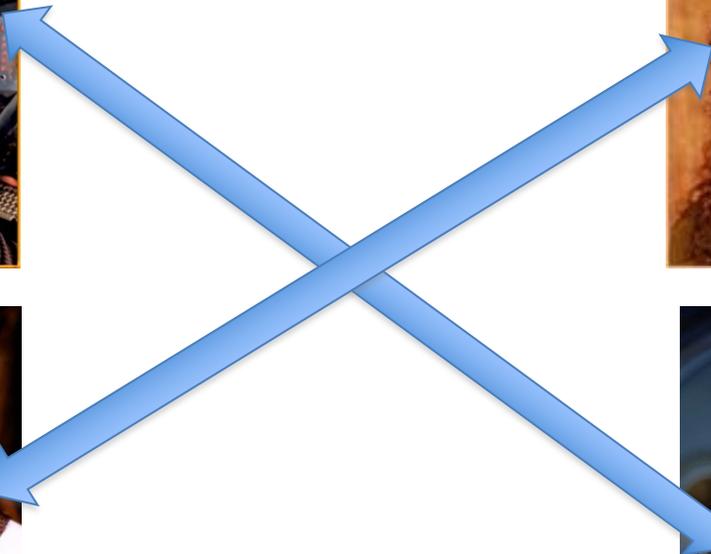
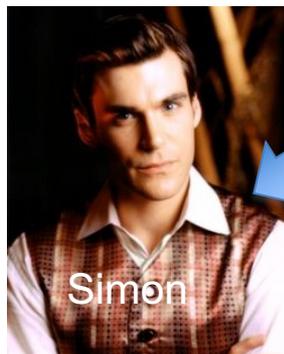
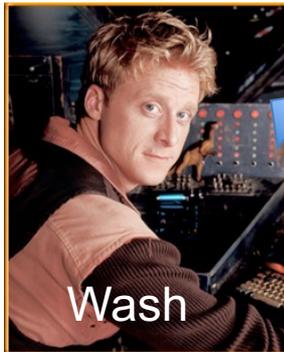
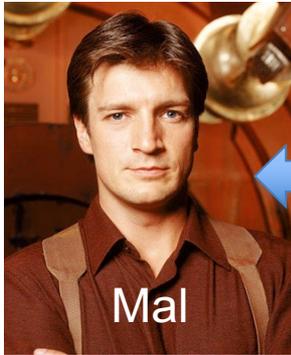
A valid matching



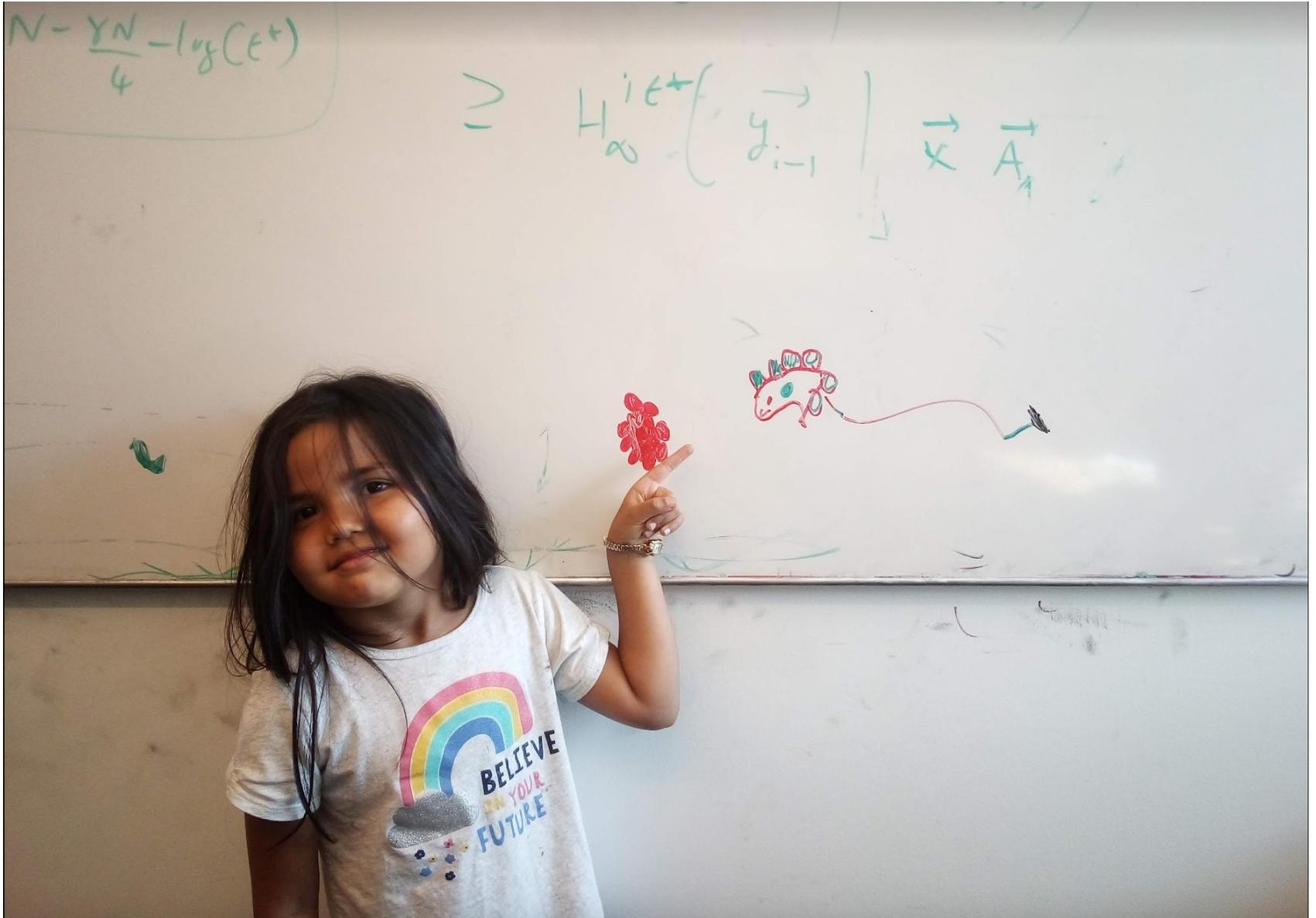
Not a matching



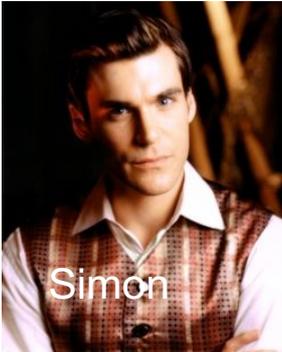
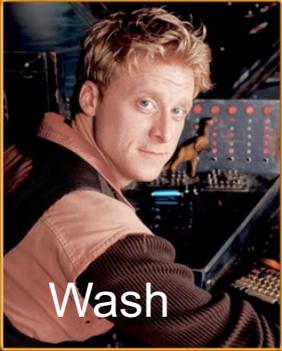
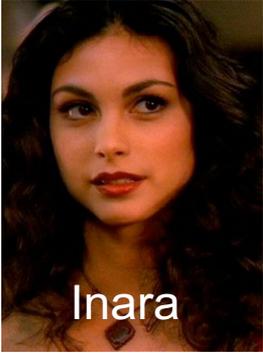
Perfect Matching



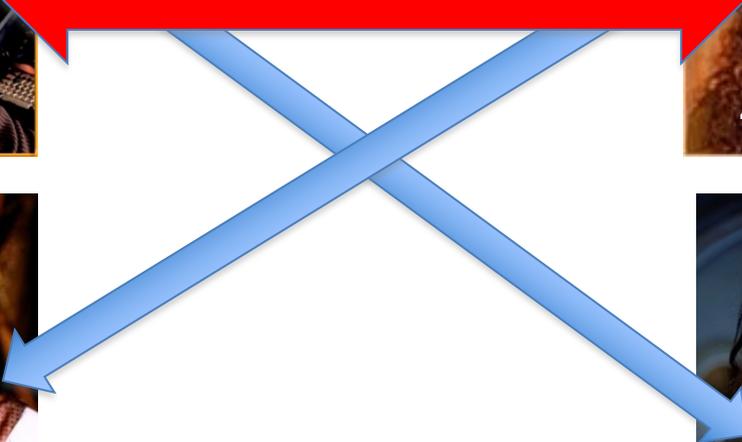
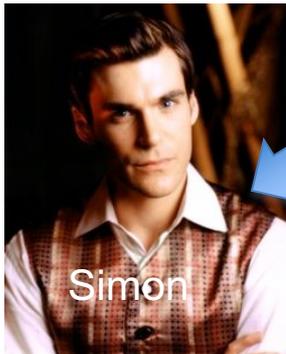
Questions/Comments?



Preferences



Instability



Back to the board...



A stable matching

Even though BBT and JA are not very happy



Brad Pitt



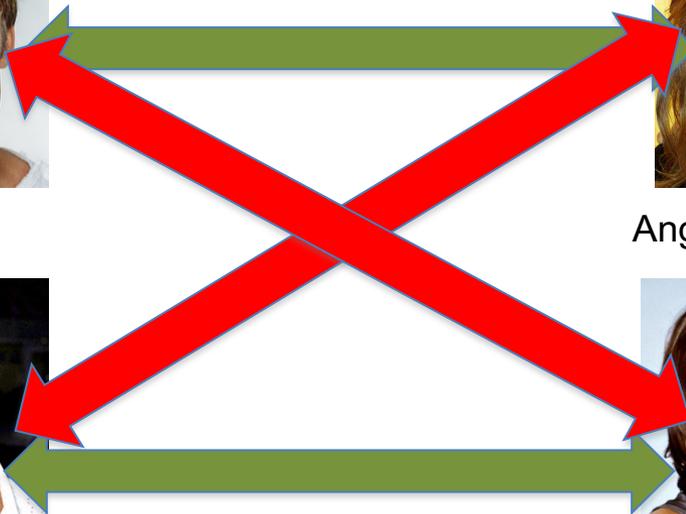
Angelina Jolie



Billy Bob Thornton



Jennifer Aniston



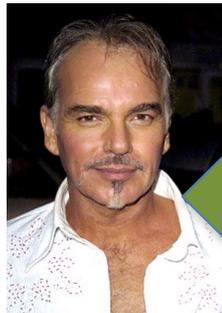
Two stable matchings



Brad Pitt



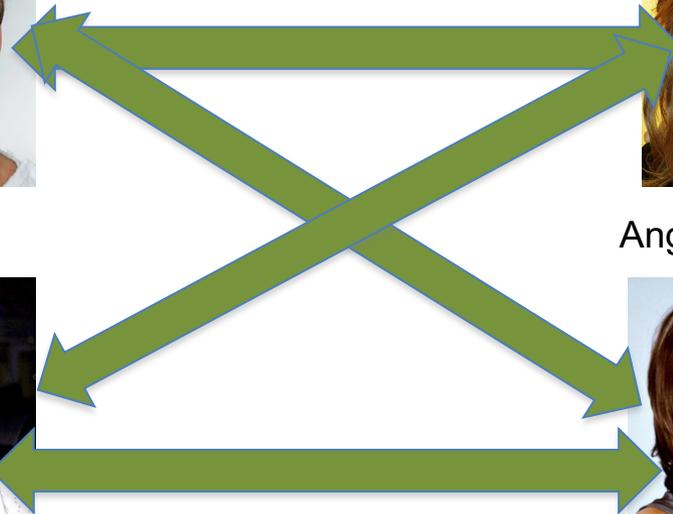
Angelina Jolie



Billy Bob Thornton



Jennifer Aniston



Stable Matching problem

Set of men M and women W

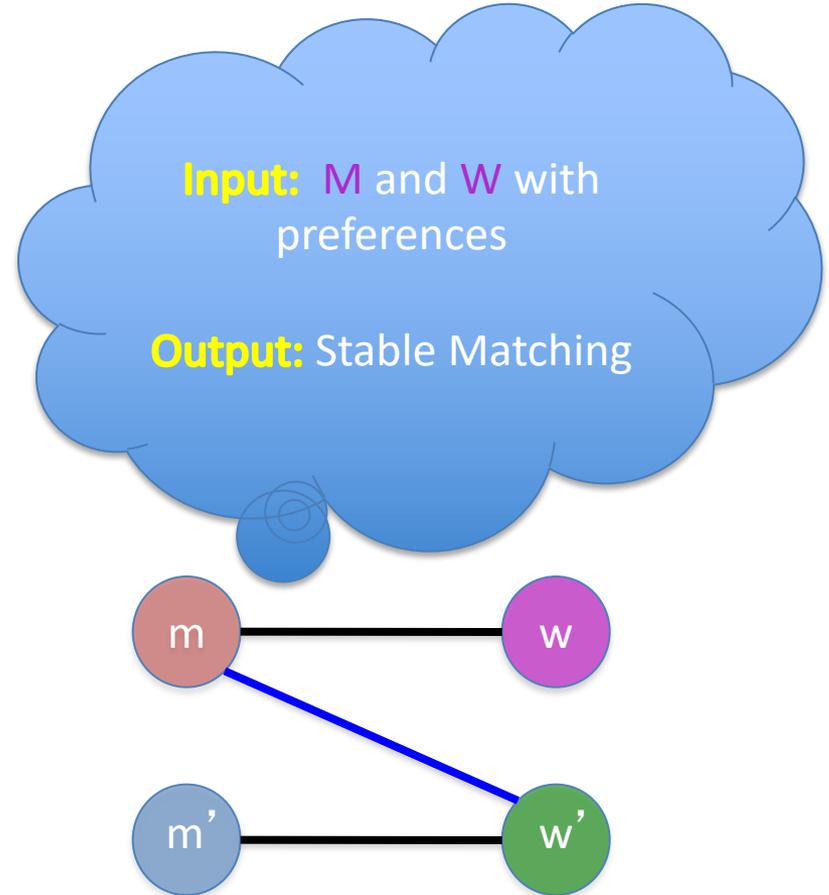
Preferences (ranking of potential spouses)

Matching (no polyandry/gamy in $M \times W$)

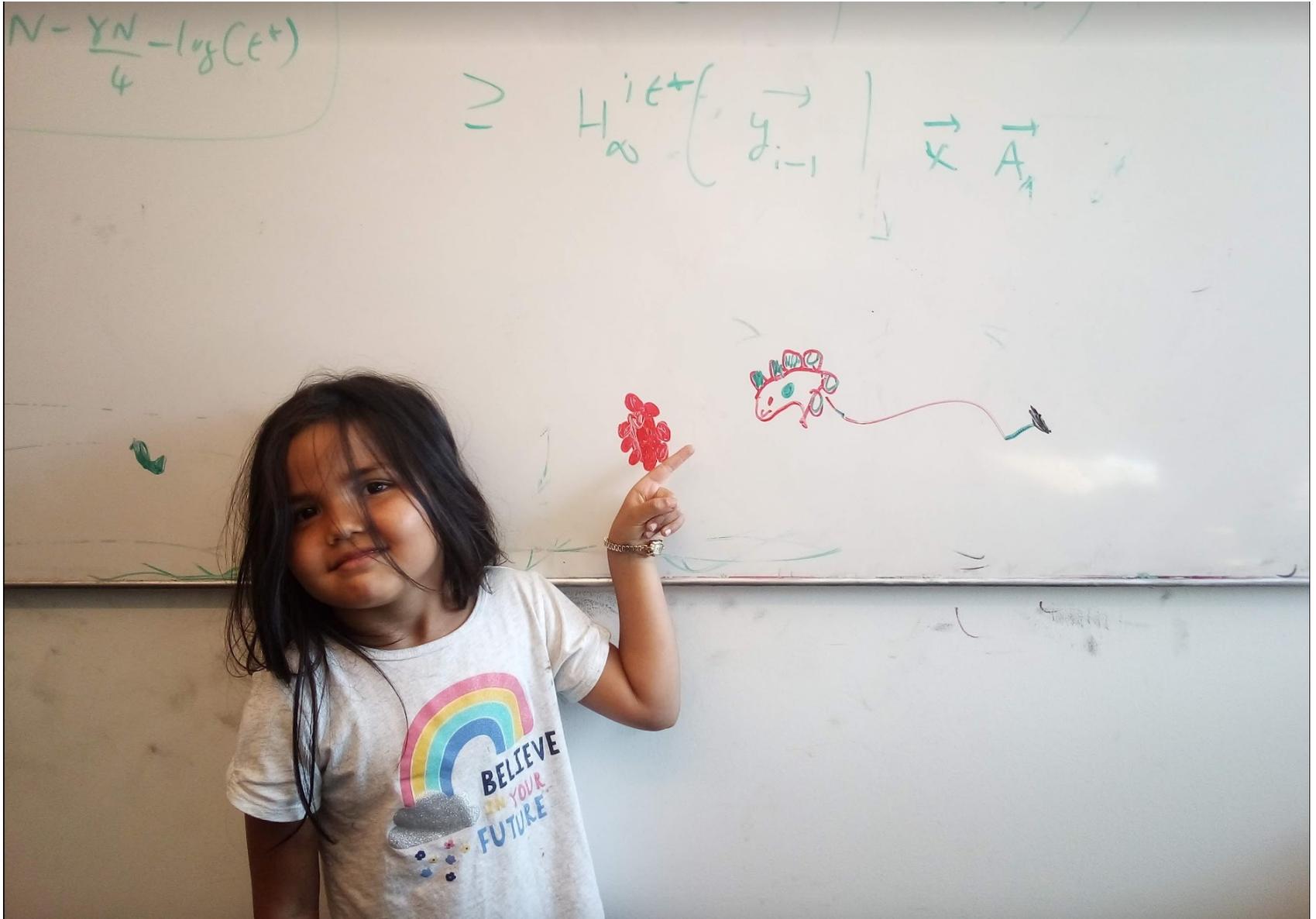
Perfect Matching (everyone gets married)

Instability

Stable matching = perfect matching + no instability



Questions/Comments?



Two Questions

Does a stable marriage always exist?

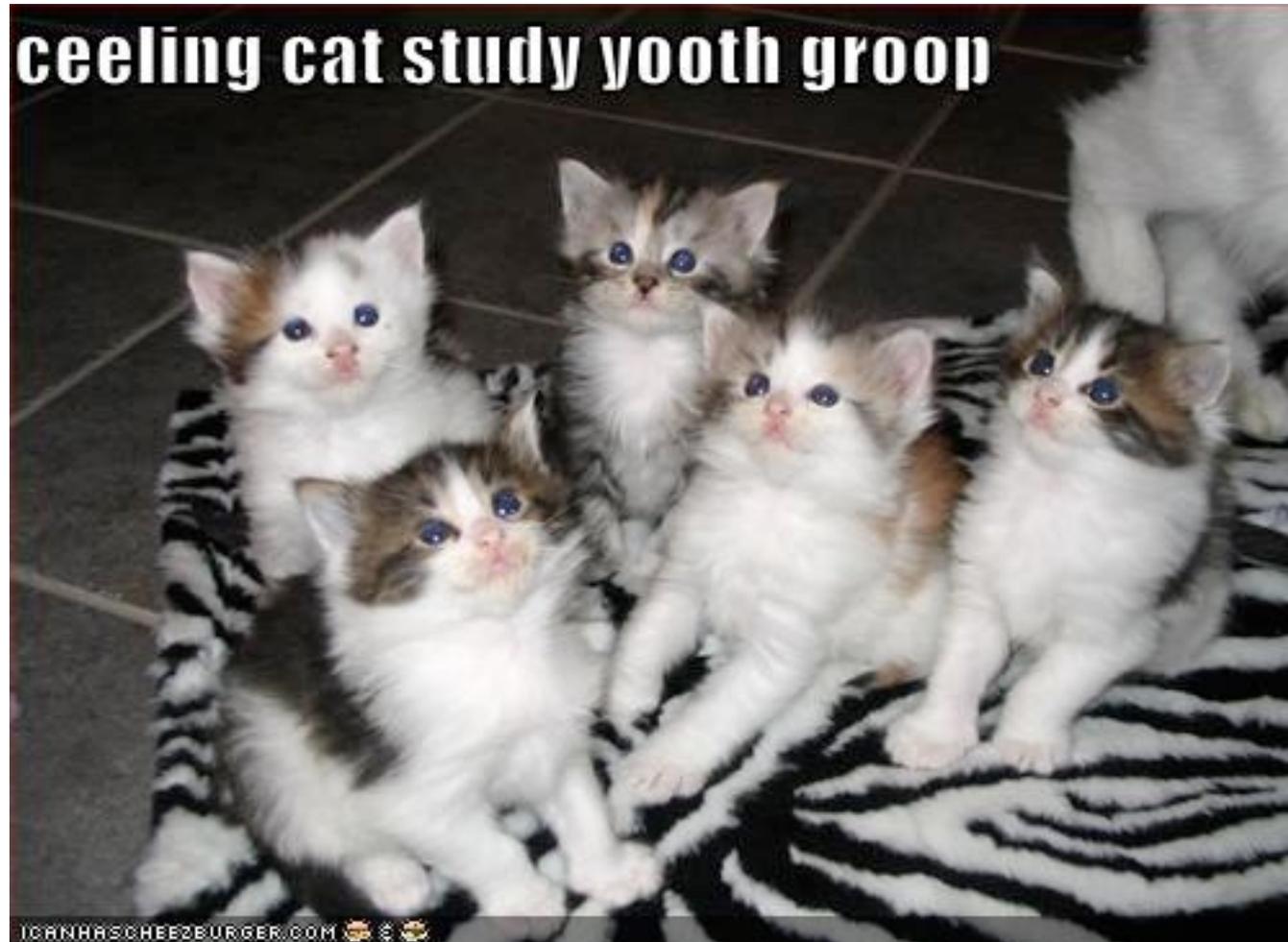
If one exists, how quickly can we compute one?

Rest of today's lecture

Naïve algorithm

Gale-Shapley algorithm for Stable Marriage problem

Discuss: Naïve algorithm!



The naïve algorithm

Incremental algorithm to produce all $n!$ perfect matchings?

Go through all possible perfect matchings S

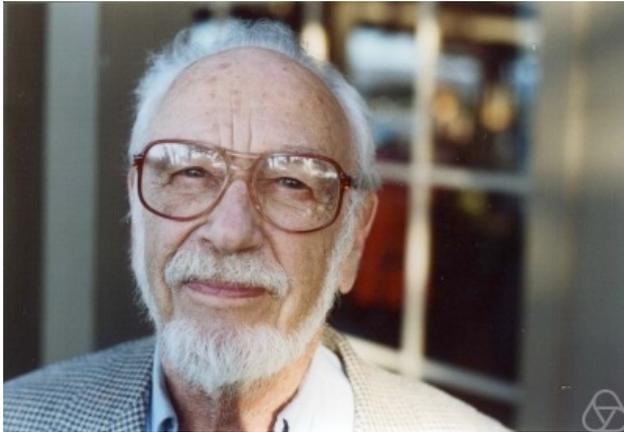
If S is a stable matching

then Stop



Else move to the next perfect matching

Gale-Shapley Algorithm



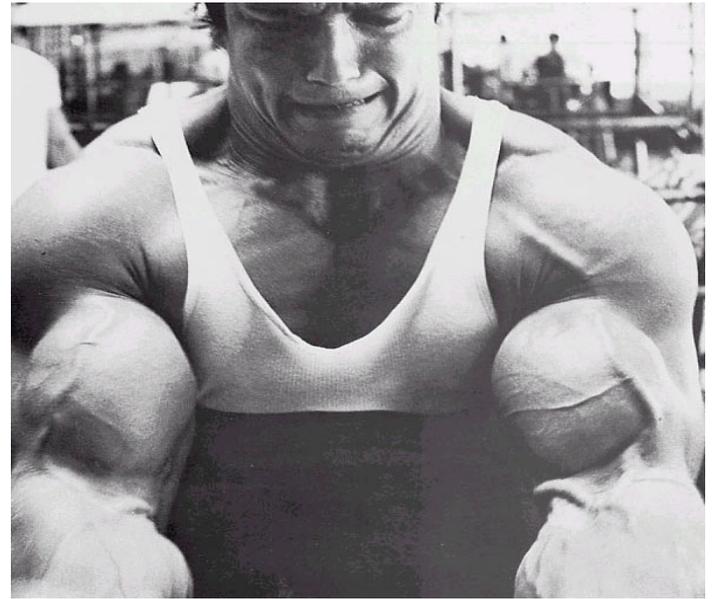
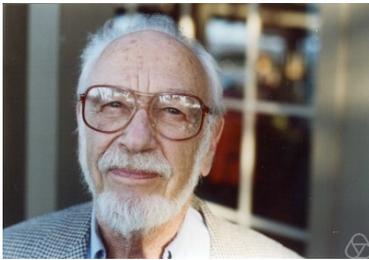
David Gale



Lloyd Shapley

$O(n^2)$ algorithm

Moral of the story...



Questions/Comments?

