Scheduler Web App

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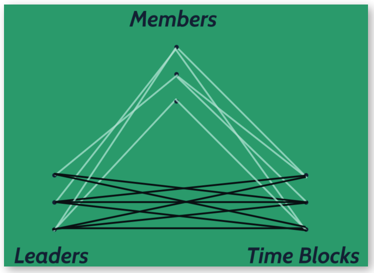
CS500 - Fall 2017

Abstract

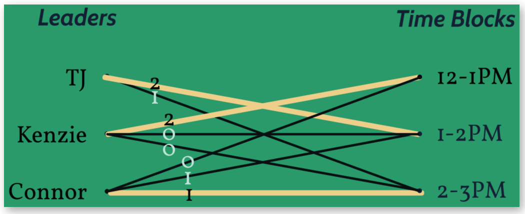
Every semester, the Riddim World Dance Troupe faces a scheduling dilemma. The co-directors receive choreographers' availability and must schedule rehearsals around those constraints, which is often a tedious and time-consuming task. Additionally, this scheduling process does not take a dancer's preference for specific choreographers nor their availability into account, leaving the majority of Riddim members frustrated with their assignment.

The goal of this project was to implement an algorithm that takes three factors into account—choreographers' availability, dancers' availability, and dancers' preferences for specific choreographers—and outputs an optimal schedule for all parties involved. This algorithm was embedded in a web application where an administrator can input everyone's availability and preferences, run the algorithm, and view the outputted schedule.

(1)



(2)



The Algorithm

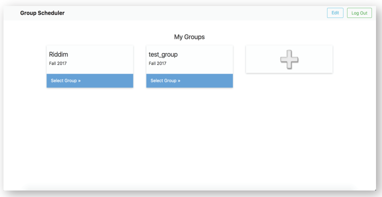
The problem can be visualized as a tripartite graph between members (dancers), leaders (choreographers), and time blocks. A node represents an individual entity within the greater group, an edge between a member and leader signifies a member's preference for that leader, and an edge between a time block and a member/leader signifies that person's availability (see graph 1).

The algorithm is broken down into two steps. The first "pre-processing" step is to convert the tripartite graph into a simpler bipartite graph between leaders and time blocks, where the edges represent the number of members who both prefer that leader and are available at that time block. If a leader is not available at a specific time block, that edge weight is set to negative infinity and will not be chosen as part of the final schedule. The second step is to apply the Hungarian algorithm, which is an existing solution to a commonly known maximum weight matching problem for a biparte graph. This algorithm matches each leader to a time slot such that the edge weights—the number of dancers who prefer that choreographer and that time slot—is maximized (see graph 2).

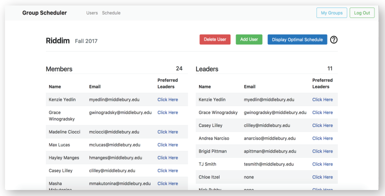
The Application

After we developed the algorithm, our next step was to build a web application that implemented it. Upon loading the app and logging in, the admin is shown a page of all their groups (different Riddim semesters, for example). When a group is selected, the admin can input their user data, which is then displayed in the Group Dashboard. Once all user data is entered the admin can run the algorithm, which displays the optimal schedule and alternative members for each matched sub-group.

We decided to build the app with Django (a Python Web framework) and deploy with Heroku due to both technologies' ease of use and our choice to write the algorithm in Python. We built the UI with HTML/CSS/JS, and stored group information in a PostgreSQL database.



Group Landing Page



Riddim Fall 2017

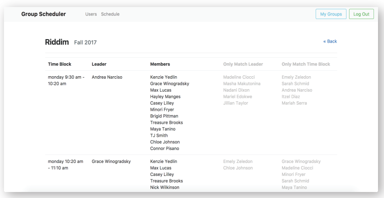
Members 24

Name	Email	Preferred Leaders
Kenzie Yedlin	myedlin@middlebury.edu	Click Here
Grace Winogradsky	gwinogradsky@middlebury.edu	Click Here
Madeline Ciocci	mciocci@middlebury.edu	Click Here
Max Lucas	mclucas@middlebury.edu	Click Here
Hayley Manges	hmanges@middlebury.edu	Click Here
Casey Lilley	clilley@middlebury.edu	Click Here
Masha Makutonina	mmakutonina@middlebury.edu	Click Here

Leaders 11

Name	Email	Preferred Leaders
Kenzie Yedlin	myedlin@middlebury.edu	Click Here
Grace Winogradsky	gwinogradsky@middlebury.edu	Click Here
Casey Lilley	clilley@middlebury.edu	Click Here
Andrea Narciso	anarciso@middlebury.edu	Click Here
Brigid Pittman	apittman@middlebury.edu	Click Here
TJ Smith	tesmith@middlebury.edu	Click Here
Chloe Itzel	none	Click Here
Nick Bubby	none	Click Here

Group Dashboard



Riddim Fall 2017

Time Block	Leader	Members	Only Match Leader	Only Match Time Block
monday 9:30 am - 10:20 am	Andrea Narciso	Kenzie Yedlin, Grace Winogradsky, Max Lucas, Hayley Manges, Casey Lilley, Minori Fryer, Brigid Pittman, Treasure Brooks, Maya Tanino, TJ Smith, Chloe Johnson, Connor Pisano	Madeline Ciocci, Masha Makutonina, Nadani Dixon, Mariel Edokwe, Jillian Taylor	Emely Zeledon, Sarah Schmid, Andrea Narciso, Itzel Diaz, Mariah Serra
monday 10:20 am - 11:10 am	Grace Winogradsky	Kenzie Yedlin, Max Lucas, Casey Lilley, Treasure Brooks, Nick Wilkinson	Emely Zeledon, Chloe Johnson	Grace Winogradsky, Madeline Ciocci, Minori Fryer, Sarah Schmid, Maya Tanino

Schedule Output

Acknowledgements

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Joe Antonioli - *project advisor*
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Adam Franco - *technical support*

Hungarian Algorithm

https://github.com/bmc/munkres

Technologies

django PostgreSQL heroku HTML CSS JS jQuery Bootstrap