

Lecture 3

CSE 331

Aug 31, 2018

Enroll on Piazza

University at Buffalo - Fall 2018

CSE 331: Introduction to Algorithm Analysis and Design

+ Add Syllabus

Course Information

Staff

Resources

Description

Edit

Add a Class Description

Click the Edit button to add a class description.

General Information

Edit

One stop shop

For your CSE 331 needs go to <http://www-student.cse.buffalo.edu/~atri/cse331/fall18/>

Announcements

+ Add

Welcome to CSE 331!

Edit

Delete

8/19/15 11:00 AM

Welcome to the Fall 2018 edition of CSE 331. It'll be a fun course and I'm looking forward to it.

Please use the Q&A portion of Piazza to ask questions. In fact, unless your query is personal, we will not answer the question unless it is posted on Piazza.

Pretty much everything that you need to know about the course can be found on the [CSE 331 webpage](#).

In particular, I will draw your attention to the [syllabus](#), [HW policies](#) and the [support pages](#). Happy Reading!
[View on Piazza](#)

<https://piazza.com/buffalo/fall2018/cse331/>

Please do keep on asking Qs!

note ☆ stop following 119 views

Great job asking Questions

Today's lecture was probably the most interactive lecture 1 of CSE 331 ever, which was awesome! I hope the trend will continue throughout the semester :-)

Also a fair number of you stopped by my office hour today, which is also great! Please make full use of them for the rest of the semester too.

lectures

- An instructor (Mehmet Ozdemir) thinks this is a good note -

edit good note | 1 Updated 1 day ago by Atri Rudra

Read the syllabus CAREFULLY!

No graded material will be handed back till you pass the syllabus quiz!

Syllabus Quiz

Admin Options


CA Options


Options

[View handin history](#)

[View writeup](#)

[Download handout](#)

 Due: **December 7th 2018, 9:06 pm**

 Last day to handin: **December 7th 2018, 9:06 pm**

You can submit the following now

🏠 ➤ CSE331: Introduction to Algorithm Analysis and Design (f18)

Assignments

Homework 0
Q1 (Sorting)
Q2 (Number of Perfect Matchings)

Quiz
Syllabus Quiz

[Autolab Project](#) - [Contact](#) - [GitHub](#) - [Facebook](#) - [Logout](#)

You should be on Autolab now

Autolab FAQ

CSE 331 Syllabus Piazza Schedule Homeworks - Autolab Mini Project - Support Pages - Youtube channel

Autolab

Details on Autolab, which will be used for all homework submissions in CSE 331.

The main link

We will be using the UB CSE extension to [Autolab](#) for submission and (auto)grading of CSE 331 homeworks. You can access Autolab via <https://autograder.cse.buffalo.edu/>.

Signing up

Follow these steps to setup an account on Autolab (unless you already have one in which case you'll use your existing account):

1. Go to [this page](#) and click on the [Sign in with MyUB link](#). A new account will automatically be created for you.
2. By default, AutoLab will use your official UB first and last name. **If you have a different preferred name, please let us know ASAP**
3. We will have leader boards for all the programming assignments. For anonymity, all students are identified by their chosen nicknames. So please make sure you pick an appropriate one (you can change your nickname at any point of time).
4. After you have done the above steps, you wait.

What happens next

TA office hours

Finalized by today

Details on 1-on-1 meeting by Monday

HW 0 Solution posted

Solutions to Homework 0

Please note that we will provide online solutions for HW 0 **only**. From HW 1 onwards, we will only hand out hard copies of the solutions.

What is a proof?

The goal of this question is to present a gentle start to proofs. In particular, the idea is to highlight a common mistake students make while writing proofs.

The Problem

Consider the following "proof":

- Brad Pitt  has a beard:



Two comments on Programming

Programming is worth about 10% of your final grade

Algorithm design/proofs are worth about 84% of your final grade

Invest your time wisely

331 is not the place to learn a new language!

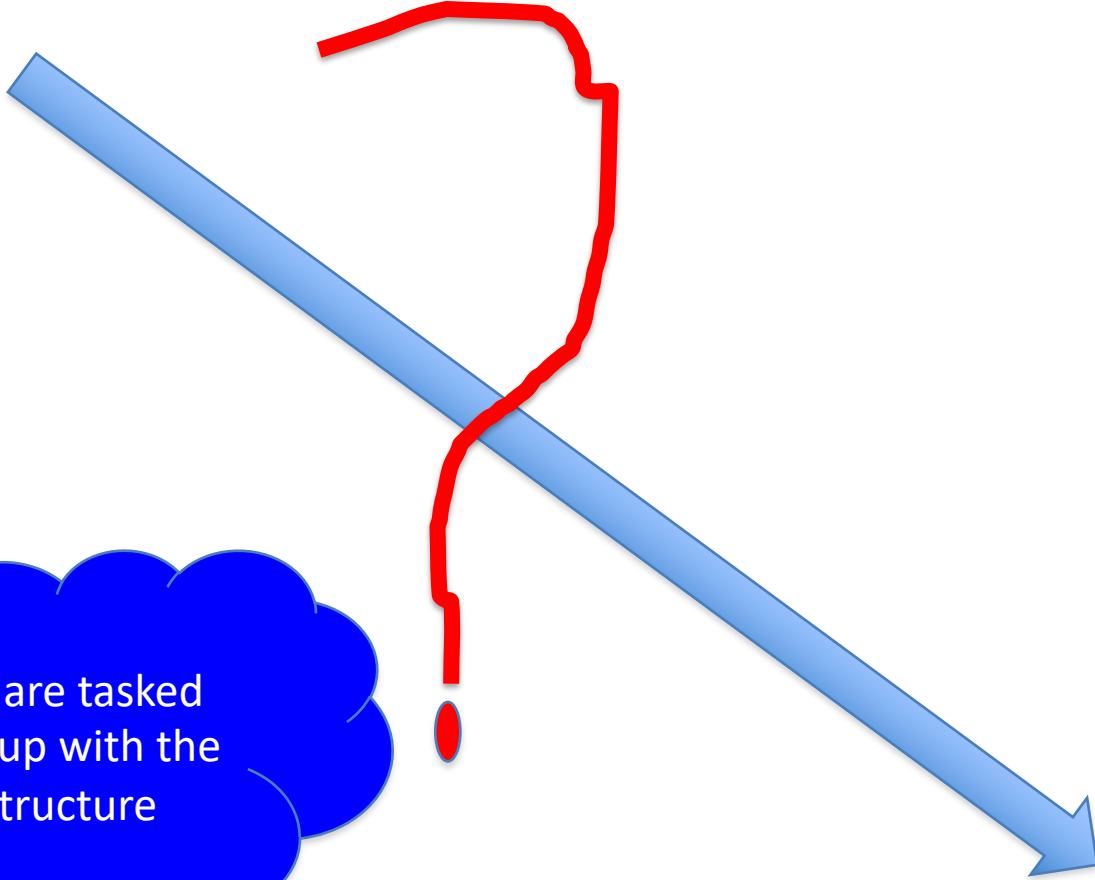
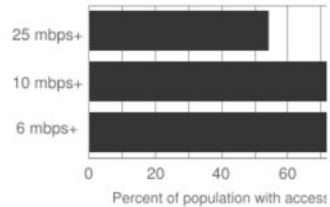
Questions/Comments?



Make broadband more available

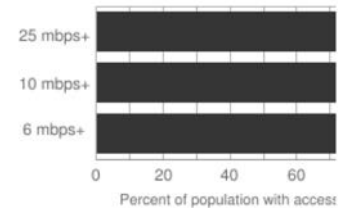
Cattaraugus County

Population: 79518
Median Income: \$41,368.88
Access to any cable technology: 67.5%
Access to two or more wireline providers: 61.2%



Erie County

Population: 913295
Median Income: \$49,817.67
Access to any cable technology: 98.9%
Access to two or more wireline providers: 96.8%



Make broadband more available

Input requirements

Where are the customers located?
What are the bandwidth requirements?
How is the input represented?

What objective are we optimizing?
How should the connections be configured?

Output requirements

Problem Definition

Where should we lay down the physical stuff?
What algorithm should be use to do this?

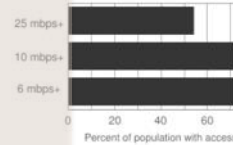
Algorithm Design

Implement the scheme

How should we do testing and maintenance?

Cattaraugus County

Population: 79518
Median Income: \$41,368.88
Access to any cable technology: 67.5%
Access to two or more wireline providers: 61.2%



Decide whether this will be for-profit enterprise

What are technology should we use?

Get regulatory approval

Get funding

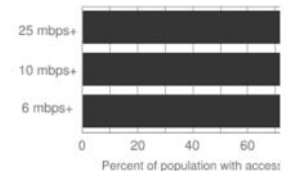
Hire people

Get access to physical space

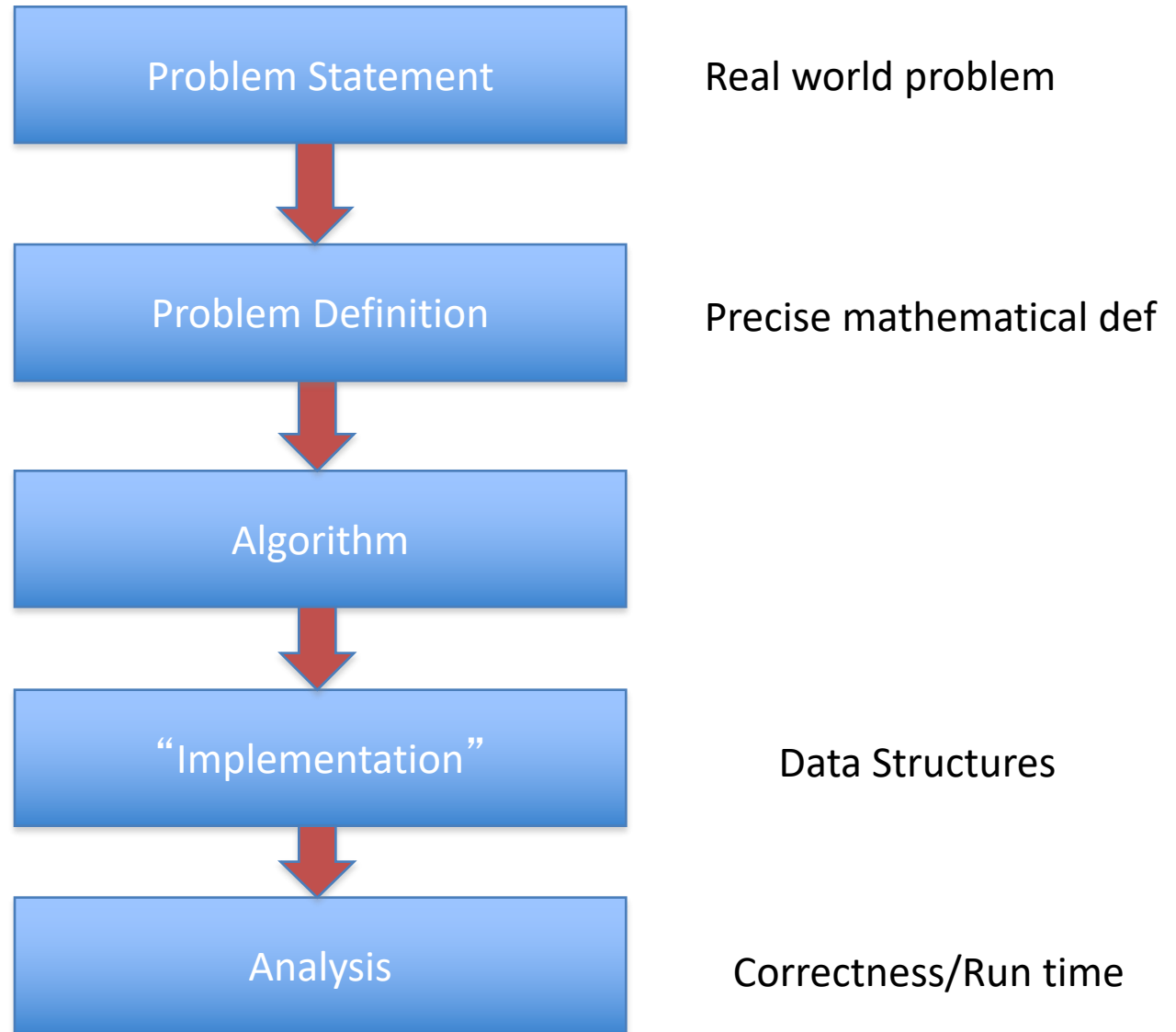
Outreach

Erie County

Population: 913295
Median Income: \$49,817.67
Access to any cable technology: 98.9%
Access to two or more wireline providers: 96.8%



Main Steps in Algorithm Design



National Resident Matching

THE MATCH
NATIONAL RESIDENT MATCHING PROGRAM

RESIDENCY FELLOWSHIP POLICIES DATA AND REPORTS ABOUT

MATCH CALENDARS LOGIN/REGISTER

Preparing for #Match2018?

Frequently
Asked
Question

An NRMP ID is
NOT Required for
Submitting Your
Applications

[>> Learn more](#)

WHAT'S HAPPENING

- Check the Eligibility of Applicants
- Registration Open for Adolescent Medicine, Medical Toxicology, and Headache Medicine
- Timely Residency Applicant Resources
- Registration Open for Colon & Rectal Surgery, Medical Genetics, Sleep Medicine, and Spinal Cord Injury

[READ MORE](#)



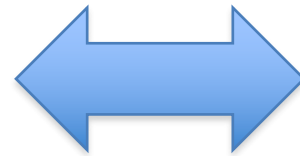
VIDEO: The Match Process for Applicants



(Screen) Docs are coming to BUF



Bailey (Grey's Anatomy)



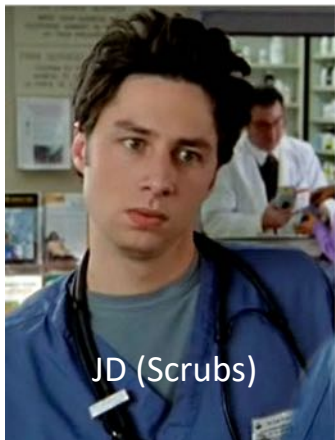
Buffalo General



Millard Filmore (Gates Circle)

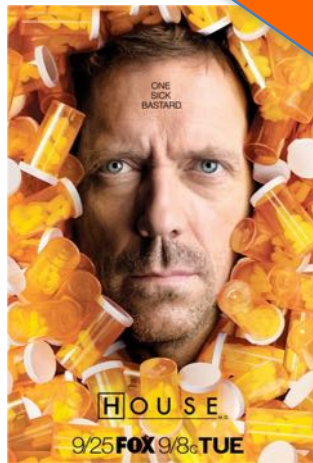


Millard Filmore (Suburban)



JD (Scrubs)

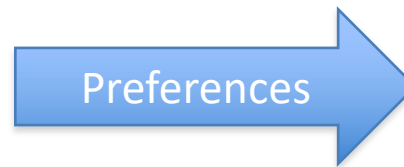
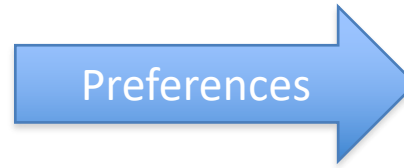
What can go wrong?



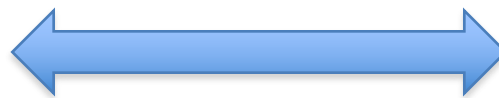
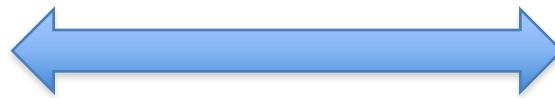
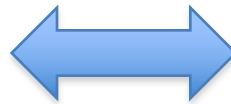
The situation is unstable!



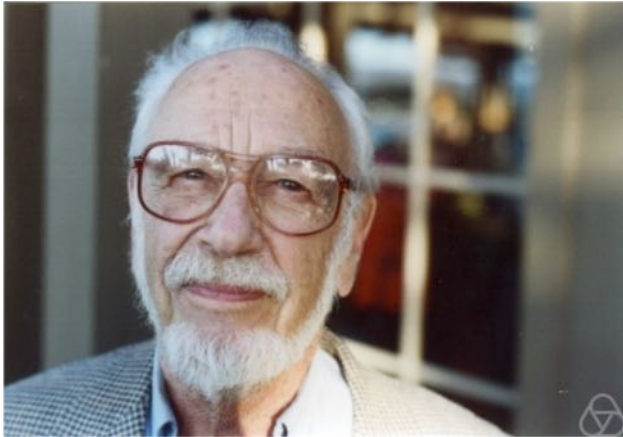
What happens in real life



NRMP plays matchmaker



Stable Matching Problem



David Gale



Lloyd Shapley

Questions/Comments?



Matching Employers & Applicants

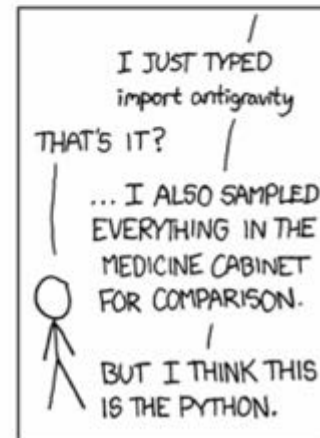
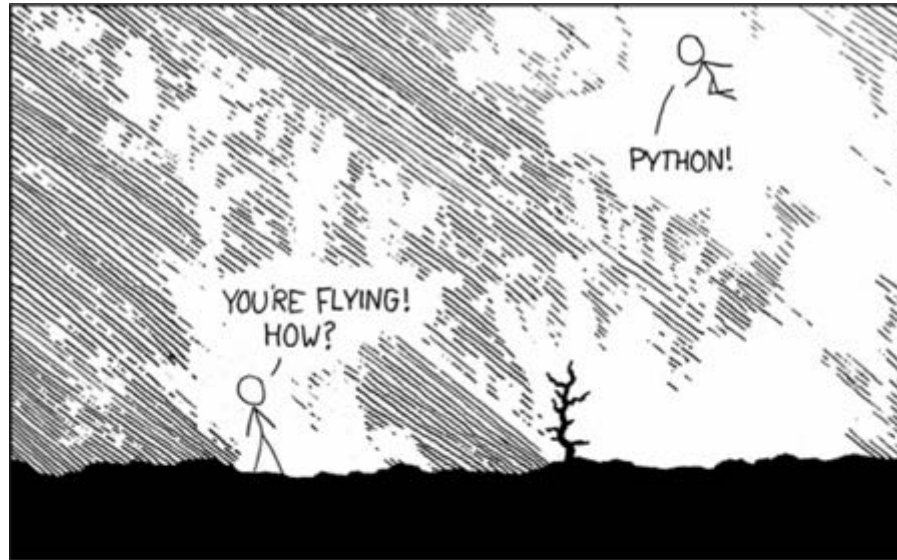
Input: Set of employers (E)
Set of applicants (A)
Preferences

Output: An assignment of applicants to employers that is “stable”

For every x in A and y in E such that x is **not** assigned to y , either

- (i) y prefers every accepted applicant to x ; or
- (ii) x prefers her employer to y

Simplicity is good



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


















Lost in Notation....

CSE 331 Fall 2018 Schedule

Previous schedules: [2017](#), [2016](#), [2014](#) , [2013](#) , [2012](#) , [2011](#) , [2010](#)  and [2009](#) .

Future Lectures

The topics for lectures in the future are tentative and subject to change. Also the links for future lectures are from Fall 2017. Recordings of Fall 2018 lectures are also available from [uLearn](#).

Date	Topic	Notes
Mon, Aug 27	Introduction    ¹⁸  ¹⁷	(HW 0 out)   Week 1 recitation notes
Wed, Aug 29	Main Steps in Algorithm Design     ¹⁸  ¹⁷	 
Fri, Aug 31	Stable Matching Problem   ¹⁷	[KT, Sec 1.1] (HW 0 in by 11:59pm, THURSDAY Aug 30)  

Questions/Comments?



Non-feminist reformulation

n men

Each with a preference list

n women

Match/marry them in a “stable” way

On matchings

Mal



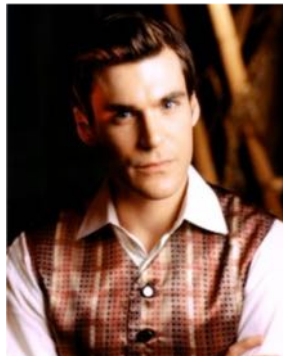
Inara

Wash

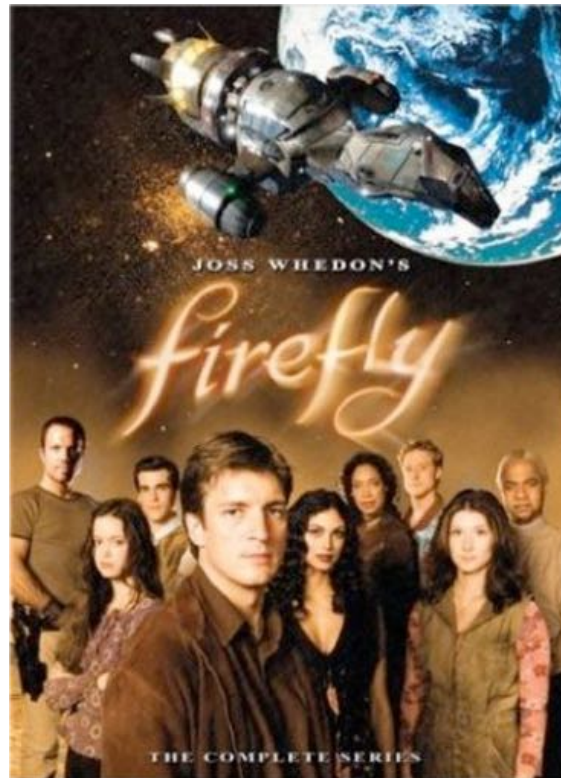


Zoe

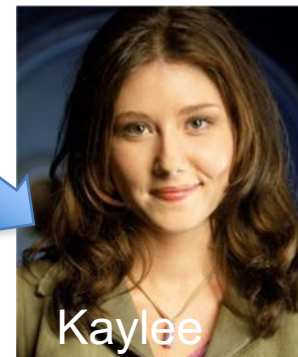
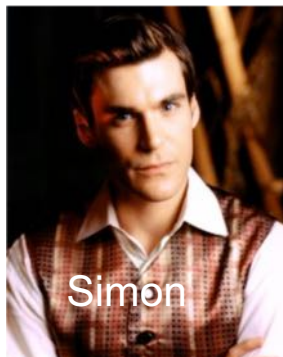
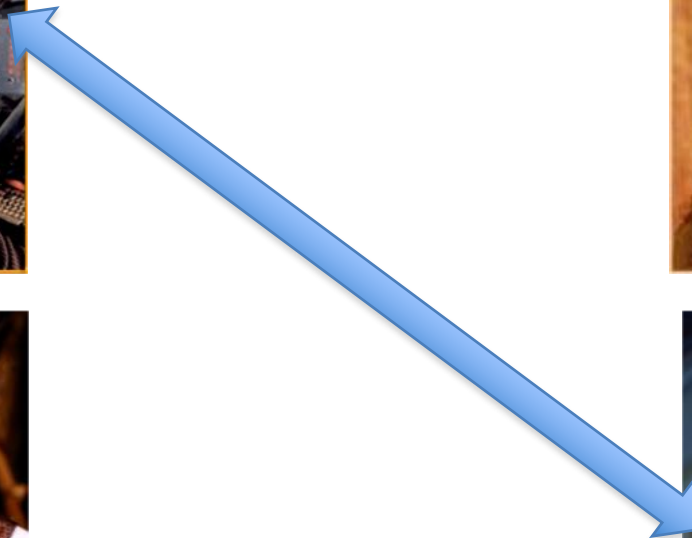
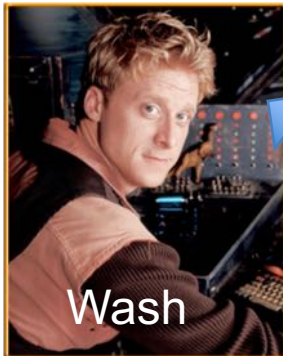
Simon



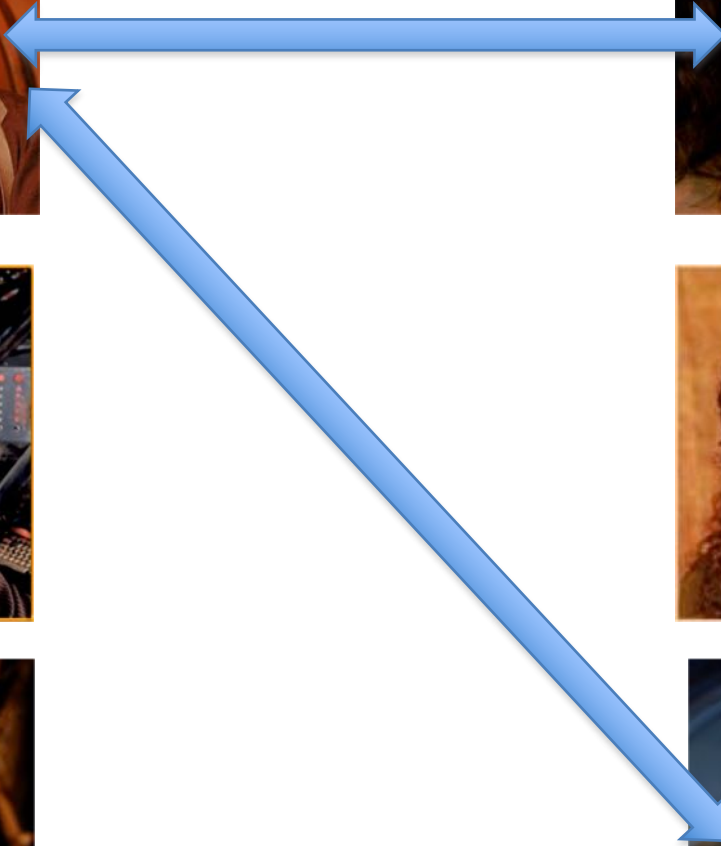
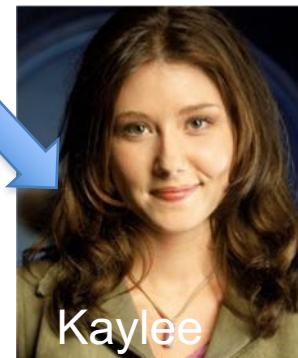
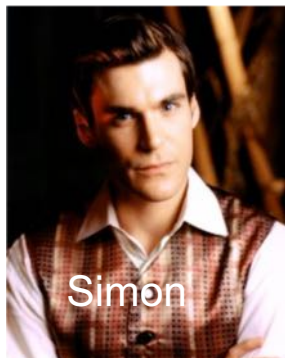
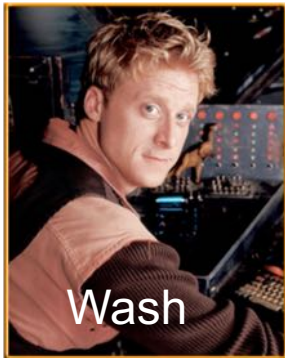
Kaylee



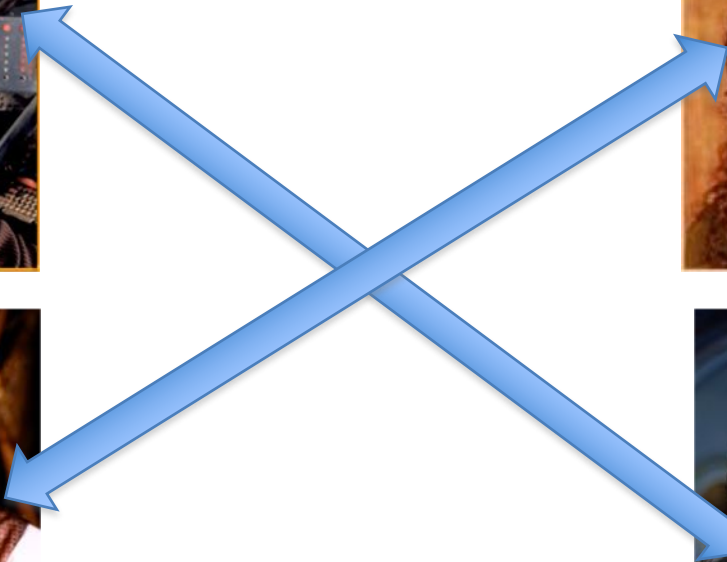
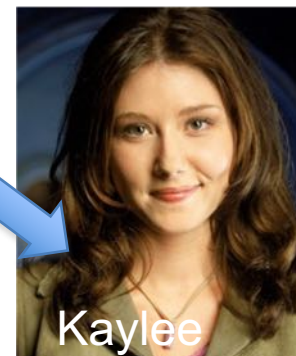
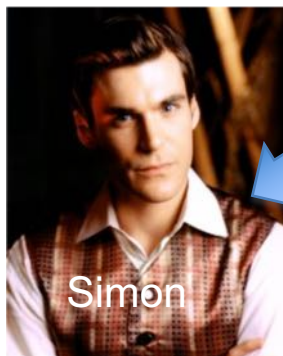
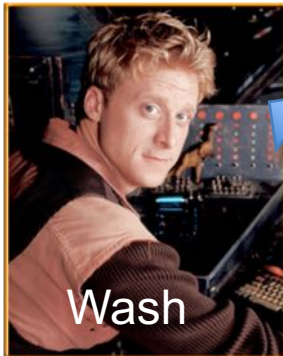
A valid matching



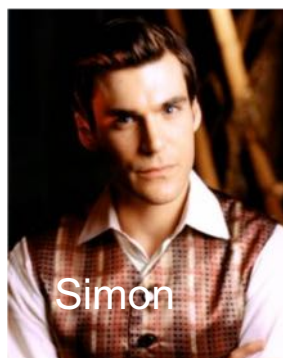
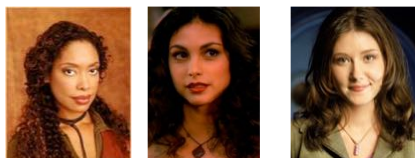
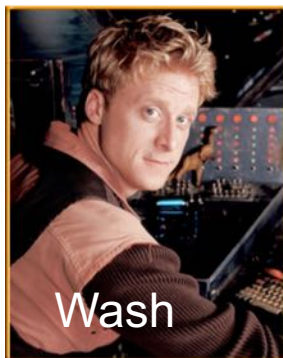
Not a matching



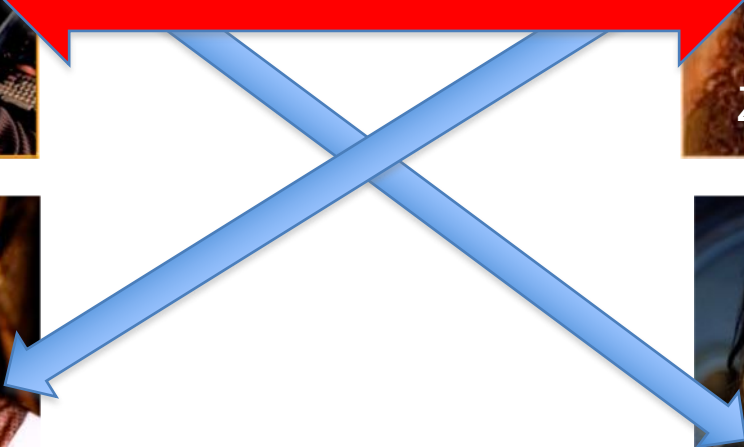
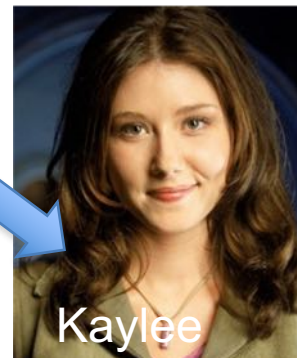
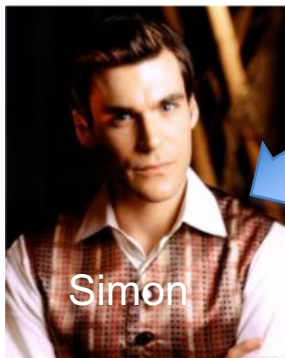
Perfect Matching



Preferences



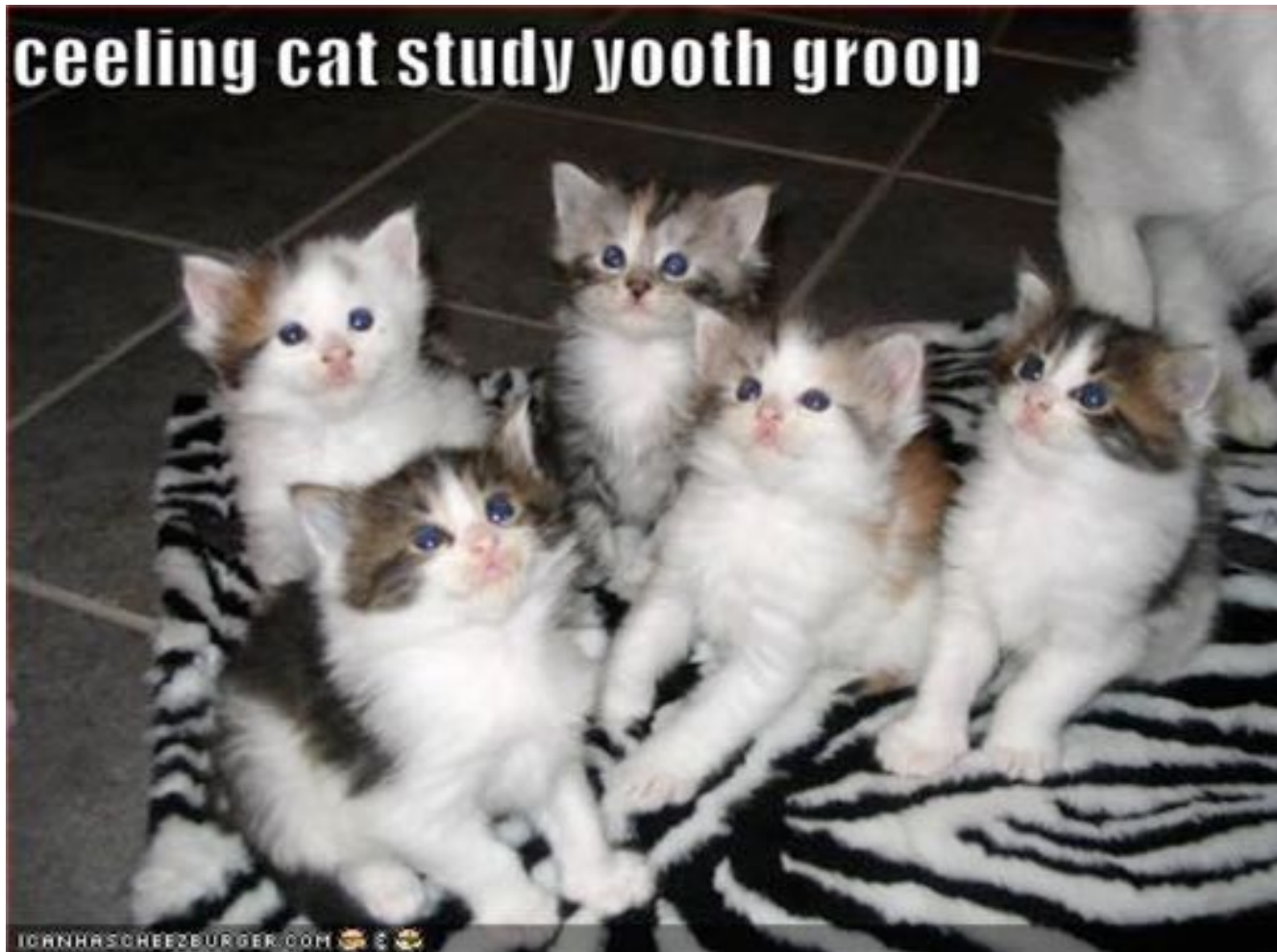
Instability



Questions/Comments?



Discuss: Naïve algorithm!



The naïve algorithm

Go through all possible perfect matchings S

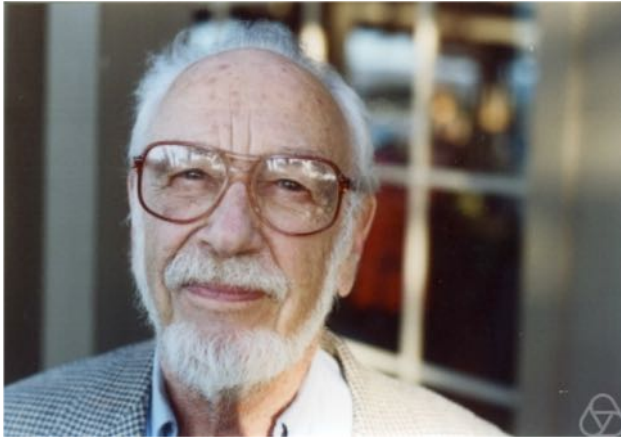
If S is a stable matching

then Stop



Else move to the next perfect matching

Gale-Shapley Algorithm



David Gale



Lloyd Shapley

$O(n^3)$ algorithm

Moral of the story...

