Lecture 6

CSE 331

Sep 13, 2021

Please have a face mask on

Masking requirement

UB requires all students, employees and visitors – regardless of their vaccination status – to wear face coverings while inside campus buildings.

https://www.buffalo.edu/coronavirus/health-and-safety/health-safety-guidelines.html

2nd T/F poll up

CSE 220 Unix session recording

My office hour last Friday

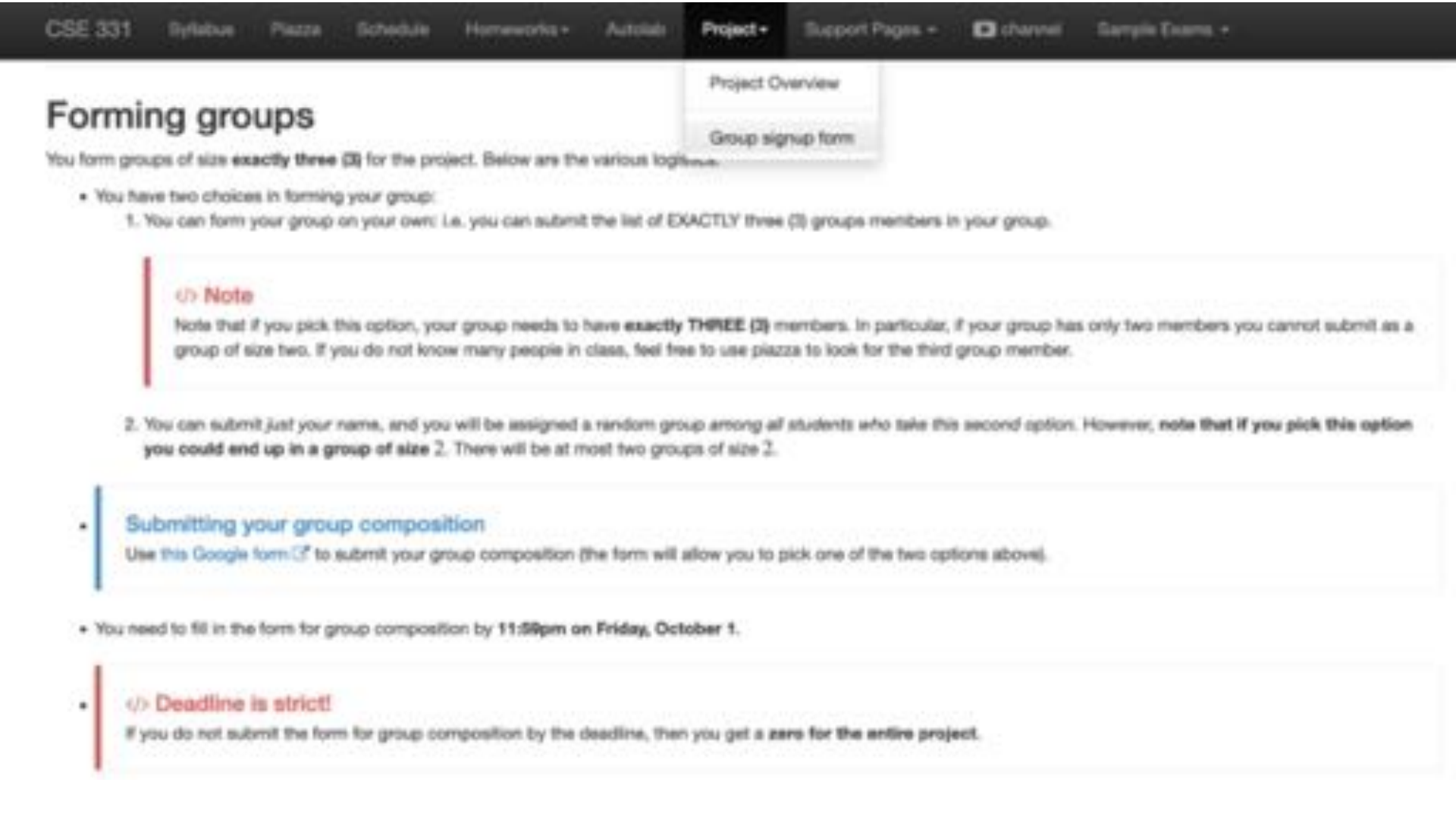
Went through the process of writing a proof on the board!

We’re not mind readers

If you need it, ask for help

Register your project groups

Deadline: Friday, Oct 1, 11:59pm



HW 1 gets released this Wed

Wed, Sep 15	Gale Shapley algorithm outputs a stable matching	[KT, Sec 1.1] **(HW 1 out)**
Fri, Sep 17	Efficient algorithms and asymptotic analysis	[KT, Sec 1.1] *Reading Assignment:* Worst-case runtime analysis notes *Reading Assignment:* [KT, Sec 1.1, 2.1, 2.2, 2.4]
Mon, Sep 20	Runtime Analysis of Gale-Shapley algorithm	[KT, Sec 2.3]
Wed, Sep 22	Graph Basics	[KT, Sec 2.3, 3.1] **(HW 2 out, HW 1 in)**
Fri, Sep 24	Computing Connected Component	[KT, Sec 3.2] *Reading Assignment:* Care package on trees *Reading Assignment:* BFS by examples
Mon, Sep 27	Explore Algorithm	[KT, Sec 3.2]
Wed, Sep 29	Runtime Analysis of BFS algorithm	[KT, Sec 3.3] **(HW 3 out, HW 2 in)**
Fri, Oct 1	More graph stuff	[KT, Sec 3.3, 3.6] **(Project Team Composition Due)** *Reading Assignment:* [KT, Sec 3.3, 3.4, 3.5, 3.6] *Reading Assignment:* Care package on topological ordering
Mon, Oct 4	Interval Scheduling Problem	[KT, Sec 4.1]
Wed, Oct 6	Greedy Algorithm for Interval Scheduling	[KT, Sec 4.1] **(HW 3 in)** **(Project out)** *Reading Assignment:* [KT, Sec 4.1, 4.2]
Fri, Oct 8	Shortest Path Problem	[KT, Sec 4.4] **(Quiz 1)** *Reading Assignment:* Care package on minimizing maximum lateness
Mon, Oct 11	**Mid-term exam: I**	
Wed, Oct 13	**Mid-term exam: II**	**(HW 4 out)**

Questions/Comments?

Reading Assignment - I


note @89

stop following 4 views

Reading Assignment: Asymptotic Analysis

As one of the changes made in F19, we will assume that y'all are familiar with asymptotic analysis and not spend reviewing it in any detail during the lectures. In case you are not that comfortable with asymptotic analysis and/or want to review the material, please read through the asymptotic analysis care package:

http://www-student.cse.buffalo.edu/~atri/cse331/support/care-package/asymptotics/index.html

We will need this either the middle of lecture on Wednesday or in the Friday lecture.

lectures

edit good note | 0

Updated 41 seconds ago by Atri Rudra

Reading Assignment - II

Stable Marriage problem

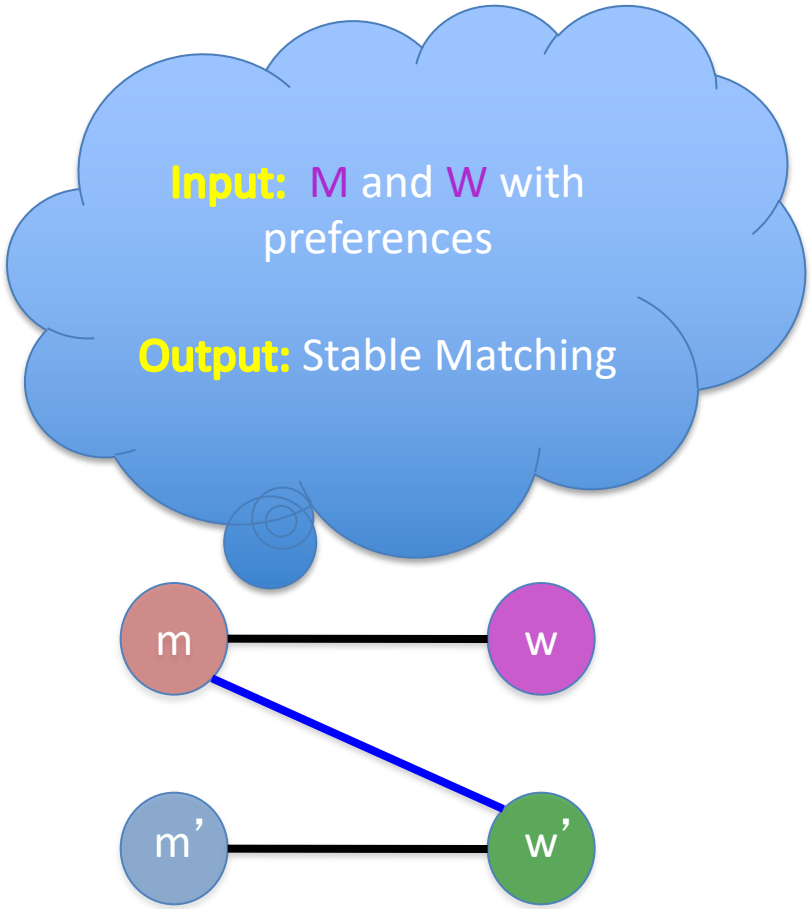
Set of men M and women W

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

Two Questions

Does a stable marriage always exist?

If one exists, how quickly can we compute one?

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

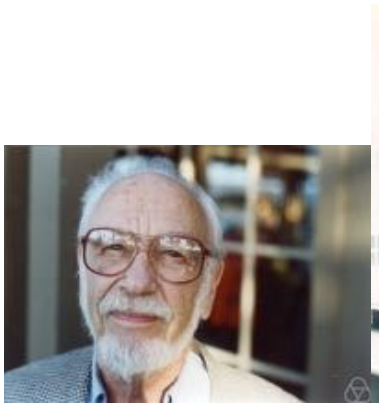
Gale-Shapley Algorithm

David Gale

Lloyd Shapley

$O(n^2)$ algorithm

Moral of the story…



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Questions/Comments?

Rest of today's agenda

GS algorithm

Run of GS algorithm on an instance

Prove correctness of the GS algorithm

Back to the board…

Gale-Shapley Algorithm

Intially all men and women are free

While there exists a free woman who can propose

Let w be such a woman and m be the best man she has not proposed to

w proposes to m

If m is free

(m,w) get engaged

Else (m,w') are engaged

If m prefers w' to w

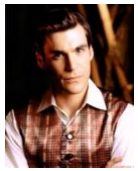
w remains free

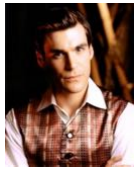
Else

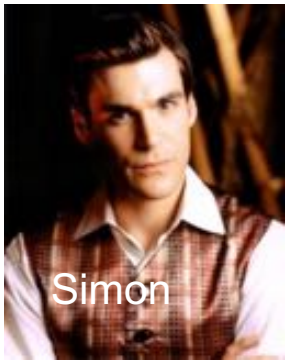
(m,w) get engaged and w' is free

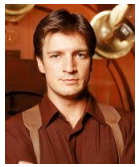
Output the engaged pairs as the final output

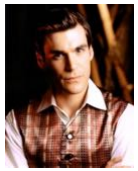
Preferences











GS algorithm: Firefly Edition

Observation 1

Intially all men and women are free

While there exists a free woman who can propose

Let w be such a woman and m be the best man she has not proposed to

w proposes to m

If m is free

(m,w) get engaged

Else (m,w') are engaged

If m prefers w' to w

w remains free

Else

(m,w) get engaged and w' is free

Once a man gets engaged, he remains engaged (to "better" women)

Output the engaged pairs as the final output

Observation 2

Intially all men and women are free

While there exists a free woman who can propose

Let w be such a woman and m be the best man she has not proposed to

w proposes to m

If m is free

(m,w) get engaged

Else (m,w') are engaged

If m prefers w' to w

w remains free

Else

(m,w) get engaged and w' is free

If w proposes to m after m', then she prefers m' to m

Output the set S of engaged pairs as the final output

Questions/Comments?

Why bother proving correctness?

Consider a variant where any free man **or** free woman can propose

Is this variant any different? Can you prove it?

GS’ does not output a stable marriage