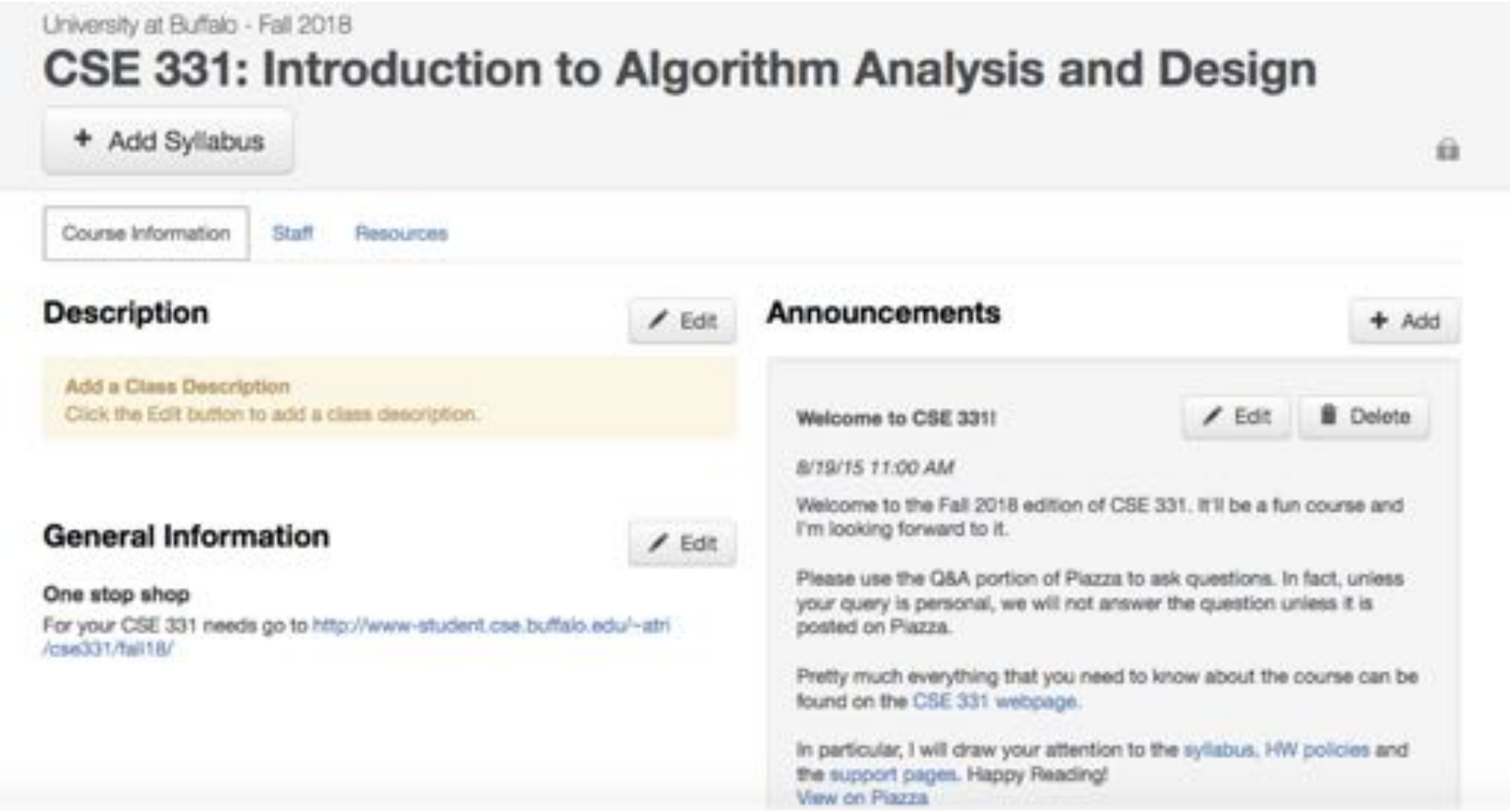
Lecture 3

CSE 331

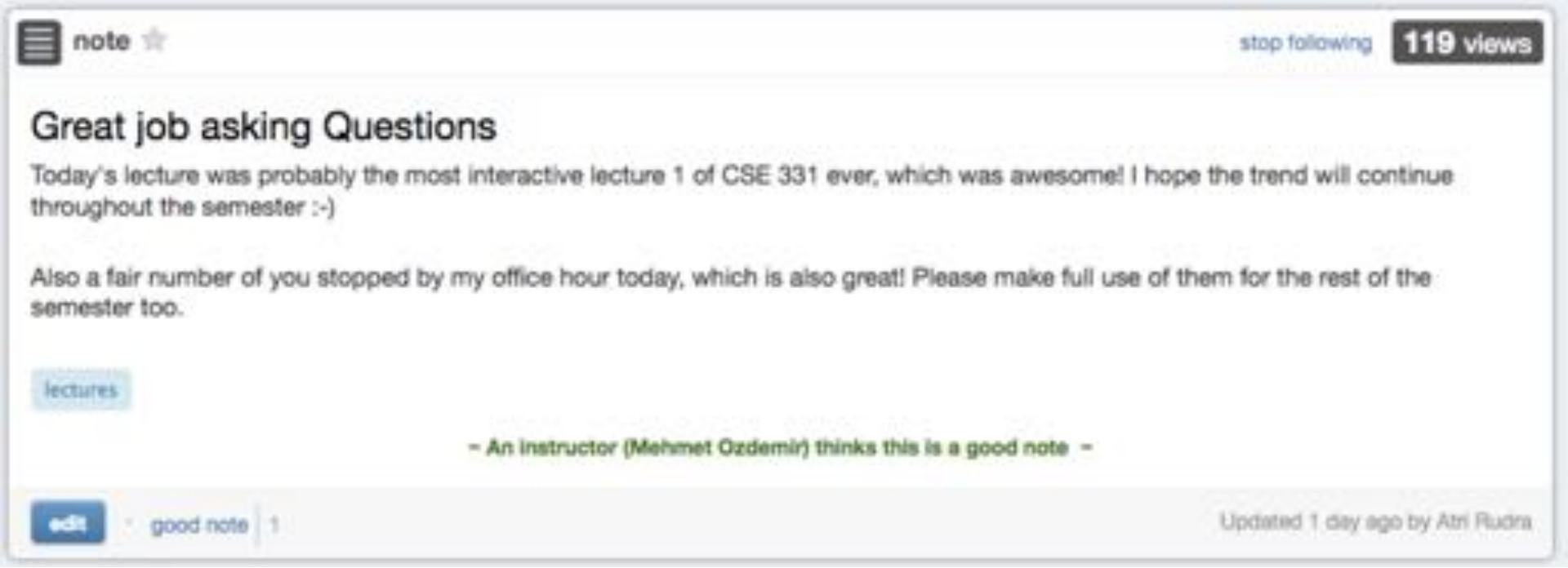
Aug 31, 2018

Enroll 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

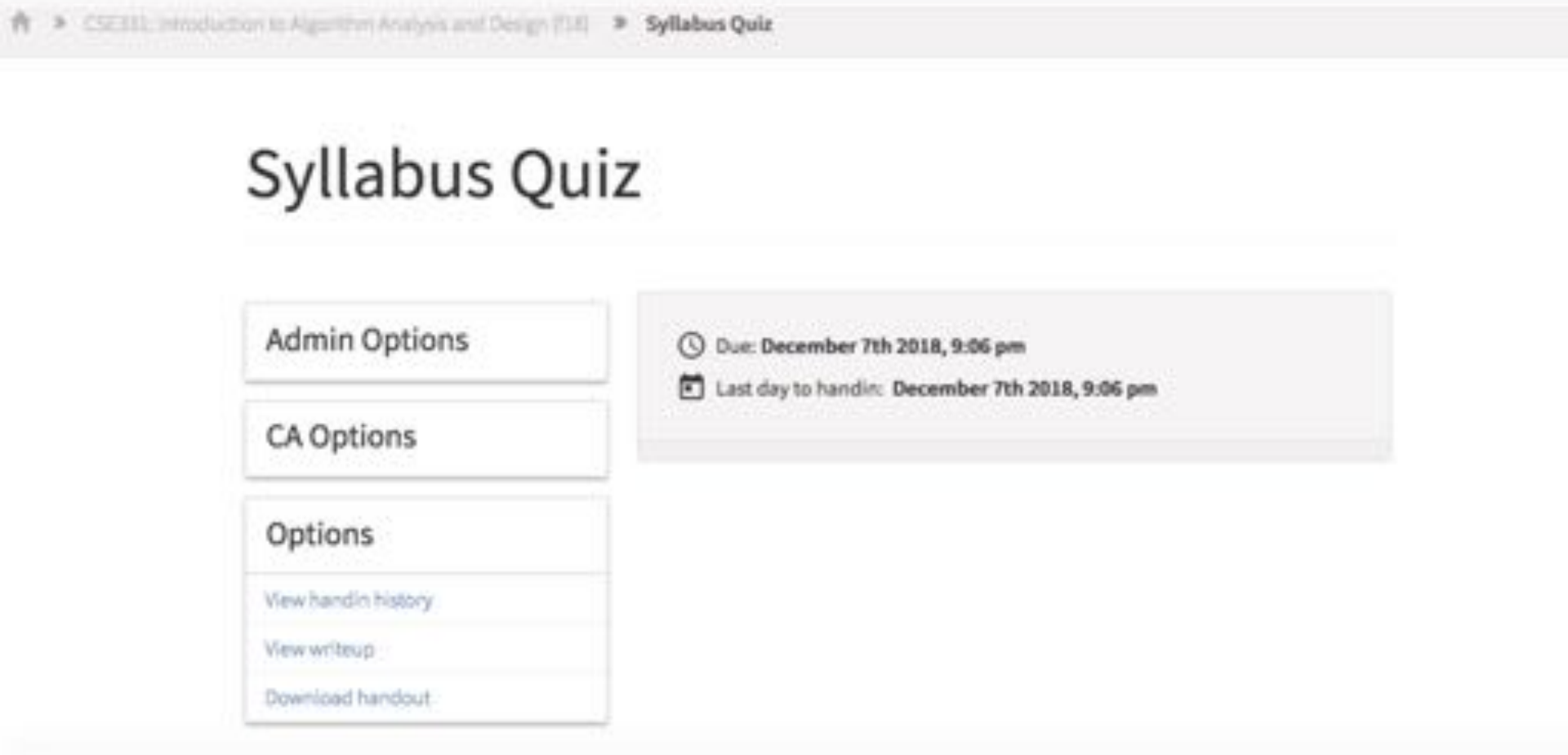
– An instructor (Mehmet Ozdemir) thinks this is a good note –

edit · good note 1

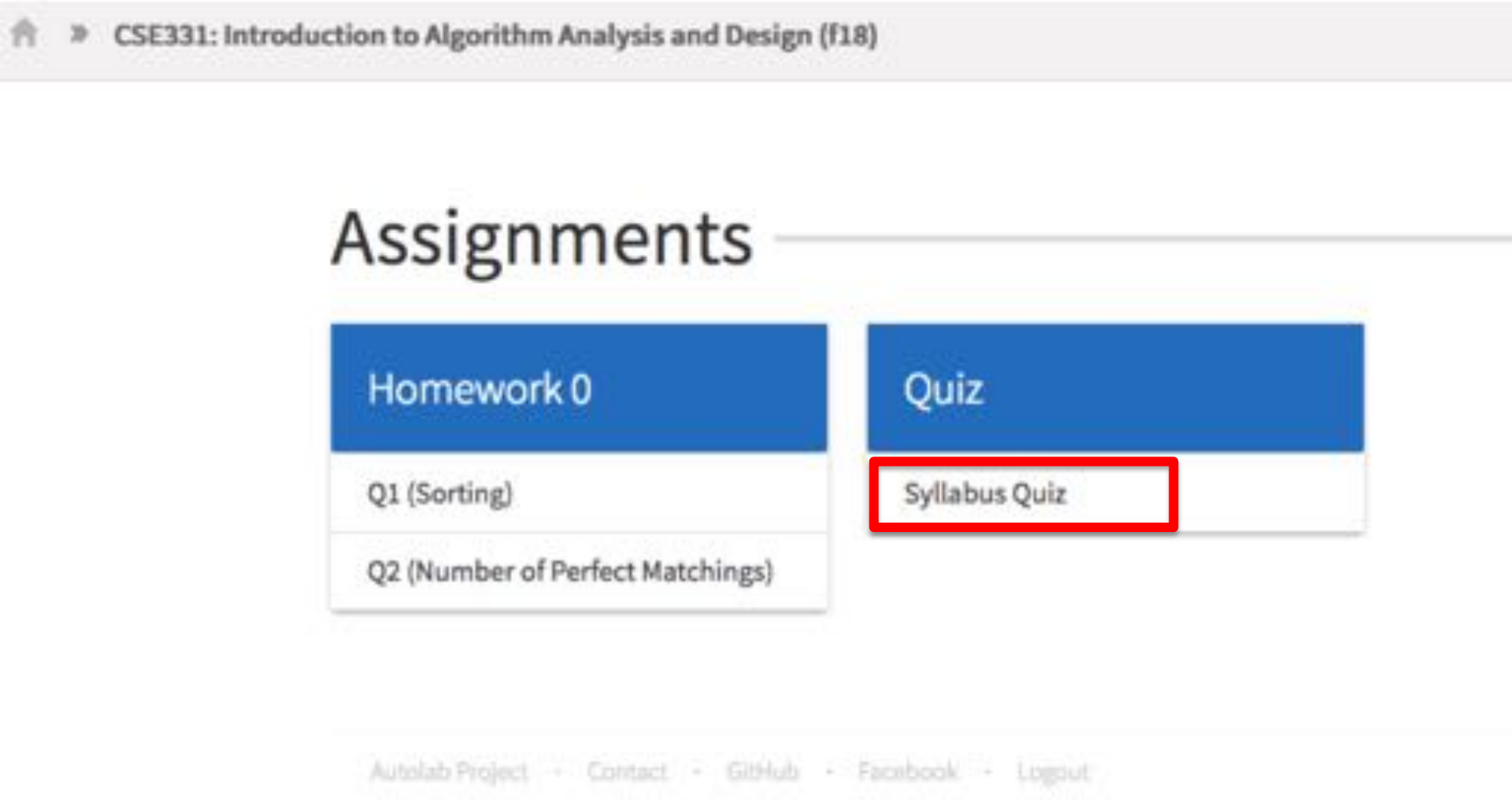
Updated 1 day ago by Atri Rudra

Read the syllabus CAREFULLY!

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

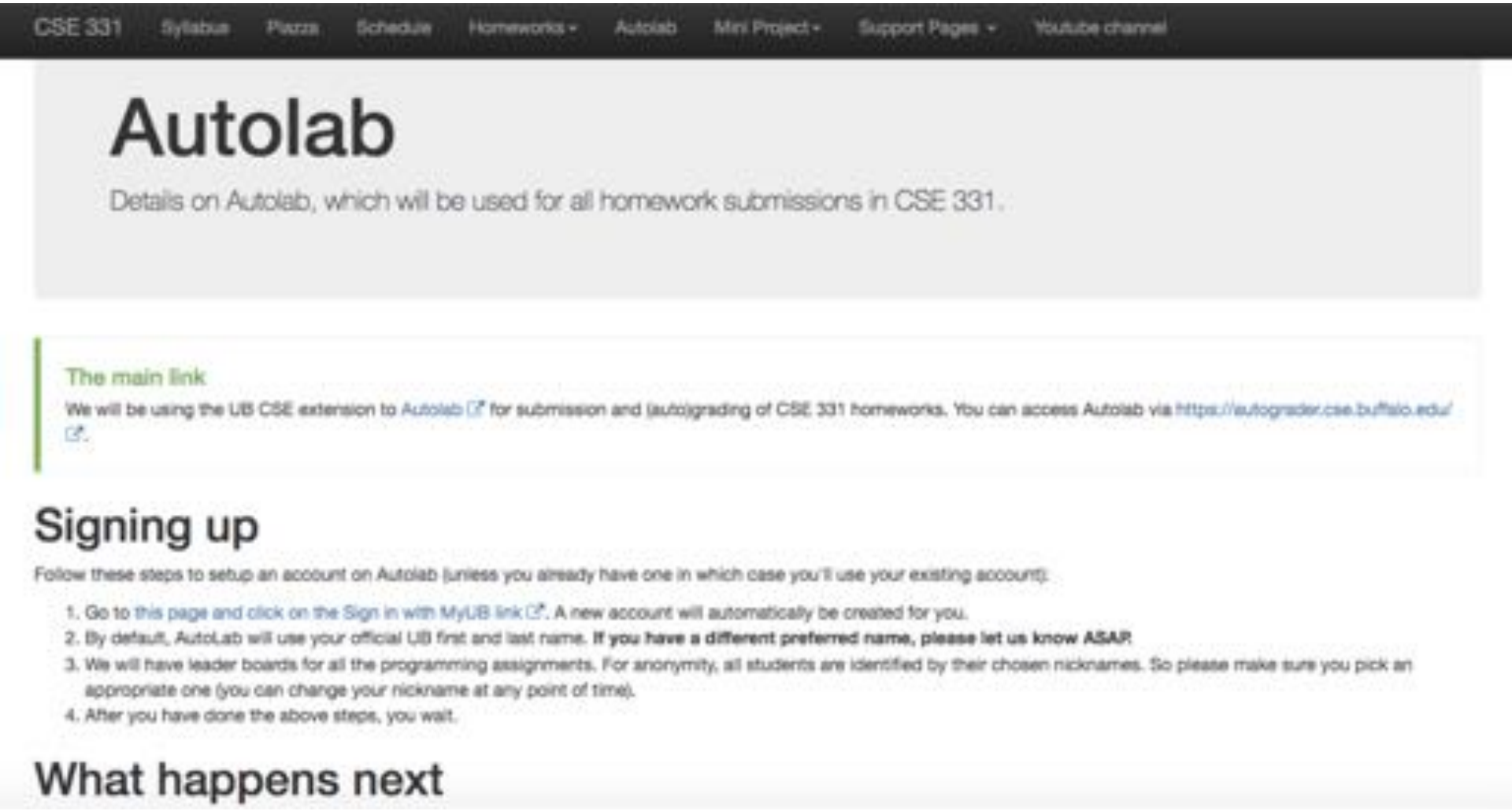


You can submit the following now



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

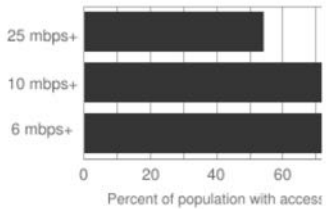
331 is not the place to learn a new language!

Questions/Comments?

Make broadband more available

Cattaraugus County

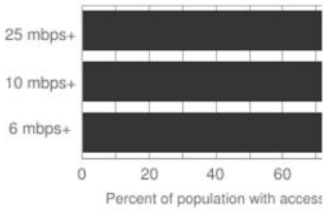
Population: 79518
Median Income: $41,368.88
Access to any cable technology: 67.5%
Access to two or more wireline providers: 61.2%



Say you are tasked to come up with the infrastructure

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?

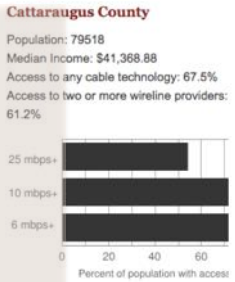
Output requirements

Problem Definition

Where should we lay down the physical stuff?

What algorithm should be use to do this?

Algorithm Design



Decide whether this will be for-profit enterprise

What are technology should we use?

Get regulatory approval

Get funding

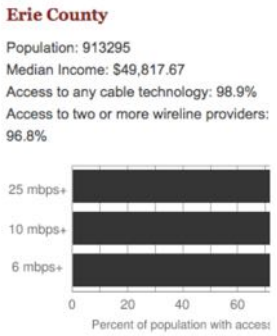
Hire people

Get access to physical space

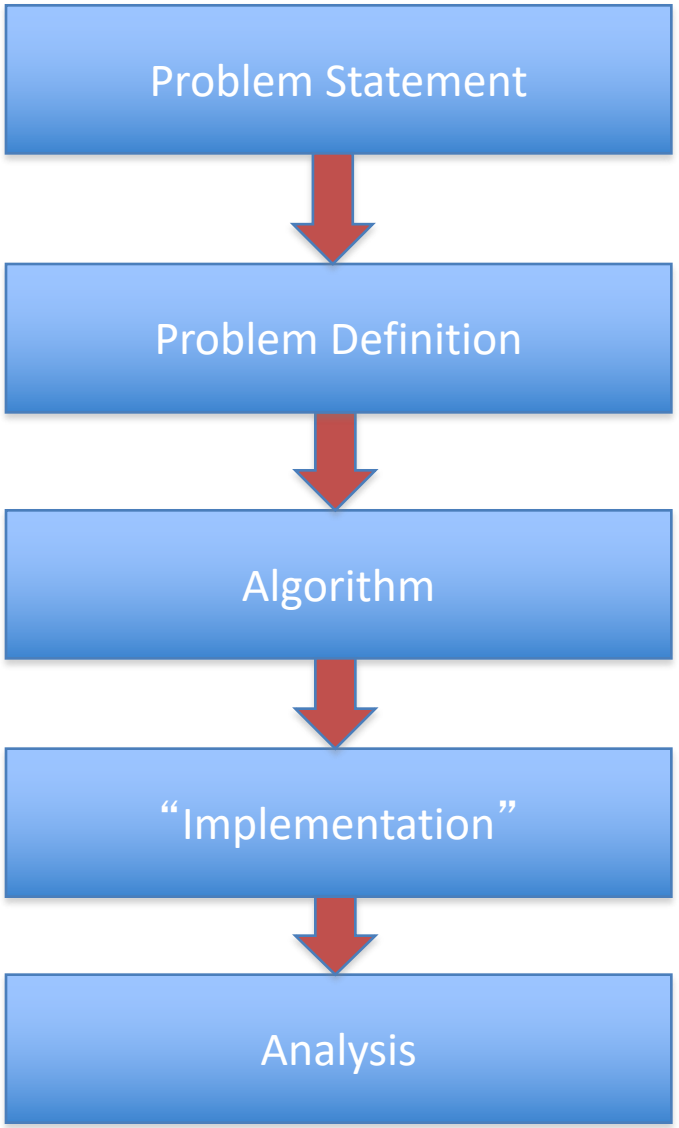
Outreach

Implement the scheme

How should we do testing and maintenance?



Main Steps in Algorithm Design



Real world problem

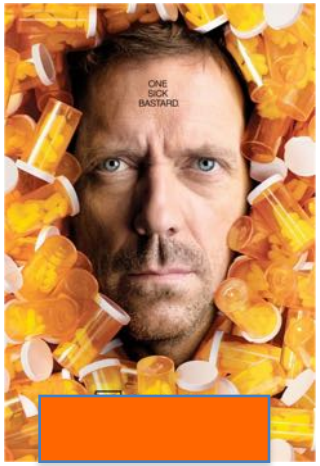
Precise mathematical def

Data Structures

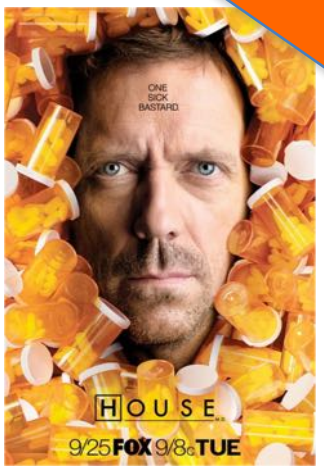
Correctness/Run time

National Resident Matching

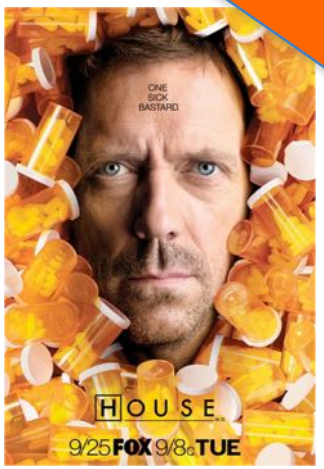
(Screen) Docs are coming to BUF



What can go wrong?



The situation is unstable!



What happens in real life

Preferences

NRMP
National Resident Matching Program

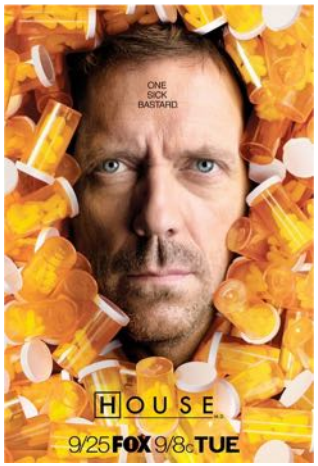
Information

NRMP
National Resident Matching Program

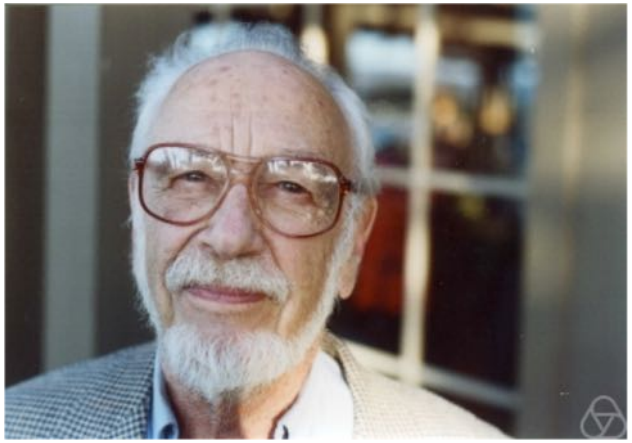
Preferences

NRMP
National Resident Matching Program

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

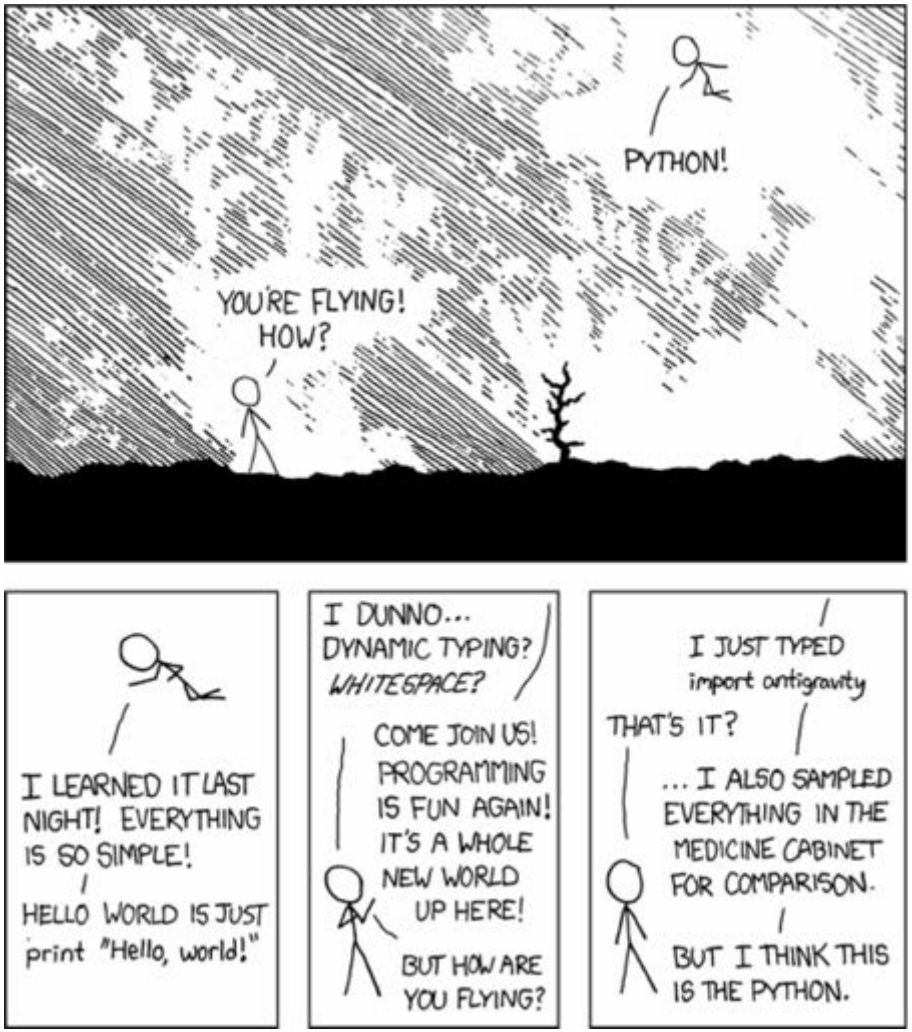
Output: An assignment of applicants to employers that is "stable"

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



http://xkcd.com/353/

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

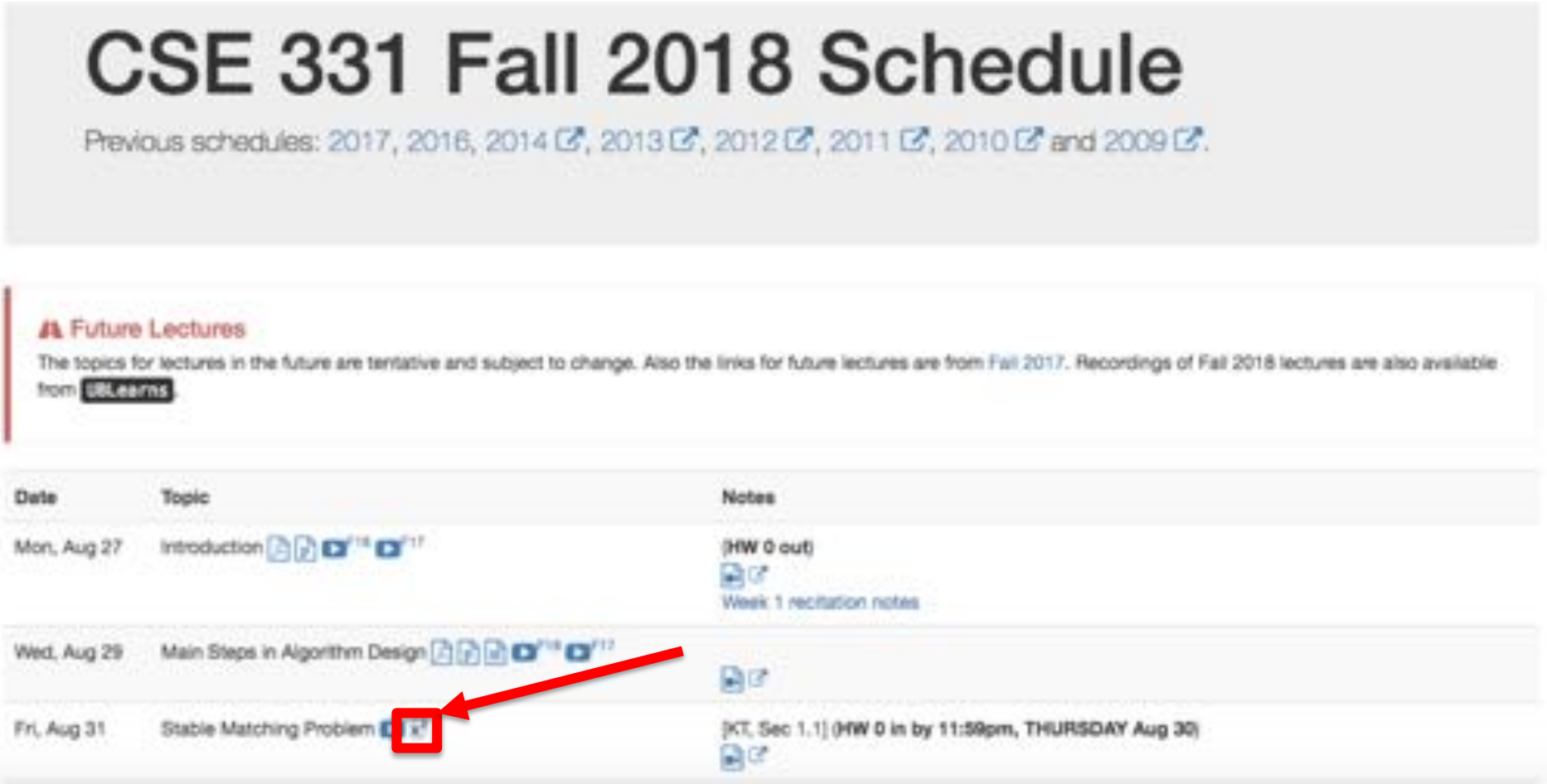
5) Can an applicant have > 1 job? NO

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 UWLearns.

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

Questions/Comments?

Non-feminist reformulation

n men

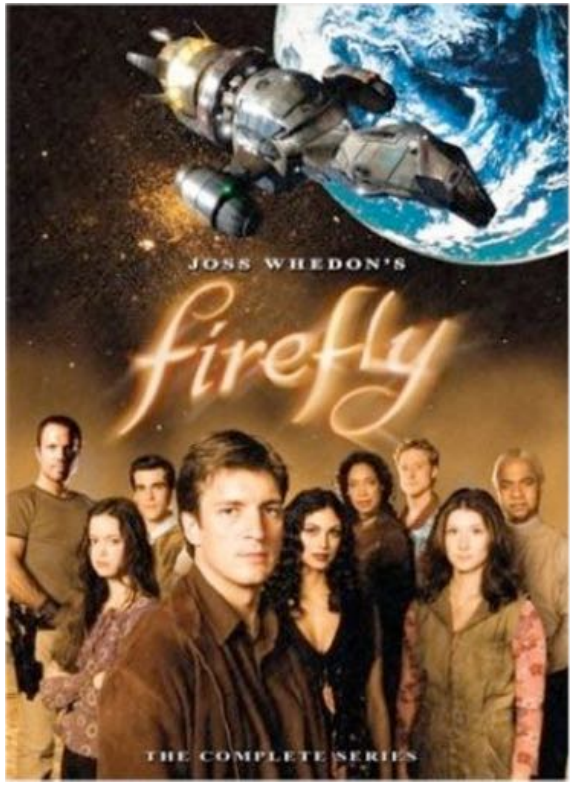
n women

Each with a preference list

Match/marry them in a “stable” way

On matchings

Mal

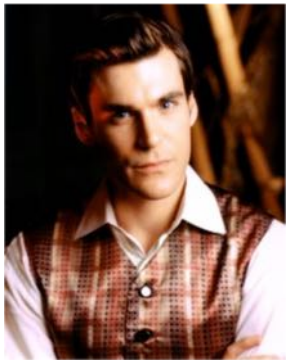


Inara

Wash

Zoe

Simon

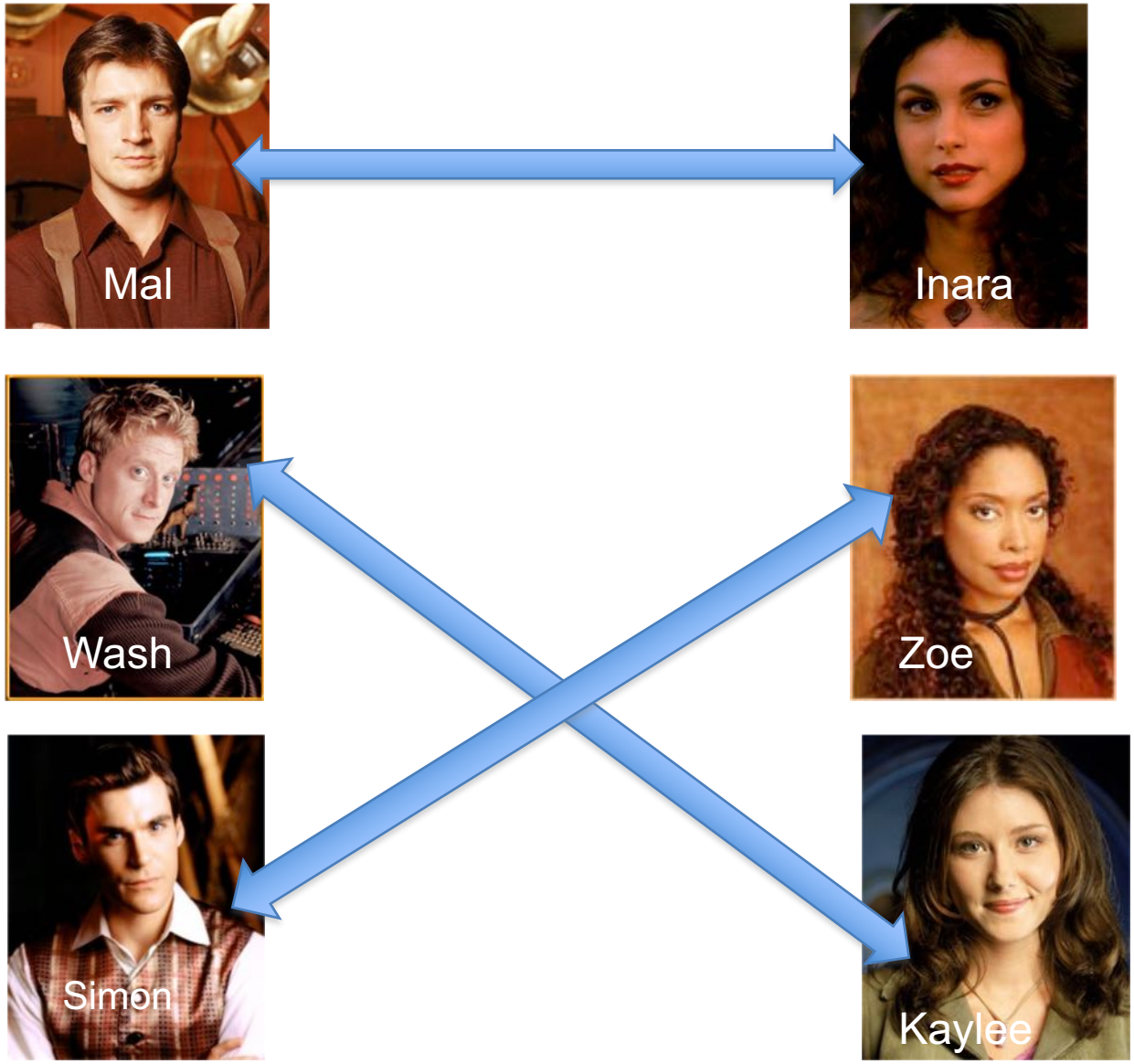


Kaylee

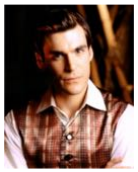
A valid matching

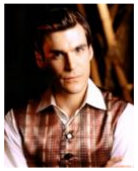
Not a matching

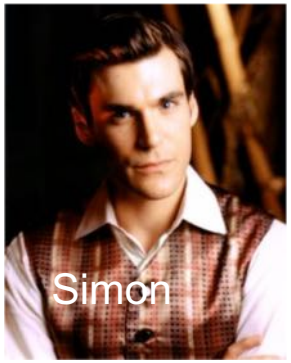
Perfect Matching

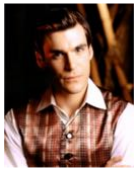


Preferences

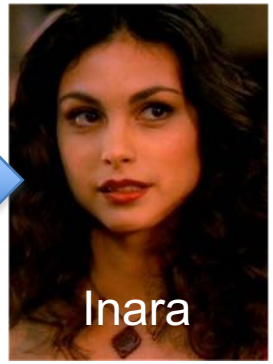


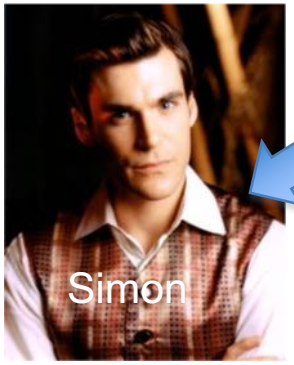


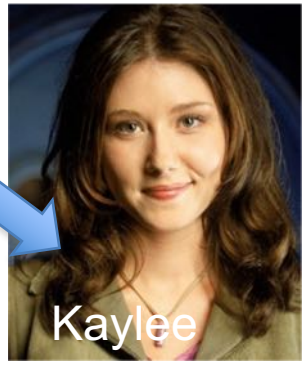




Instability

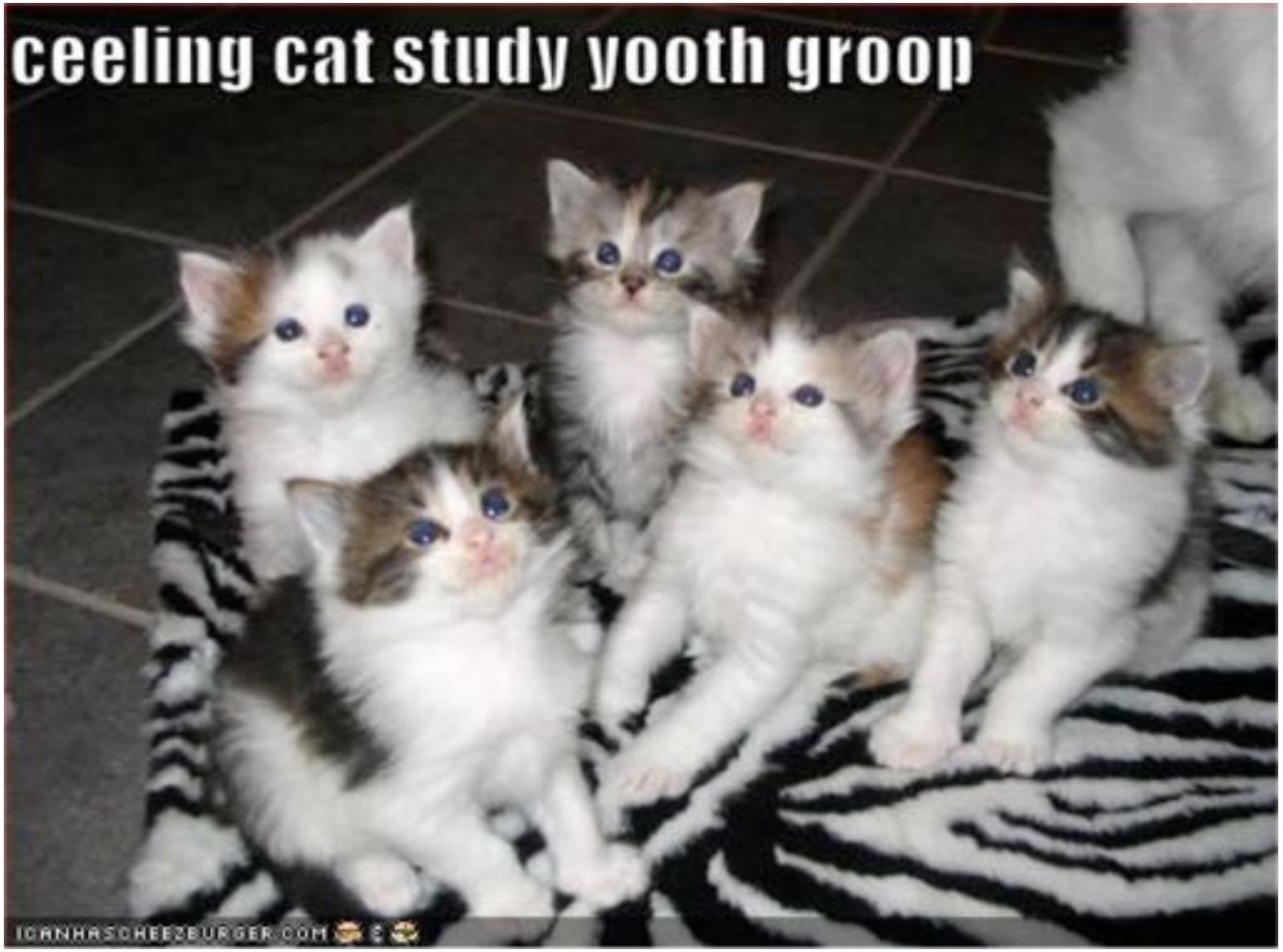






Questions/Comments?

Discuss: Naïve algorithm!



The naïve algorithm

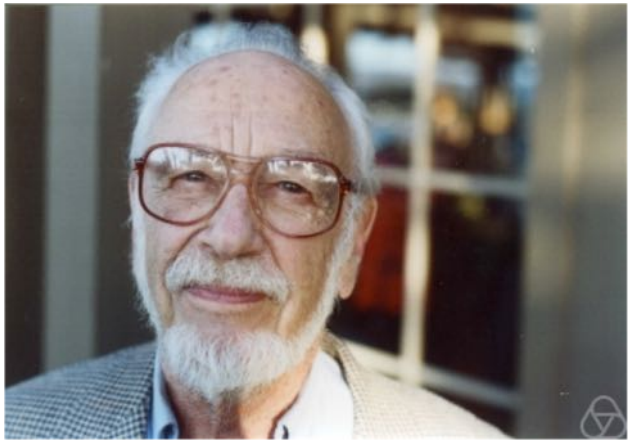
Go through all possible perfect matchings S

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…

>