Background
On-campus work study jobs employ workforces of dozens of students. This means creating a schedule that meets the availabilities of every student. For CIS-110 this means:

\[ >50 \times 26 = \text{Too Many Combinations} \]

Building a schedule manually is time-consuming and often prone to errors. These errors complicate the scheduling process even further by forcing the need for additional revisions that may be difficult to resolve.

Query > Process > Revise

Days Weeks ???

Objective
HelpDesk is a system that allows for the efficient creation of mathematically optimal shift schedules. It also provides a simple user interface for students, employees, and managers to access and manipulate this information.

Implementation Details

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<th>DATABASE</th>
<th>SERVER</th>
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<td>Dropwizard (Java)</td>
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Scheduling Workflow
The first step in the scheduling process is for the manager to specify which hours and locations need to be filled.

The number of available slots can be specified on a shift-by-shift basis. At the same time, employees connect to the system and submit their availability. Employees can specify that they are available or unavailable, and can even mark preferred working times.

All times marked unavailable must be noted with a reason for accountability. Employees are not limited to the scheduled shifts to specify their availability, allowing for managers to modify the specified shifts to further fit the employees schedules.

The manager can then automatically assign users to shifts. This process is highly customizable. The manager can specify parameters such as number of shifts assigned to each user. Additionally, the manager can specify which algorithm is used to run the optimization.

Schedule Optimization
The problem of scheduling is handled as an Integer Linear Programming problem and is structured accordingly. It is then passed to JavaliLP, a wrapper library for ILP Solvers. HelpDesk includes the pure-Java SAT4J as a reference implementation but also supports proprietary solvers such as the Gurobi Optimizer or IBM’s ILOG CPLEX.

Analysis
HelpDesk’s improvement in scheduling efficiency can be quantified by constructing schedules from previous semesters’ preferences and comparing their metrics. One such metric is average preference level: closer to 2.0 if an employee is working shifts that they would prefer to work, closer to 1.0 if an employee is working shifts they would prefer not to work, but are available for. Data from CIS-110:

HelpDesk provides a significant increase in average preference level for both semesters. Compared to the schedules manually created by CIS-110 staff, HelpDesk’s schedules were 10% more effective at accurately matching employees, not just to shifts they were available for, but to shifts they actually preferred.

Support Case Management
HelpDesk also has built-in functionality to manage and analyze support cases. Historically for CIS-110, office hours were conducted with a running queue of students’ names on a whiteboard. HelpDesk provides a way for each support case to be internally managed and logged by the system. This also allows for analytics that would otherwise be unknowable, such as average time per case or daily traffic.