Problem Statement

Dermatology residents must be assigned to daily half-day activities (specific clinics, administrative time, etc.), subject to various rules, guidelines, and metrics.

Specifically, the goal is to determine which activity to assign each resident on each work day in the morning and in the afternoon over the course of a month.

Solution Approach

Formulate

A linear programming model using binary decision variables.

Encode

Written in C++ using CPLEX, implemented with Visual Studio

Load

Input files are created each month with schedule requirements

Solve

Software generates an optimized solution

Review

Schedule and metrics reported to be reviewed by chief residents

Impact/Results

In a matter of seconds, the computer model produces a schedule of higher quality than a human could produce over many hours or even days.

This tool frees the chief residents to focus on more important tasks related to caring for patients.

Making updates to an initial schedule takes the computer only seconds, meaning changes are relatively easy to implement.

Research Goal

Build a computerized tool that rapidly generates high-quality schedules.

Challenge

Constructing a feasible, high-quality schedule is difficult and requires many hours for a human to do.

Optimal Schedule

A schedule requiring a minimal number of undesirable features, such as mid-day travel, lost admin time, and deviations from preferred assignments.

Feasible Schedule

A valid schedule that meets all of the hard requirements presented by the Dermatology chief residents.

Metrics

We incorporate measures of quality to differentiate feasible schedules. These metrics should be optimized, but optimizing one metric may result in other metrics being suboptimal. We work with the chief residents to determine an acceptable balance.

Sample Output

<table>
<thead>
<tr>
<th>Name</th>
<th>Time</th>
<th>2-Oct</th>
<th>3-Oct</th>
<th>4-Oct</th>
<th>5-Oct</th>
<th>6-Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident 1</td>
<td>AM</td>
<td>PEDS</td>
<td>PEDS</td>
<td>Holiday</td>
<td>PEDS Call</td>
<td>PEDS-Cell</td>
</tr>
<tr>
<td>PEDS/PEDS1</td>
<td>PM</td>
<td>PEDS</td>
<td>PEDS</td>
<td>Holiday</td>
<td>Surgery</td>
<td>TC</td>
</tr>
<tr>
<td>Resident 2</td>
<td>AM</td>
<td>DF</td>
<td>TC</td>
<td>Holiday</td>
<td>Admin-Thur</td>
<td>DF-CC</td>
</tr>
<tr>
<td>Clinic/Clinic</td>
<td>PM</td>
<td>Admin-Gen</td>
<td>TC</td>
<td>Holiday</td>
<td>TC</td>
<td>Admin-Gen</td>
</tr>
<tr>
<td>Resident 3</td>
<td>AM</td>
<td>DF</td>
<td>Admin-Gen</td>
<td>Holiday</td>
<td>Admin-Thur</td>
<td>DF</td>
</tr>
<tr>
<td>DOM3/DOM3</td>
<td>PM</td>
<td>DF</td>
<td>DF</td>
<td>Holiday</td>
<td>DF</td>
<td>DF</td>
</tr>
<tr>
<td>Resident 4</td>
<td>AM</td>
<td>TC</td>
<td>DF</td>
<td>Holiday</td>
<td>Admin-Thur</td>
<td>TC</td>
</tr>
<tr>
<td>VA/Foot/VAFoot</td>
<td>PM</td>
<td>VA-Foot</td>
<td>DF</td>
<td>Holiday</td>
<td>Admin-Gen</td>
<td>TC</td>
</tr>
<tr>
<td>Resident 5</td>
<td>AM</td>
<td>TC</td>
<td>TC</td>
<td>Holiday</td>
<td>Admin-Thur</td>
<td>TC</td>
</tr>
<tr>
<td>Clinic/Clinic</td>
<td>PM</td>
<td>TC</td>
<td>Admin-Gen</td>
<td>Holiday</td>
<td>TC</td>
<td>TC</td>
</tr>
</tbody>
</table>

Ongoing Work

Implement functionality to modify existing schedules with new requirements, applying minimal changes.

Implement new infrastructure to more efficiently handle resident pre-assignments and clinic coverage requirements.

Acknowledgements

We thank the following organizations for sponsoring this work: