



# An Interactive Solver for the Math-Day Event

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## Motivation

Math-Day is annually organized by UNL's CSMCE and brings over 1,500 high school students from across Nebraska to compete in math for scholarships to UNL.

In a traditional year, the Math-Day manager recruits over 350 volunteers to help run the event. These volunteers are assigned to 42 different types of tasks for the event to run smoothly. Each task has a load (the number of volunteers required for the task) and a backup load (the number of stand-by volunteers).

Currently, the manager manually makes and manages these assignments using an Excel sheet. The goal of this project is to support her in this task by providing an interactive interface and, ultimately, a mixed-initiative framework in which automated solvers cooperate amongst each other, and with the human user to generate assignments.

## New Design: Two Tables

Our new design organizes the interactive assignment in two tables: the tasks (left) and the volunteers (right). The system maintains the consistency of the two views.

Tasks				Applicants			
TASK	TIME	LCB	ASGN	NAME	STATUS	AVAIL	ASGN
Grader	13:20-15:45	12(12)	0(0)	F. L_20	Staff	6:00-18:00...	None
MCC	8:30-16:30	8(8)	0(0)	F. L_338	Staff	6:00-18:00...	None
AM L LCC	10:00-12:15	3(3)	0(0)	F. L_965	Grad	12:30-13:45...	None
AM LCC	10:00-12:15	3(3)	0(0)	F. L_658	Grad	7:45-9:15...	None
L TCC	8:30-16:30	1(1)	0(0)	F. L_455	Grad	6:45-9:00...	None
Teachers CC Coordinator Assistant	8:30-16:30	1(1)	0(0)	F. L_130	Grad	8:00-14:00...	None
PM Local CC Coordinator	13:00-15:45	3(3)	0(0)	F. L_201	Lect	7:00-15:30...	None
PM Local CC Coordinator Assistant	13:00-15:45	3(3)	0(0)	F. L_506	Grad	6:00-6:00...	None
Main Command Center Coordinator	6:30-17:30	1(1)	0(0)	F. L_1131	Lect	9:00-12:15...	None
AM Mod	10:00-12:15	24(5)	0(0)	F. L_473	Grad	14:00-17:00...	None
PM Mod	13:00-15:45	22(5)	0(0)	F. L_461	Fac	9:00-17:00...	None
Champs Mod	15:00-17:00	3(3)	0(0)	F. L_485	Fac	7:30-15:45...	None
AM Proct	8:15-10:00	40(10)	0(0)	F. L_1185	Grad	7:00-11:30...	None
AM HRP	8:15-10:00	8(8)	0(0)				
AM L HRP	8:15-10:00	5(5)	0(0)				

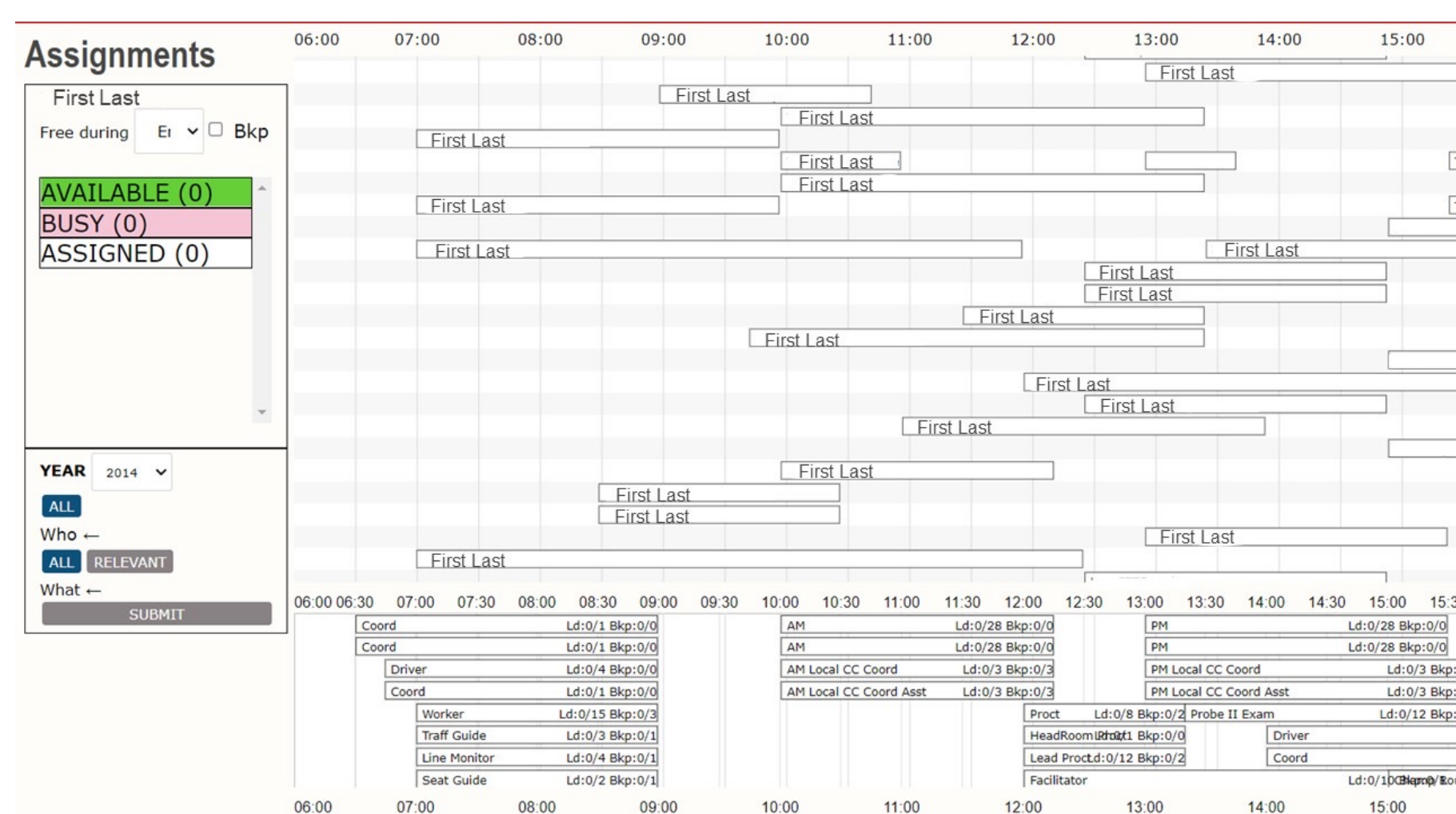
## Selecting Tasks to Assign

A table pop-up appears with the volunteer's information in the heading and the list of tasks in the body. To help the manager, the tasks are sorted by best fit. Further, the manager can view the tasks the volunteer fulfilled during previous Math-Day events.

## Math Day Website

The first online system was deployed in September 2017. New functionalities have been added over the years. The current system allows various categories of people to apply, specify their time availability, and express their preferences for the tasks open to their categories (e.g., undergrad, grad, faculty). The manager uses the website to access historical assignments, define the tasks for the current year, monitor applications, and communicate with groups of volunteers.

The first interactive system, based on a Gantt chart that mimics the manager's spreadsheet layout, had the same pitfalls. It did not fit well on the screen and was cluttered.



## Assign Task to a Volunteer

An assignment can be made from either view according to the same workflow. Here, is an example of assigning a volunteer to a task. (The data is sanitized for privacy.) You start by clicking the '+' icon in the volunteer table.

Applicants			
NAME	STATUS	AVAIL	ASGN
F. L_20	Staff	6:00-18:00...	None
F. L_338	Staff	6:00-18:00...	None
F. L_965	Grad	12:30-12:45...	PM Proct...
F. L_658	Grad	7:45-9:15...	None
F. L_455	Grad	6:45-9:00...	None
F. L_130	Grad	8:00-14:00...	None
F. L_201	Lect	7:00-15:30...	None
F. L_506	Grad	6:00-6:00...	None
F. L_1131	Lect	9:00-12:15...	None
F. L_473	Grad	14:00-17:00...	None
F. L_461	Fac	9:00-17:00...	None
F. L_485	Fac	7:30-15:45...	None
F. L_1185	Grad	7:00-11:30...	None

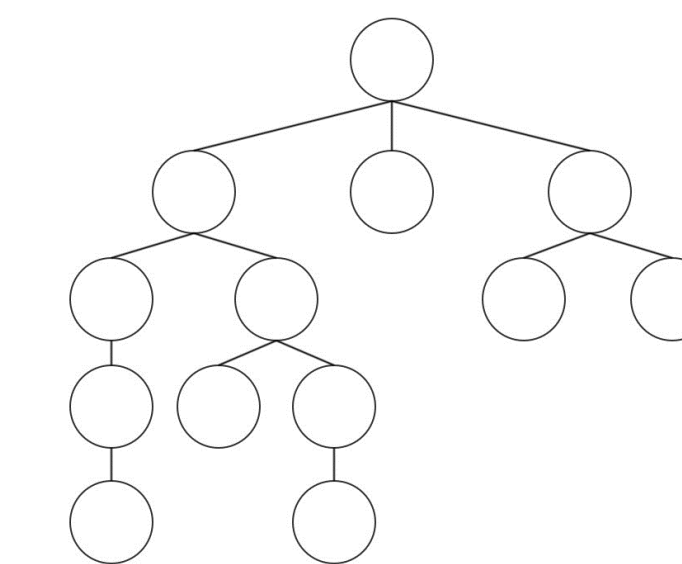
## Towards a Mixed-Initiative Solver

We are developing a preliminary automated solver based on a highly decentralized, multi-agent architecture. Hui and Choueiry [2003] have shown that this technique, initially proposed by J. Liu et al. [AIJ 2002], is particularly robust to overcoming local minima and solving tight problem instances.

*J. Liu et al. / Artificial Intelligence 136 (2002) 101-144*



We are also designing an automated solver based on systematic search, symmetry breaking constraints, branch and bound, and random restarts.



Our goal is to characterize and compare the performance of the two approaches. Then, we will develop new mixed-initiative strategies for cooperation between them and for including the human manager in the decision loop.

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