Lecture 4

CSE 331

Sep 6, 2023

Please do keep on asking Qs!

The only bad question is the one that is not asked!

Not just technical Qs but also on how the class is run

We're not mind readers

If you need it, ask for help

Syllabus Quiz (and sections)

note @61 stop following 99 views

Actions

Your Autolab section will be updated every Sunday

The way we enforce our policy that you will not receive graded HWs until you get >=18 on the syllabus quiz is by putting those who pass the syllabus quiz in section `Y` and the rest are in section `N`. We then only release grades for those in section `Y`. (You can fund your section by clicking on the dropdown menu with your name on the top right of the CSE 331 page on Autolab and then by clicking `Course Profile`)

I have updated your sections. If you passed the syllabus quiz before 9pm today (Sun, Sep 3) then your section should have been updated to a `Y`.

I plan to update the sections every Sunday (so if you pass the syllabus quiz after 9pm Sep 3 you will have to wait until Sep 10).

logistics autolab

Edit good note | 0 Updated 2 days ago by Atri Rudra

Separate Proof idea/proof details

</> **Note**

Notice how the solution below is divided into proof idea and proof details part. **THIS IS IMPORTANT: IF YOU DO NOT PRESENT A PROOF IDEA, YOU WILL NOT GET ANY CREDIT EVEN IF YOUR PROOF DETAILS ARE CORRECT**.

Proof Idea

As the hint suggests there are two ways of solving this problem. (I'm presenting both the solutions but of course you only need to present one.)

We begin with the approach of reducing the given problem to a problem you have seen earlier. Build the following complete binary tree: every internal node in the tree represents a "parent" RapidGrower while its two children are the two RapidGrowers it divides itself into. After s seconds this tree will have height s and the number of RapidGrowers in the container after s seconds is the number of leaf nodes these complete binary tree has, which we know is 2^s. Hence, the claim is correct.

The proof by induction might be somewhat simpler for this problem if you are not comfortable with reduction. In this case let $R(s)$ be the number of RapidGrowers after s seconds. Then we use induction to prove that $R(s) = 2^s$ while using the fact that $2 \cdot 2^s = 2^{s+1}$.

Proof Details

We first present the reduction based proof. Consider the complete binary tree with height s and call it $T(s)$. Further, note that one can construct $T(s+1)$ from $T(s)$ by attaching two children nodes to all the leaves in $T(s)$. Notice that the newly added children are the leaves of $T(s+1)$. Now assign the root of $T(0)$ as the original RapidGrower in the container. Further, for any internal node in $T(s)$ ($s \geq 0$), assign its two children to the two RapidGrowers it divides itself into. Then note that there is a one to one correspondence between the RapidGrowers after s seconds and the leaves of $T(s)$. Then we use the well-known fact (cite your 191/250 book here with the exact place where one can find this fact): $T(s)$ has 2^s leaves, which means that the number of RapidGrowers in the container after s seconds is 2^s, which means that the claim is correct.

Office hours finalized

note @69

stop following 86 views

Actions

TA office hours assigned!

Sorry for the delay but the TA office hours have been assigned! **The office hours start from tomorrow, Sep 5**

(*There is a small chance that some of the slots might change in the next day or two but the office hours should be finalized for the semester by the end of the week*)

Some related comments:

- The syllabus has the information for each TA office hour
    - Please note that Billy's office hours start from next week
    - Note that the syllabus also lists the preferred programming language of a TA.
- If you want a calendar view, visit the CSE 331 home page to view the CSE 331 calendar that has all the office hour inform (including mine)
- See post @10 for more details on office hour locations as well as (backup) zoom links

office_hours

Edit good note 1

ted 23 hours ago by Atri Rudra

Come ask your proof related Questions!

1^{st} True/False poll

poll @59 stop following 116 views

Actions

The first true/false question

The plan is to do a weekly True/false question on piazza. The way it is going to work is that every Monday (or so) I will post a statement in a poll and ask you guys to vote True or False. (Please just vote and do not post your justification: yet.) Then after two days, I will give the correct answer (and we will see how well crowd-sourcing works in this context) and then ask for you guys to construct the correct justification. Note that this is to give you guys more practice for the true/false questions on the exams (there will be pretty much no true/false questions on the homeworks). So try and work on these on your own so that you gain some practice.

Anyhow, here is the **question for this week**. Is the following statement **True** or **False**?

Given n numbers $a_1, \ldots, a_n$ such that for every $i \in [n]$ (we will use $[n]$ to denote the set of integers $\{1, \ldots, n\}$) we have $a_i \in \{0, 1\}$. That is, we are given n numbers each of which is a bit. Then we can sort these n numbers in $O(n)$ time.

- True
- False

Please select one option

Submit

Register your project groups

Deadline: Friday, Sep 29, 11:59pm

CSE 331 | Syllabus | Piazza | Schedule | Homeworks | Autolab | Project | Support Pages | channel | Sample Exams

Project Overview

Group signup form

Forming groups

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

- 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) group 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 29**.

Update on dept. linux servers

note @48 stop following 120 views

Actions

Update for students using C++

Due to some library version issue on the Timberlake, we have decided to use the Emon as the linux server, instead.

Please note that all the steps to transfer your files and log into the server will remain the same. Here's what you need to do:

- **Copying Your Files**: To copy your files from your local computer to the new server, you will use the same `**scp**` command as before. For example, if you want to transfer your 'HW0C++' file, use the following command: `scp HW0C++ your_ubitname@turing.cse.buffalo.edu:.`
  Make sure to replace 'your_ubitname' with your actual UBIT name.

- **Logging into the Emon Server**: After you have transferred your files, you can log into the emon server using the `**ssh**` command as follows: `ssh your_ubitname@turing.cse.buffalo.edu`
  Again make sure to replace 'your_ubitname' with your actual UBIT name.

You can also use `cerf.cse.buffalo.edu` instead of `turing.cse.buffalo.edu`

logistics

~ An instructor (Atri Rudra) endorsed this note ~

Edit undo good note | 1

Updated 4 days ago by Atri Rudra and Sujal Singh

Piazza Response policy

Piazza Response policy

Please note the following rules regarding response time to student questions on Piazza:

1. Any question posted between Friday 5pm and Monday 9am might not get an answer from CSE 331 staff before Monday 9am.
2. On weekdays, we will aim to respond to student question within four hours unless the question is posted between 7pm and 9am, in which case we might only be able to respond after 9am.

Please note that the above does *not* means that we will never answer questions posted in the evening/night times as mentioned above-- it's just that we might not always be able to respond within four hours. Based on previous years, I do expect there to be reasonable response time in the evening times as well-- it's just that OUR response times might be more variable.

Solutions to HW 0 out

note @75

stop following 1 view

Actions

HW 0 solution out

Here is the solution to HW 0:

http://www-student.cse.buffalo.edu/~atri/cse331/fall23/hws/hw0/soln.html

(Please note that as it says in the solutions, from HW 1, solutions will be released as a link to a PDF.)

See the schedule page for the recitation notes for this week.

homework0

Edit good note 0

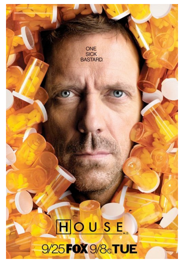
Updated 1 minute ago by Atri Rudra

Questions/Comments?

National Resident Matching

The situation is unstable!

What happens in real life



Preferences

NRMP
National Resident Matching Program

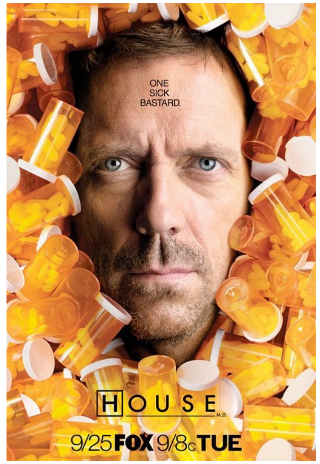
Information

NRMP
National Resident Matching Program

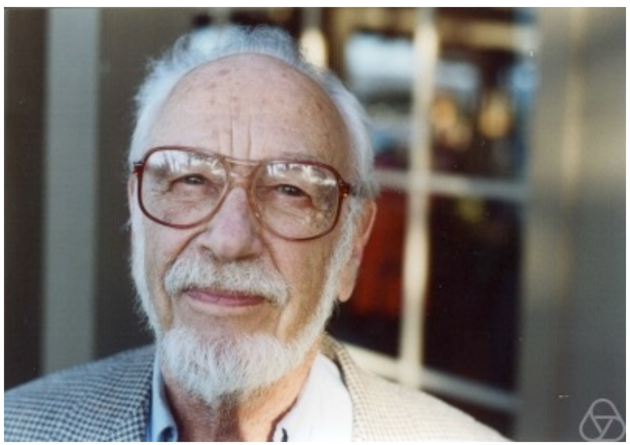
Preferences

NRMP
National Resident Matching Program

NRMP plays matchmaker



Stable Matching Problem



David Gale

Lloyd Shapley*

Questions/Comments?

Incorrect Proof Details: Q1(b) on HW0

Argument does not use ANYTHING about the problem statement!

Follows from part (a)

…of perfect matchings with n men and n wo…

This assumes number of perfect matchings only depends on n

Base case: $P(1) = 1! = 1$

Inductive hypothesis: Assume that $P(n-1) = (n-1)!$

Inductive step: Note that $P(n) = n*P(n-1) = n*(n-1)! = n!$

What are the issues with the above "proof"?

Incorrect Proof Details: Q1(b) on HW0

Needs justification

Claim 1: Number of perfect matchings is = number of permutations of 1…n

Claim 2: Number of permutations of 1…n is n!

Needs justification

Claims 1 + 2 prove the result

Follow from 191 (?)

What are the issues with the above proof?

Proof by contradiction for Q1(a)

Assume for contradiction there is an example where number of perfect matchings depends on the identities of the men and women.

You can only assume things about the example directly implied by it being a counter-example

Let n =1 and consider two cases

(1) M = {BP} and W = {JA}

(2) M = {BBT} and W = {AJ}

In both cases the number of perfect matchings is 1 = 1!

Hence contradiction.

There is NO contradiction

What are the issues with the above proof?

Questions/Comments?

Matching Employers & Applicants

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

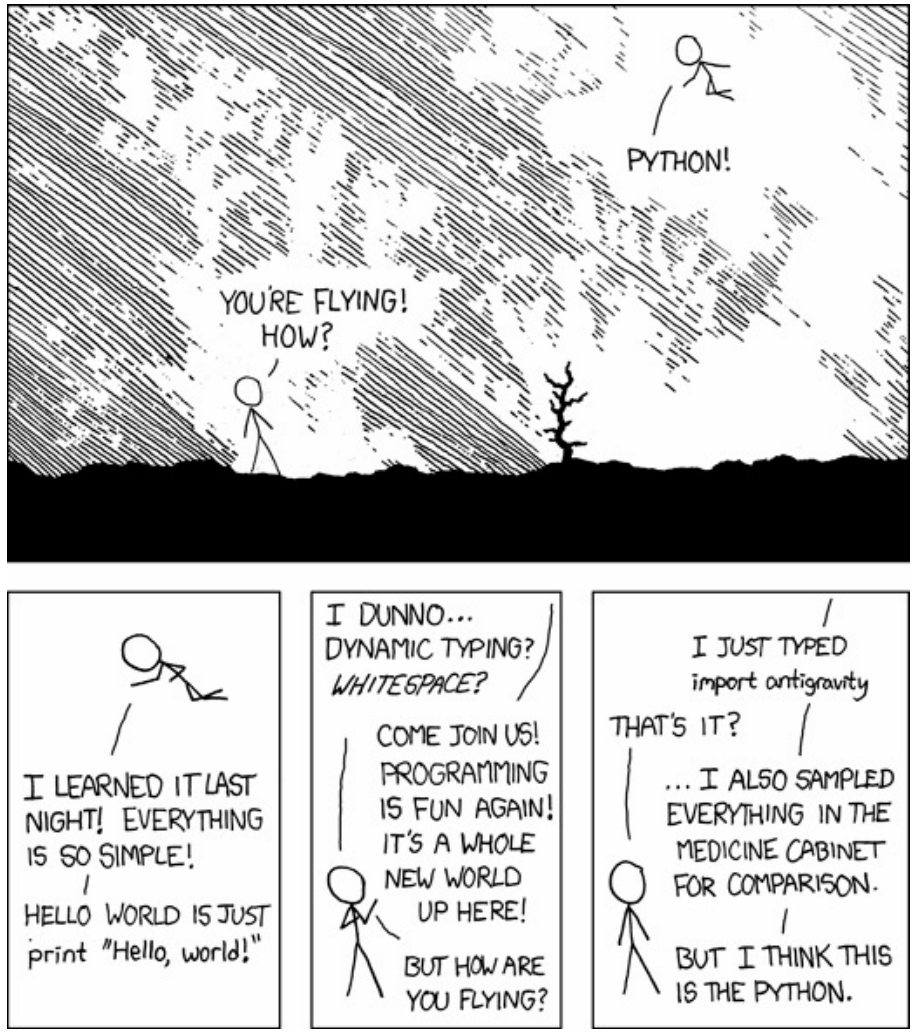
Output: An assignment of applicants to employers that is "stable"

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….

Date	Topic	Notes
Mon, Aug 28	Introduction F23 F22 F21 F19 F18 F17	Syllabus Walkthrough: 1 2
Tue, Aug 29		**(HW 0 out)**
Wed, Aug 30	Let's do a proof! F23 F22 F21 F19 F18 F17	Week 1 recitation notes
Fri, Sep 1	Main Steps in Algorithm Design F23 F22 F21 F19 F18 F17 x^2	[KT, Sec 1.1]
Mon, Sep 4	**No Class**	Labor Day
Tue, Sep 5		**(HW 0 in)**
Wed, Sep 6	Perfect Matchings F22 F21 F19 F18 F1 $\boxed{x^2}$	[KT, Sec 1.1]

Questions/Comments?

Non-feminist reformulation

n men

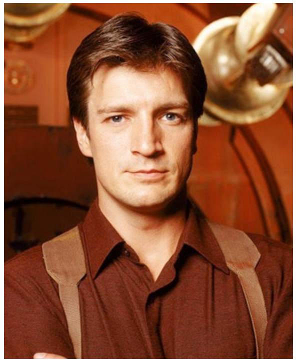
Each with a preference list

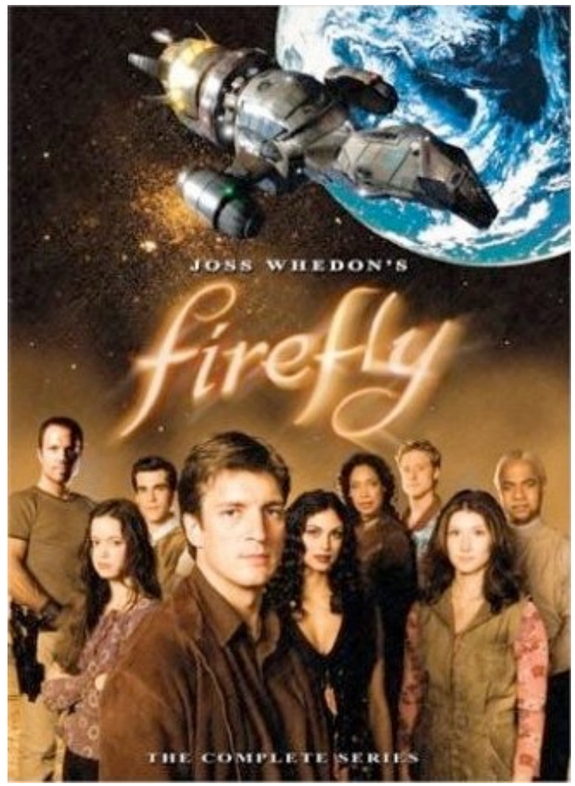
n women

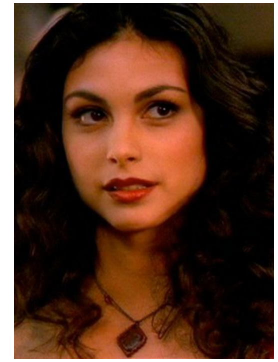
Match/marry them in a “stable” way

On matchings

Mal





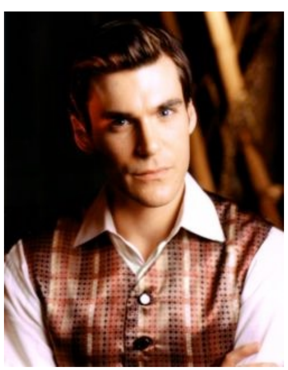


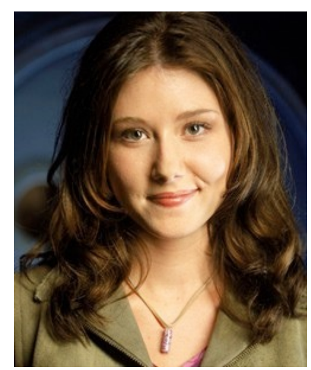
Inara

Wash

Zoe

Simon

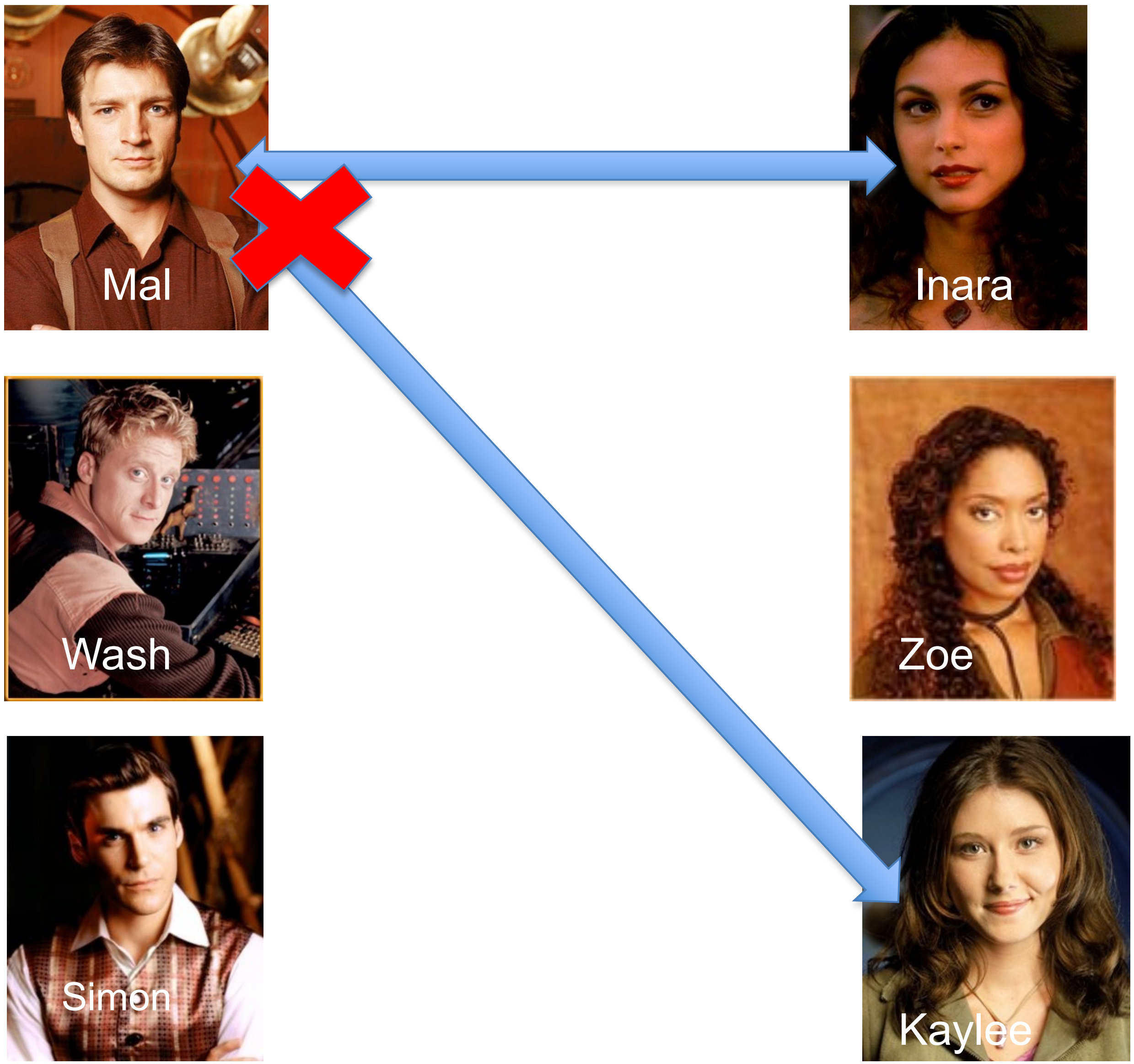




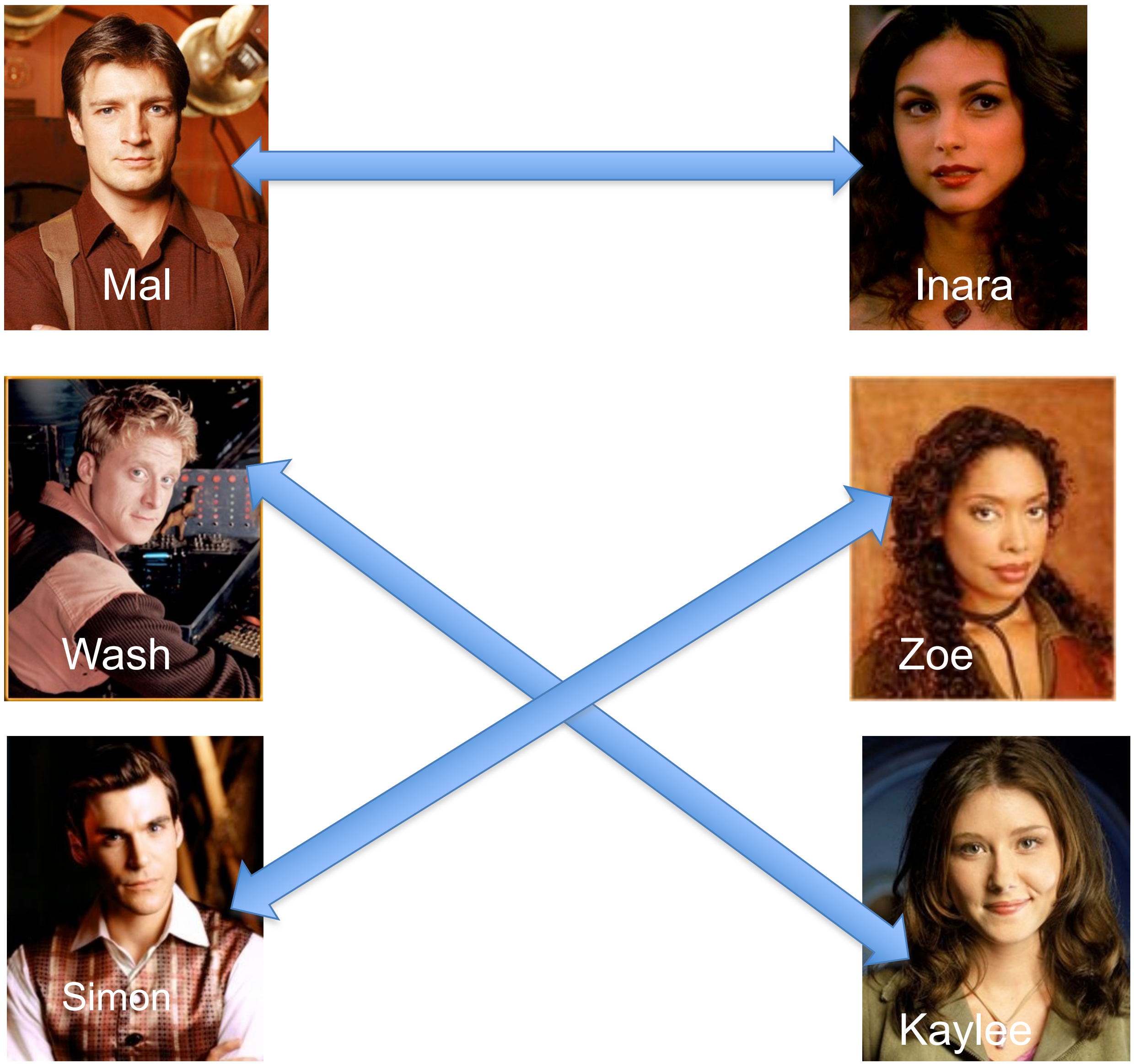
Kaylee

Is this a valid matching?

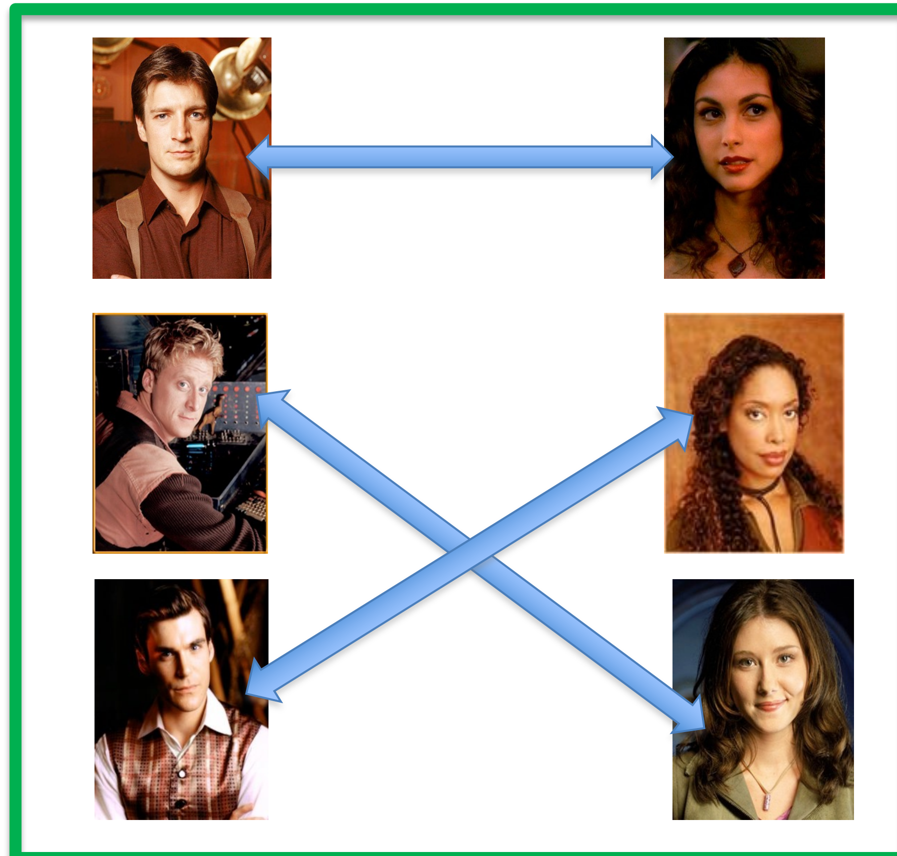
Is this a valid matching?



Is this a valid matching?



Which one is a perfect matching?



On to the board…