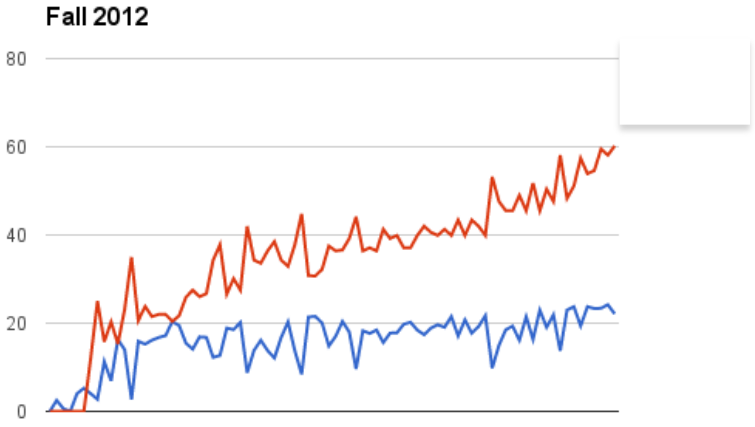
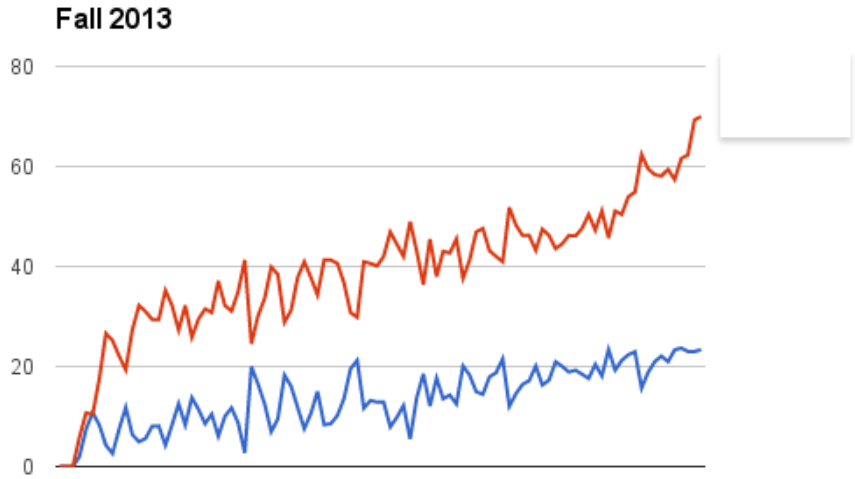
Lecture 5

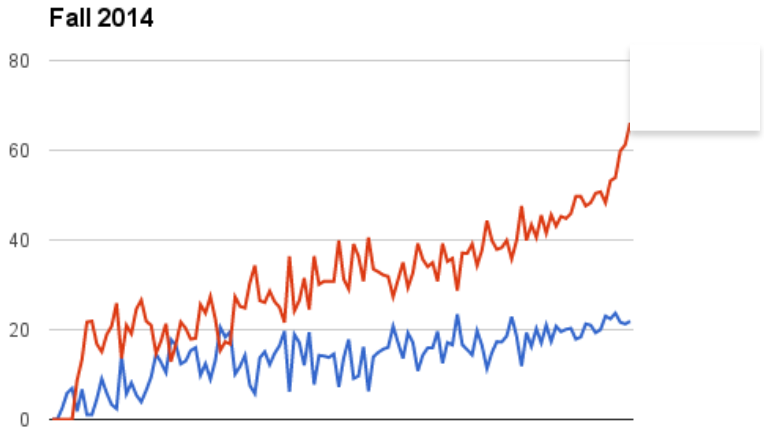
CSE 331

Sep 8, 2023

Can you guess the correlation?







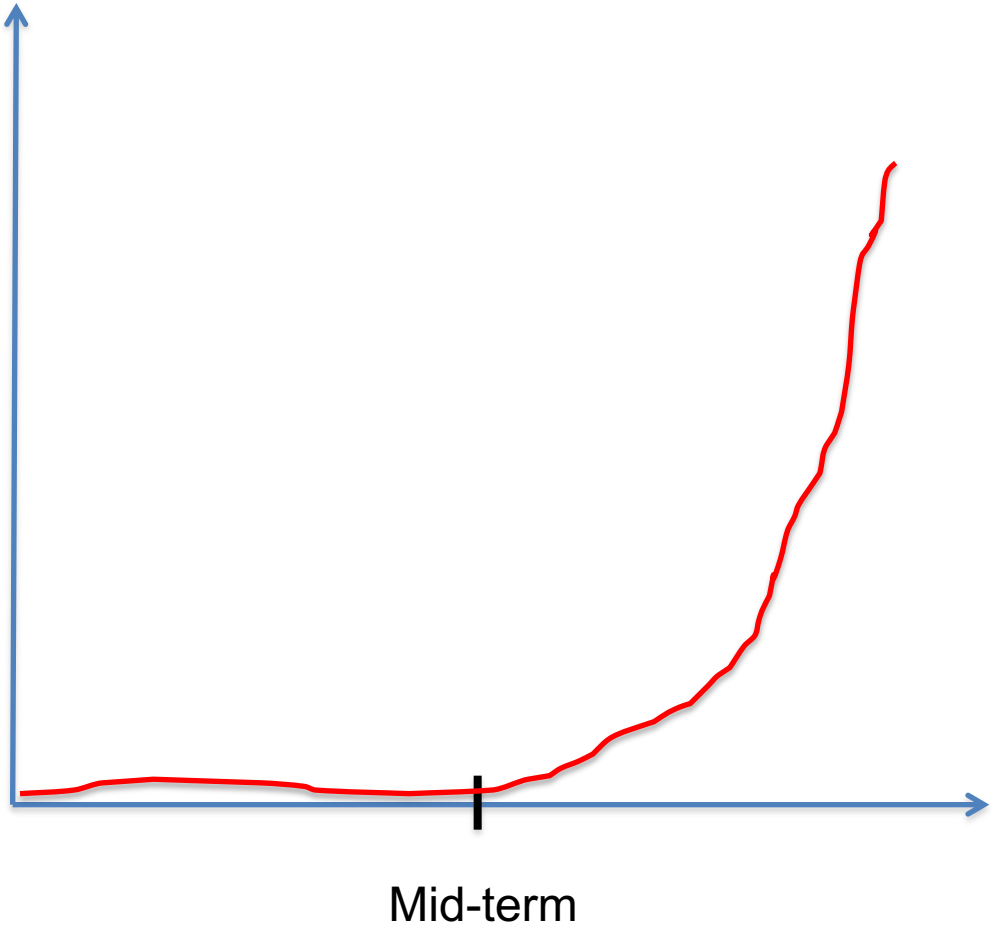
Another comment

Discomfort with proofs

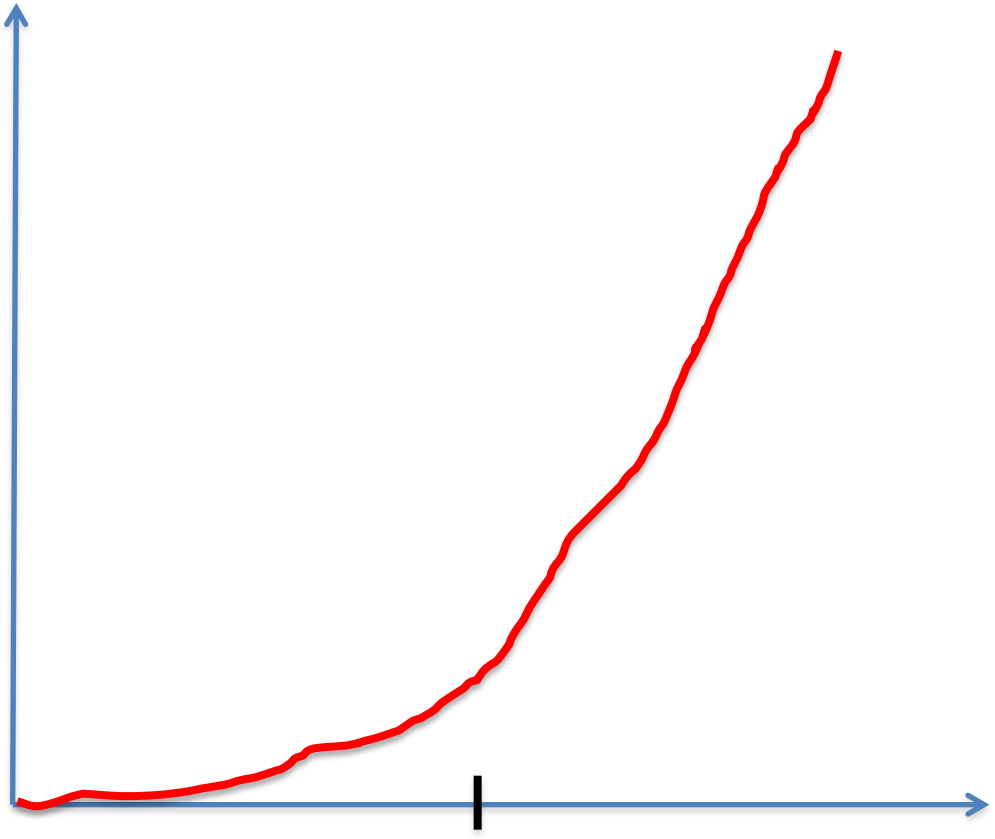
I will not cover proof basics in class anymore

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

Lecture pace (until Fall 18)

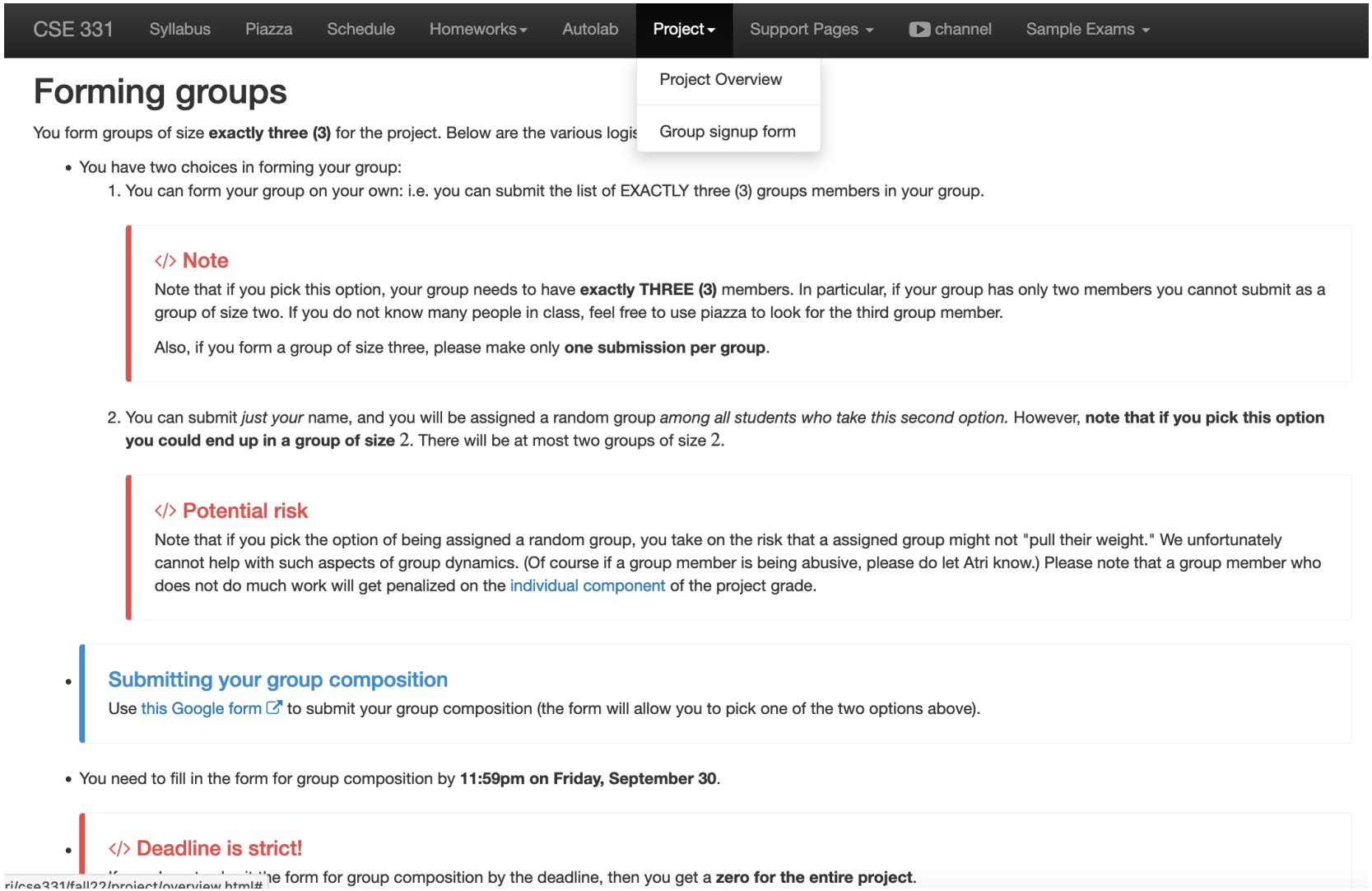


Lecture pace



Register your project groups

Deadline: Friday, Sep 29, 11:59pm



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

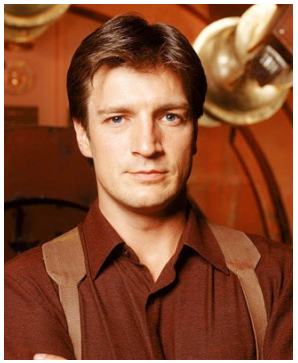
(1) For every woman w in W, exist *at most* (exactly) one m such that (m,w) in S

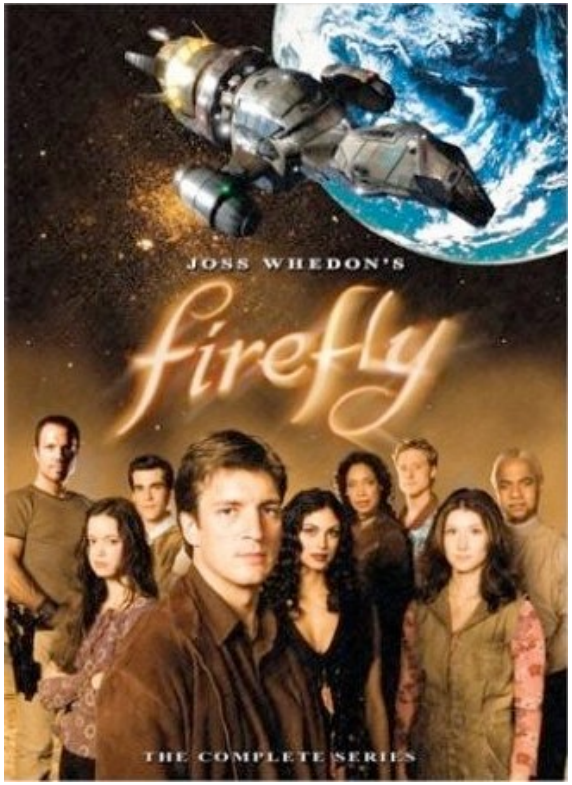
(2) For every man m in M, exist *at most* (exactly) one w such that (m,w) in S

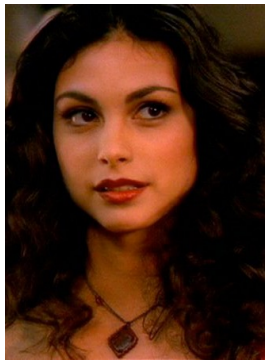
Perfect matching

On matchings

Mal





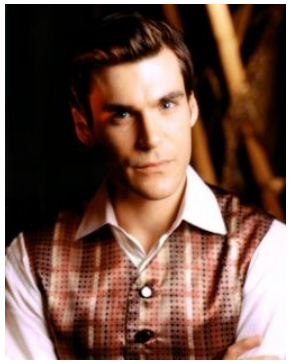


Inara

Wash

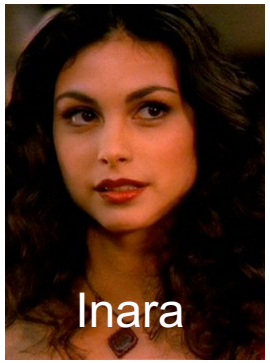
Zoe

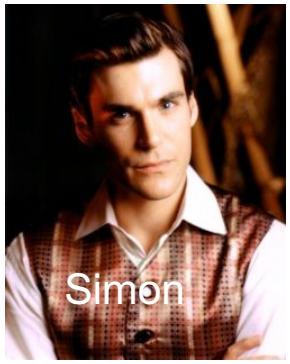
Simon



Kaylee

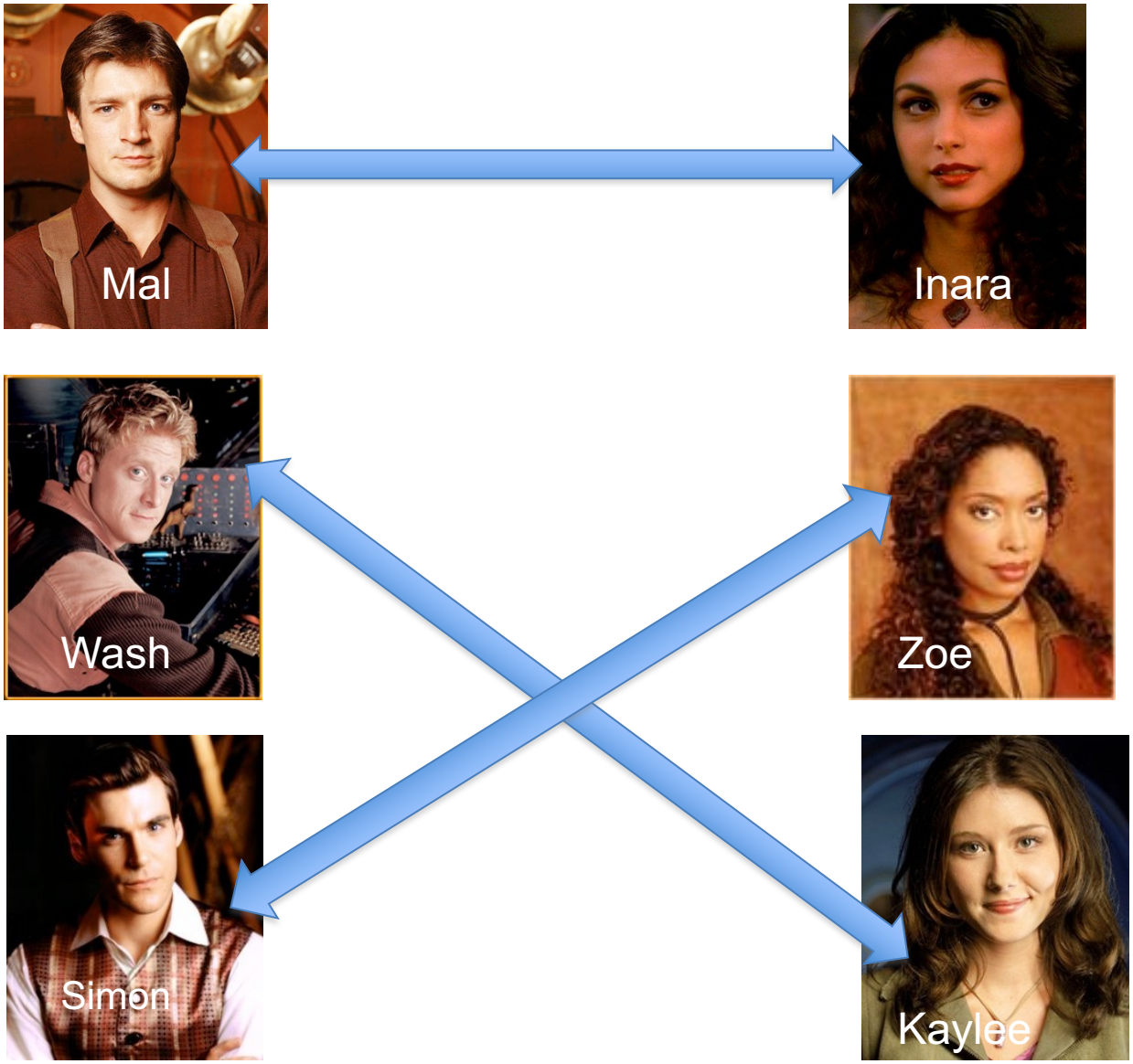
A valid matching



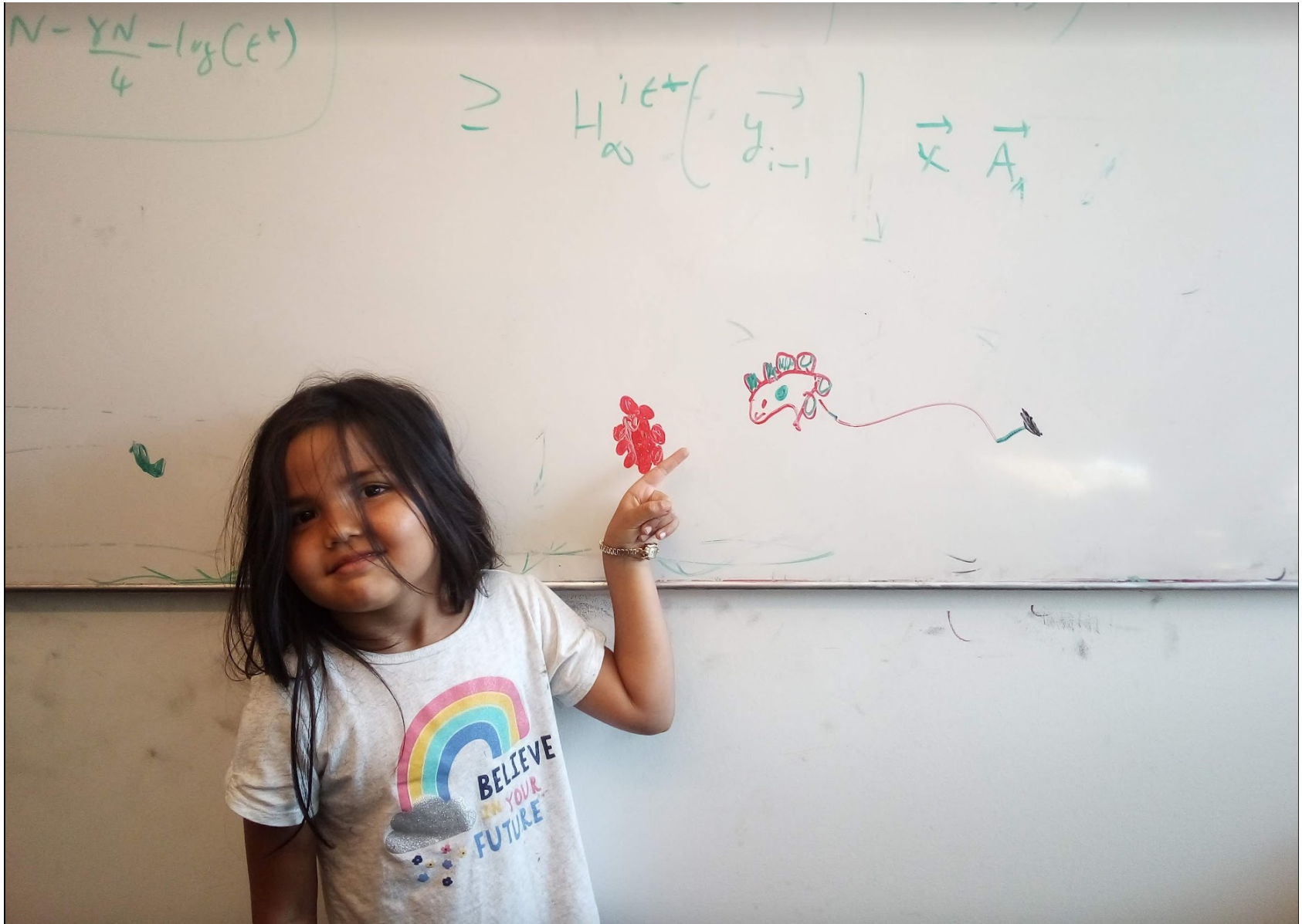


Not a matching

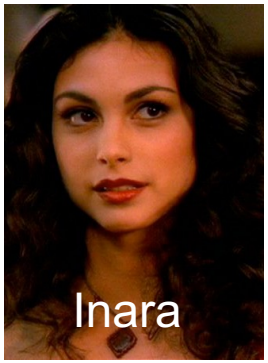
Perfect Matching

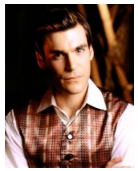


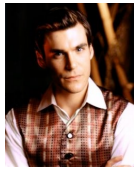
Questions/Comments?

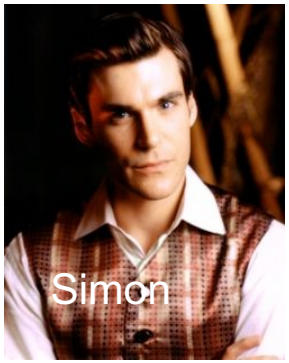


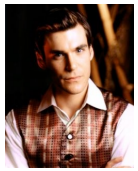
Preferences



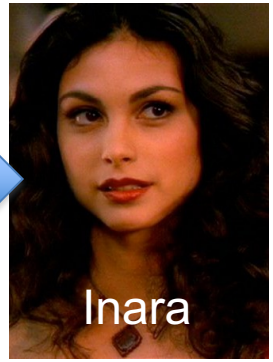


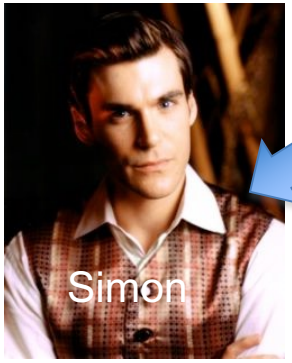


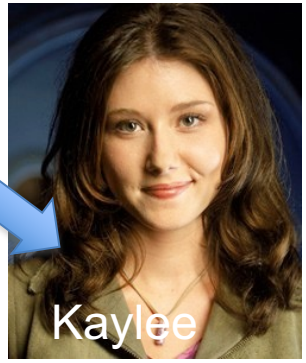




Instability



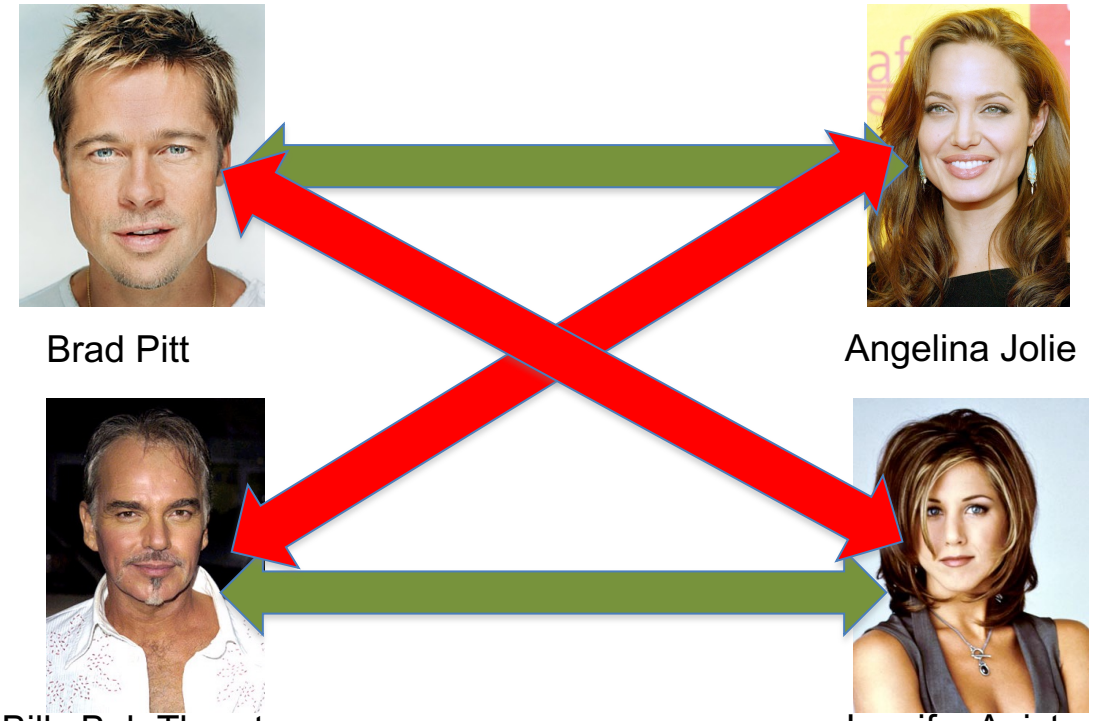




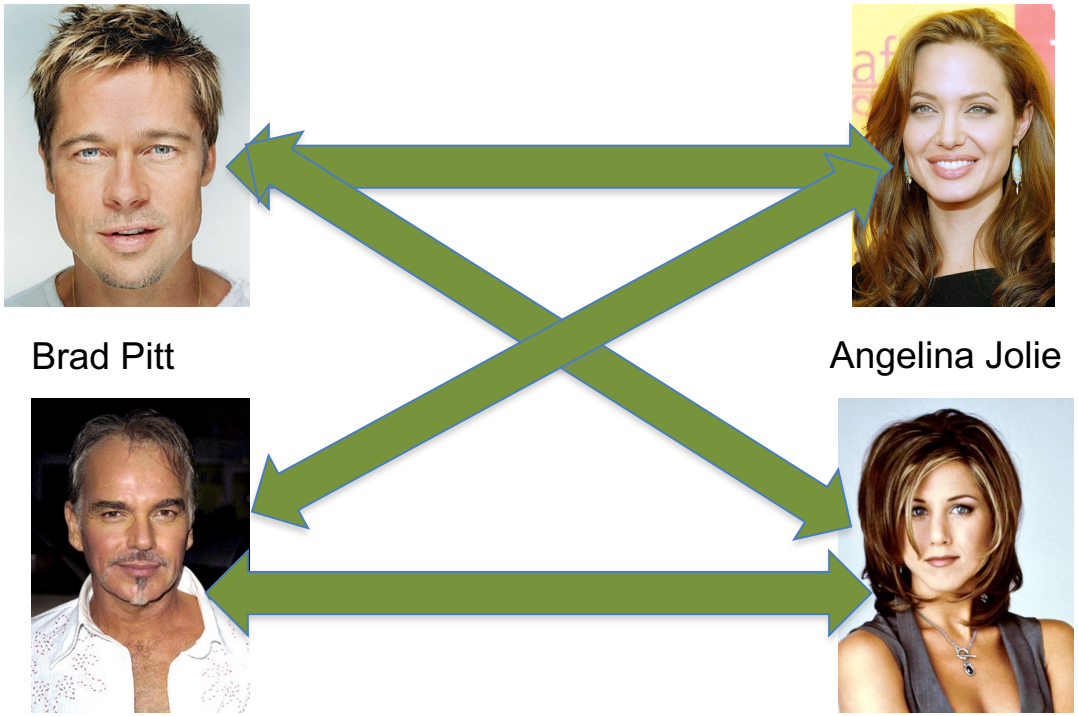
Back to the board…

A stable matching

Even though BBT and JA are not very happy



Two stable matchings



Stable Matching problem

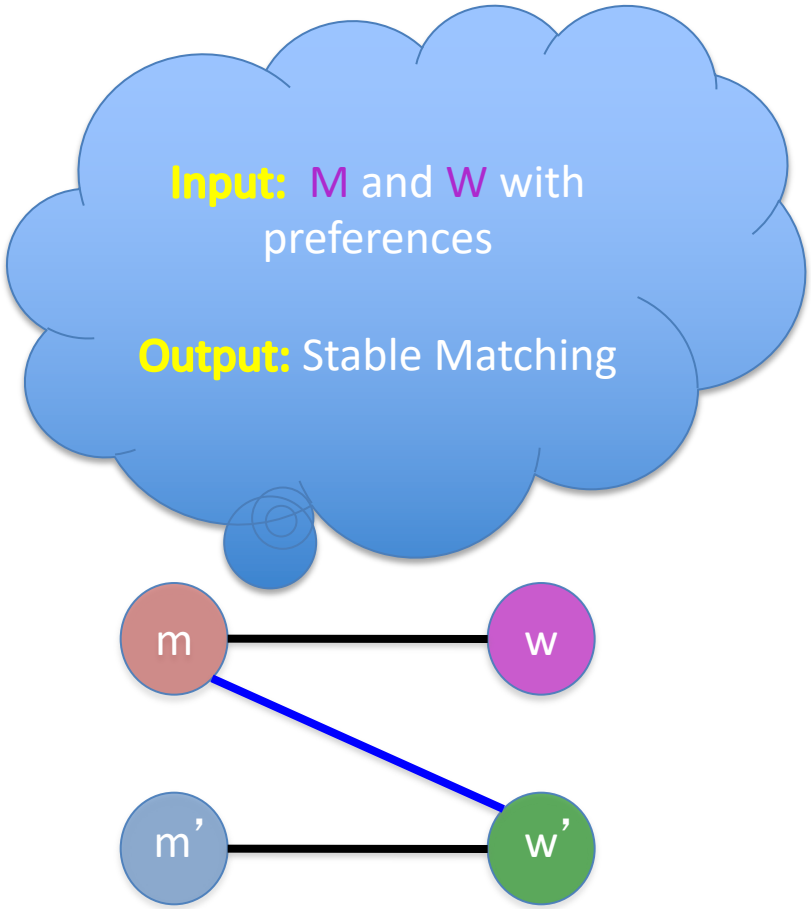
Set of men M and women W

Preferences (ranking of potential spouses)

Matching (no polyandry/gamy in M X W)

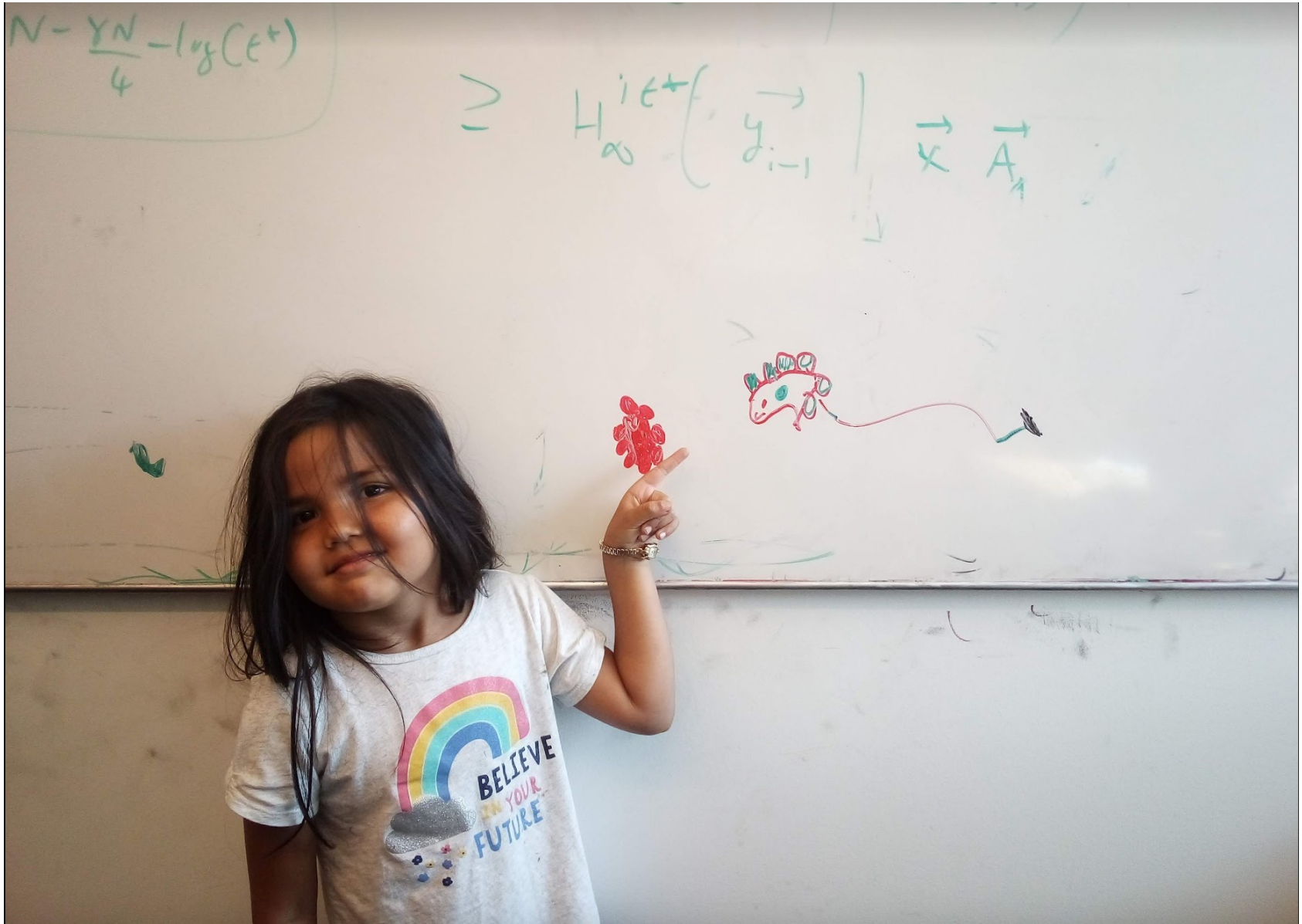
Perfect Matching (everyone gets married)

Instablity



Stable matching = perfect matching+ no instablity

Questions/Comments?



Two Questions

Does a stable marriage always exist?

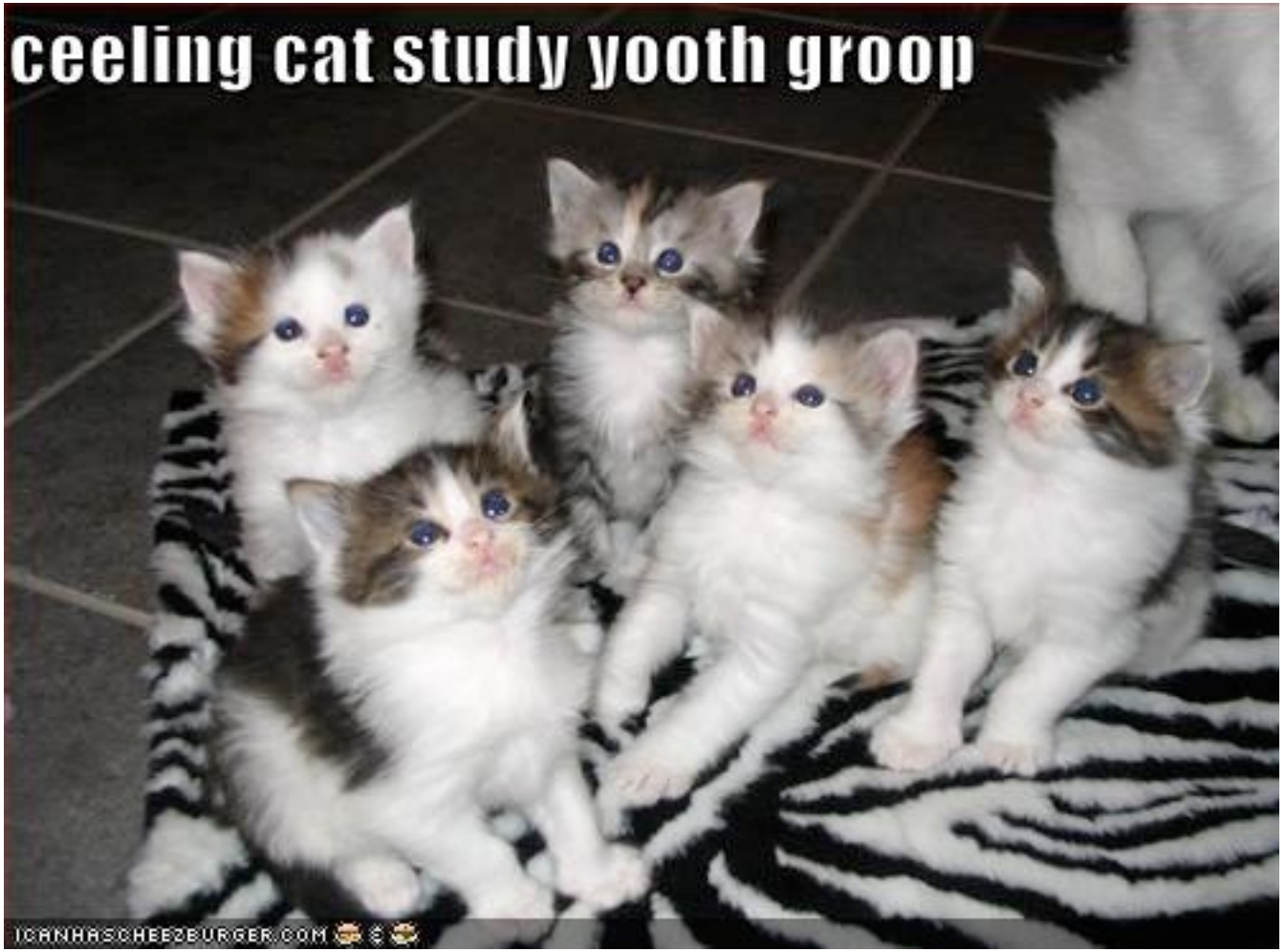
If one exists, how quickly can we compute one?

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! prefect matchings?

Go through all possible perfect matchings S

If S is a stable matching

then Stop

Else move to the next perfect matching

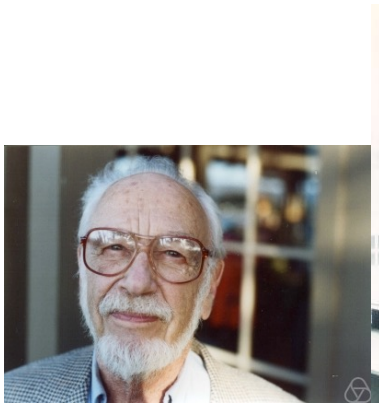
Gale-Shapley Algorithm

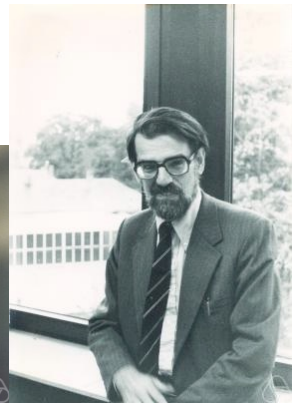
David Gale

Lloyd Shapley

$O(n^2)$ algorithm

Moral of the story…





>

Questions/Comments?