Lecture 3

CSE 331

Sep 2, 2016

Read the syllabus CAREFULLY!

CSE 331 **Introduction to Algorithm Analysis and Design** **Fall 2016**

University at Buffalo
Department of Computer Science & Engineering
CSE 331 — Introduction to Algorithm Analysis and Design

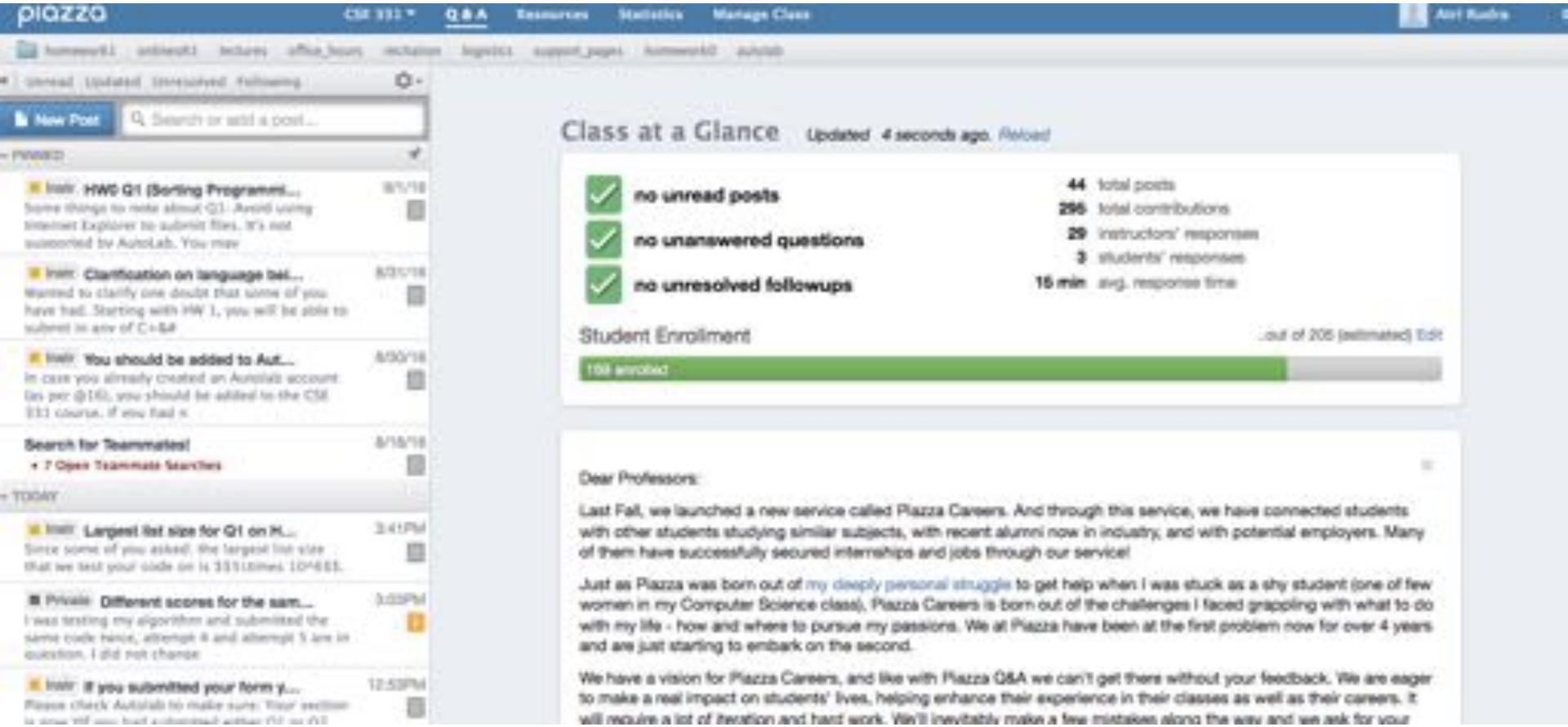
I'll need confirmation in writing. No graded material will be handed back till I get this signed form from you!

I, _____ (PRINT name), acknowledge that I have read and understood the syllabus (and the homework policy document) for this course, CSE 331 *Introduction to Algorithm Analysis and Design.*

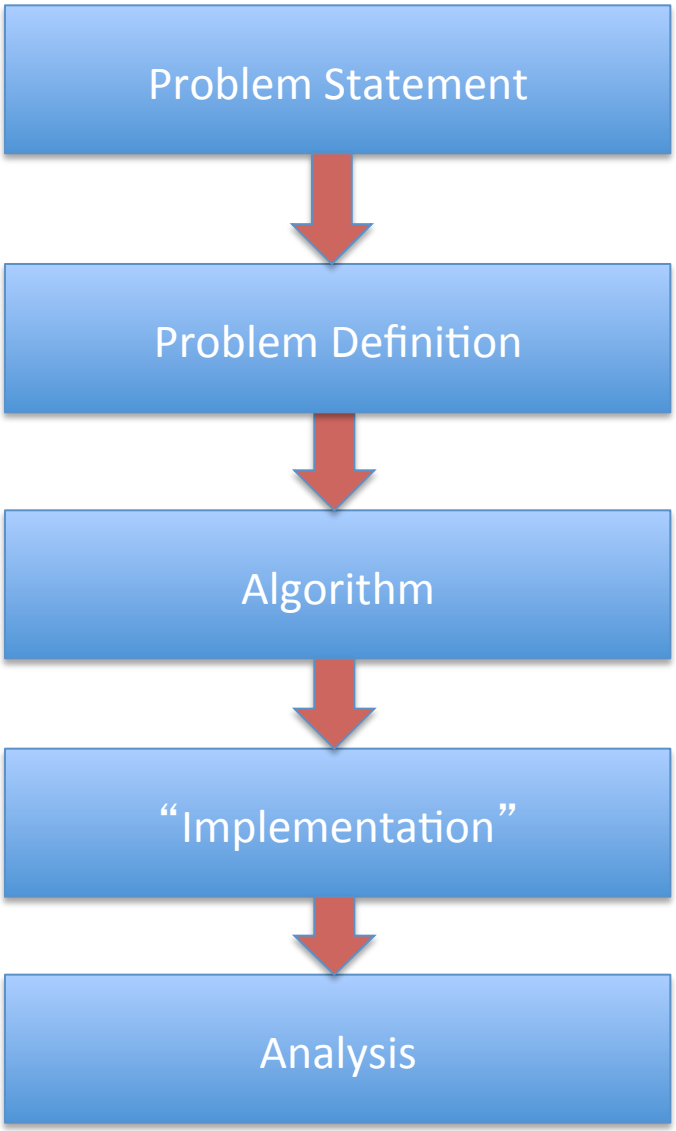
I also acknowledge that I understand the definition of academic integrity as outlined in the syllabus, and that I will minimally receive a grade of F in the course if I am found to have breached academic integrity, *even if it occurs for the first time.* In particular, I understand that I cannot claim that I did not understand the rules if I am found to have breached academic integrity.

Signature: _____ Date: _____

Join piazza!


piazza
CSE 331
Q & A
Resources
Statistics
Manage Class
New Post
Search or add a post...
Class at a Glance
Updated 4 seconds ago. Reload
no unread posts
no unanswered questions
no unresolved followups
44 total posts
256 total contributions
29 instructors' responses
3 students' responses
15 min avg. response time
Student Enrollment
Dear Professors:
Last Fall, we launched a new service called Piazza Careers. And through this service, we have connected students with other students studying similar subjects, with recent alumni now in industry, and with potential employers. Many of them have successfully secured internships and jobs through our service!
Just as Piazza was born out of my deeply personal struggle to get help when I was stuck as a shy student (one of few women in my Computer Science class), Piazza Careers is born out of the challenges I faced grappling with what to do with my life - how and where to pursue my passions. We at Piazza have been at the first problem now for over 4 years and are just starting to embark on the second.
We have a vision for Piazza Careers, and like with Piazza Q&A we can't get there without your feedback. We are eager to make a real impact on students' lives, helping enhance their experience in their classes as well as their careers. It

Main Steps in Algorithm Design



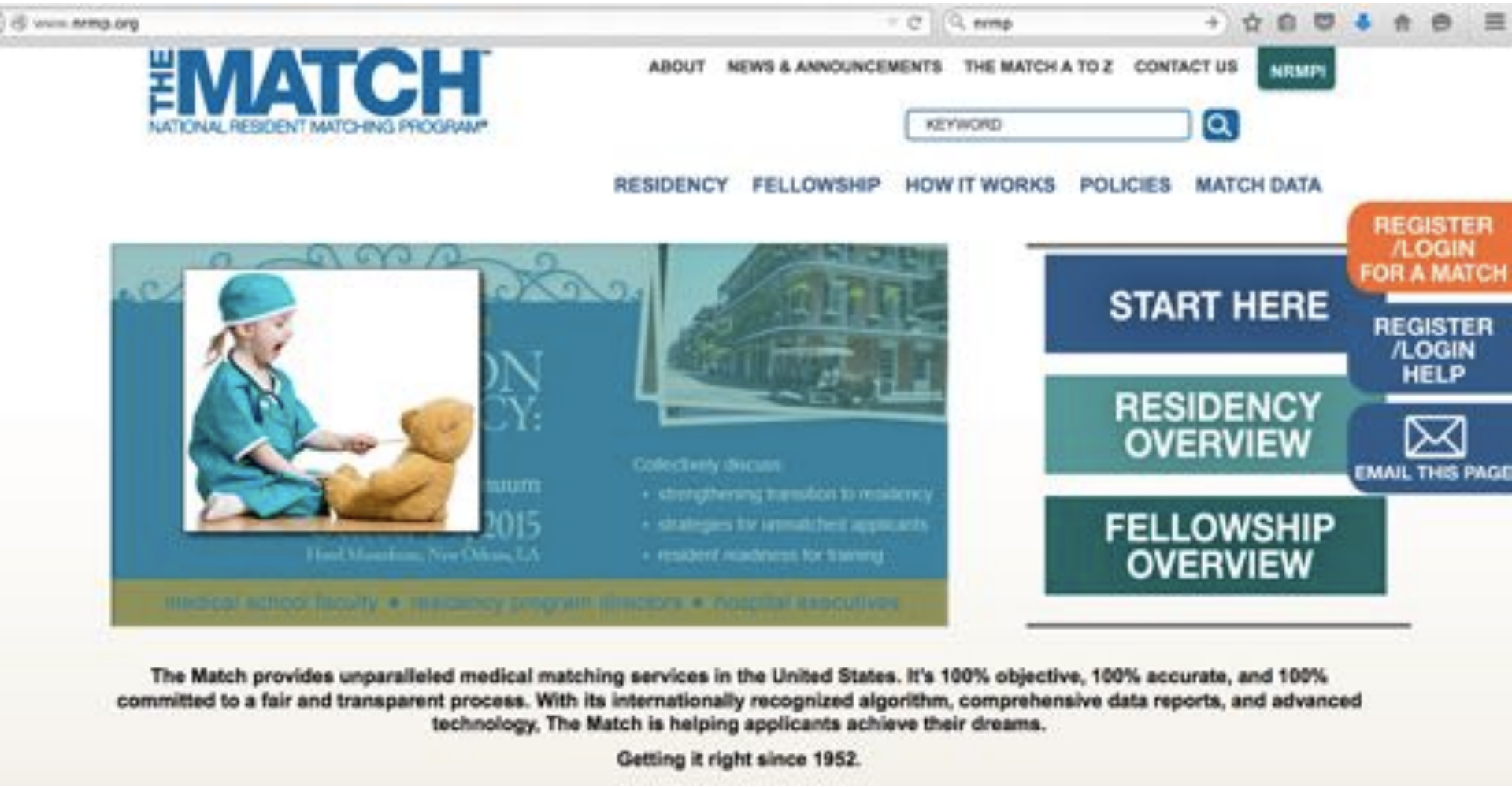
Real world problem

Precise mathematical def

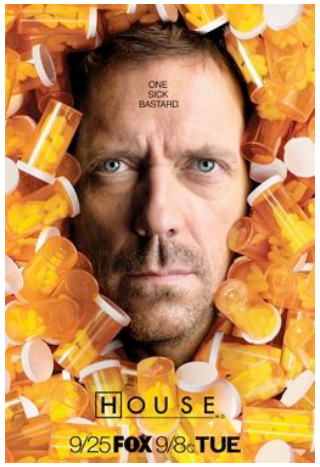
Data Structures

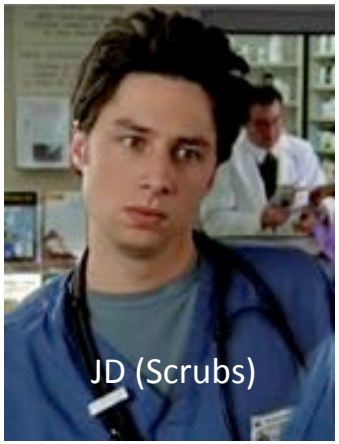
Correctness/Run time

National Resident Matching

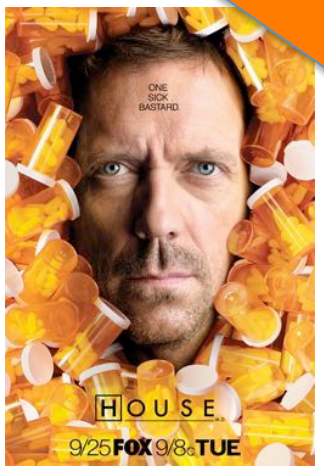


(Screen) Docs are coming to BUF

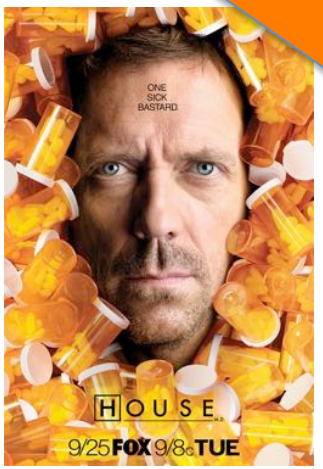




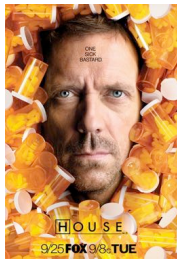
What can go wrong?



The situation is unstable!



What happens in real life



Preferences

THE MATCH℠
NATIONAL RESIDENT MATCHING PROGRAM®

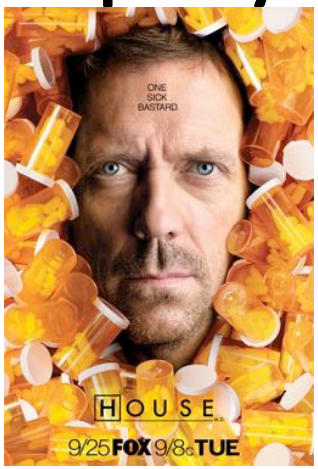
Information

THE MATCH℠
NATIONAL RESIDENT MATCHING PROGRAM®

Preferences

THE MATCH℠
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

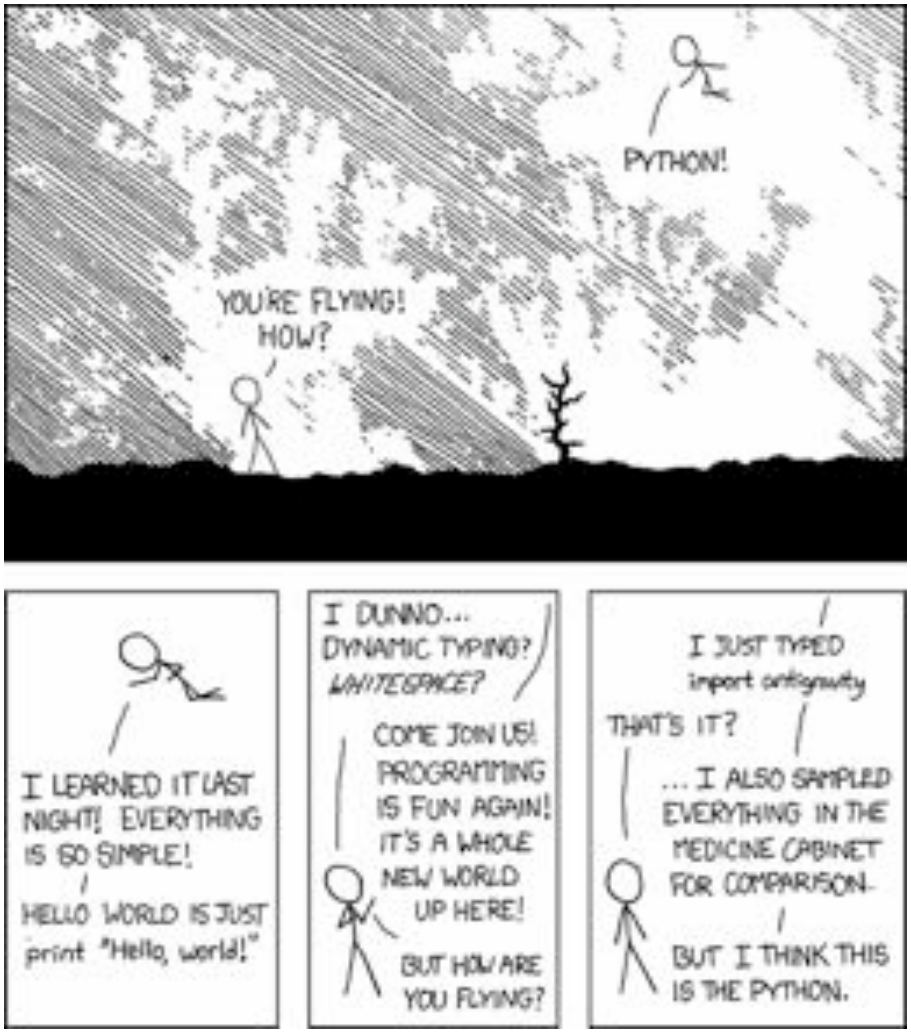
Output: An assignment of applicants to employers that is "stable"

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

Questions/Comments?

Non-feminist reformulation

n men

n women

Each with a preference list

Match/marry them in a “stable” way

On matchings

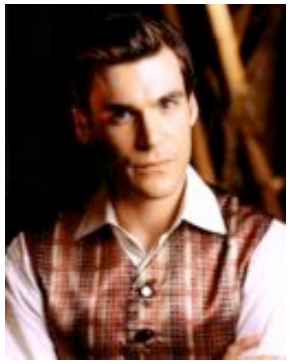
Mal

Inara

Wash

Zoe

Simon

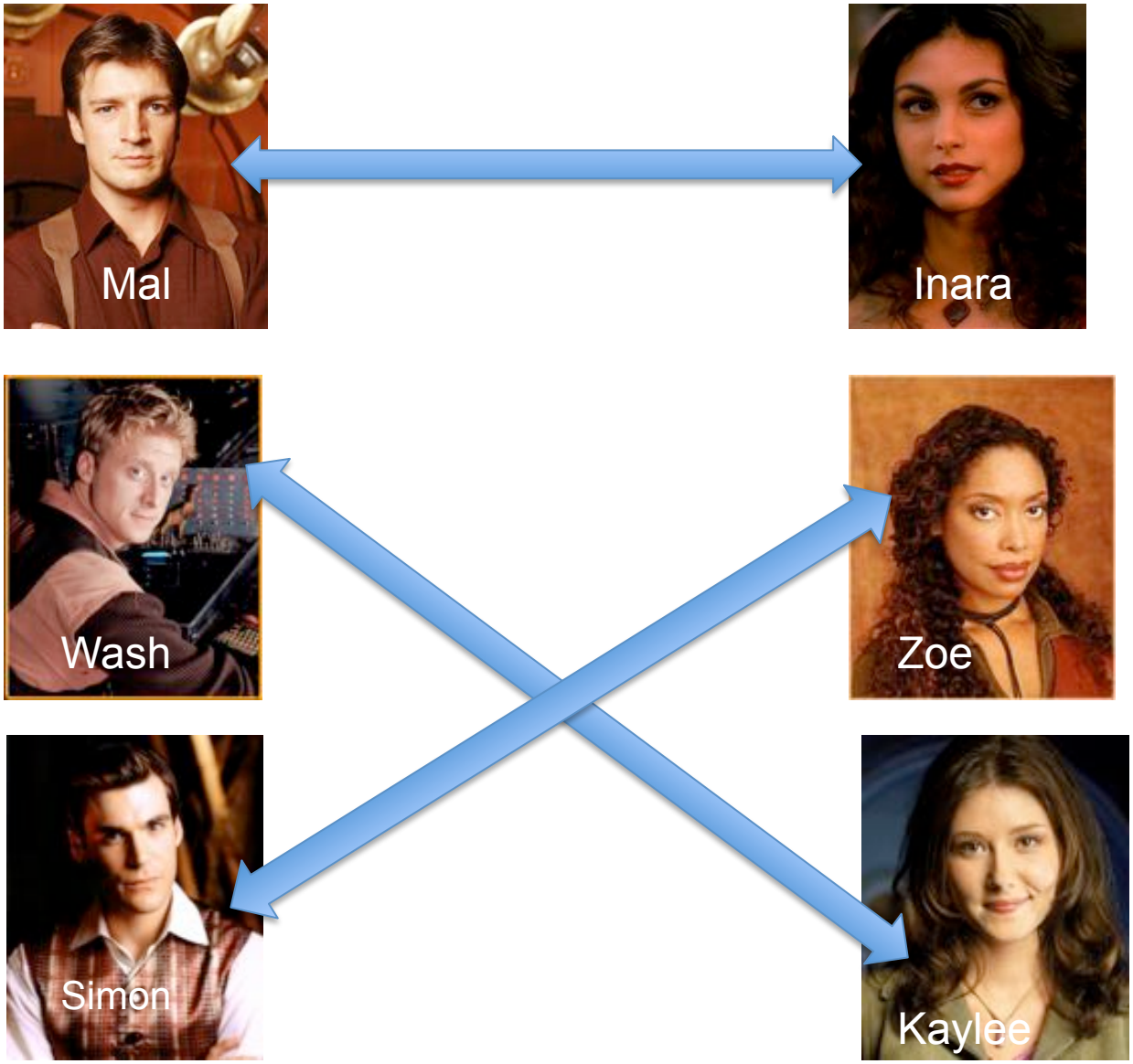


Kaylee

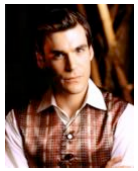
A valid matching

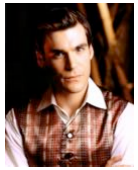
Not a matching

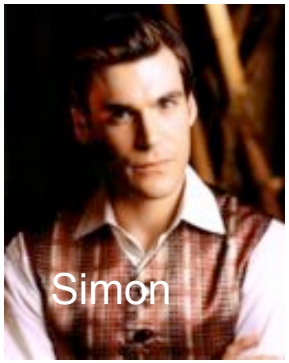
Perfect Matching

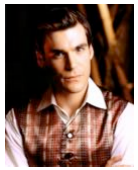


Preferences

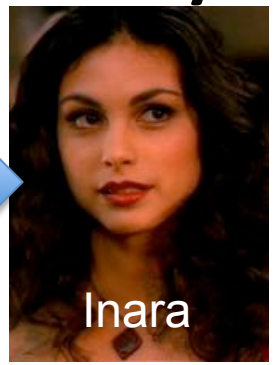


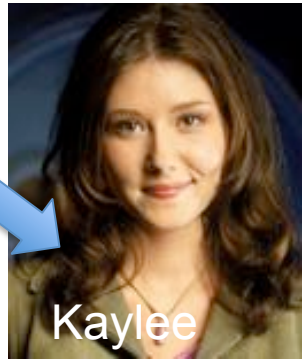






Instability





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

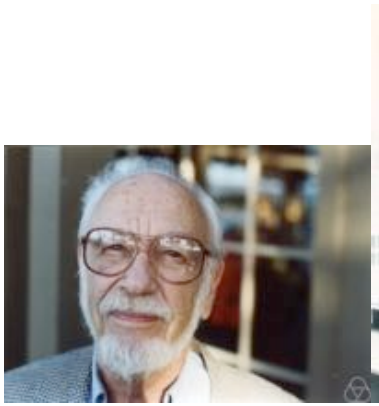
Gale-Shapley Algorithm

David Gale

Lloyd Shapley

$O(n^3)$ algorithm

Moral of the story…



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