Improving Residency Annual Block Schedule Quality with Automation

Problem Statement
- The University of Michigan Medical School offers residency programs across many disciplines.
- Schedulers must construct block schedules assigning residents to longitudinal service rotations to provide personnel coverage and satisfy educational needs. They should also consider resident requests and program balance, making this problem difficult to solve.
- Previously, annual block schedules were manually built by program chief residents. The construction process was excessively time-consuming and the schedules often failed to meet stakeholder needs and preferences.

Outcomes
CHEPS has automated our partners’ coordinated annual block schedules for the last three academic years. In that time, we have successfully generated their schedules quickly and improved the schedule quality.

Generated Schedules Quickly
1 – 2 Days to Generate the Inputs
A Few Minutes to Solve the Model
2 – 5 Construction Iterations

- Able to capture all service coverage and training program requirements (hard constraints)
- Improved schedule generation speed
- Greater specificity of resident and service needs

Improved Schedule Quality

Challenges
When making any annual block schedule, there exist the following challenges:

Communication
Evaluation

The residents, services, and rules may all change year-to-year. We are currently developing next year’s model, which will have more residents and 26 two-week periods as opposed to 24 half-month periods. This change presents its own challenges:
1. Conversion of “old” rules into the “new” rules correctly
2. Addition of new residents and their unique rules

Future Work
- Introduce additional rules and metrics to improve quality
- Improve the computational performance of solving the model
  - Develop efficient heuristic algorithms
  - Apply column generation (branch-and-price)
  - Explore constraint programming formulation
- Create mechanisms for faster input file creation
- Develop additional tools to aid review process

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