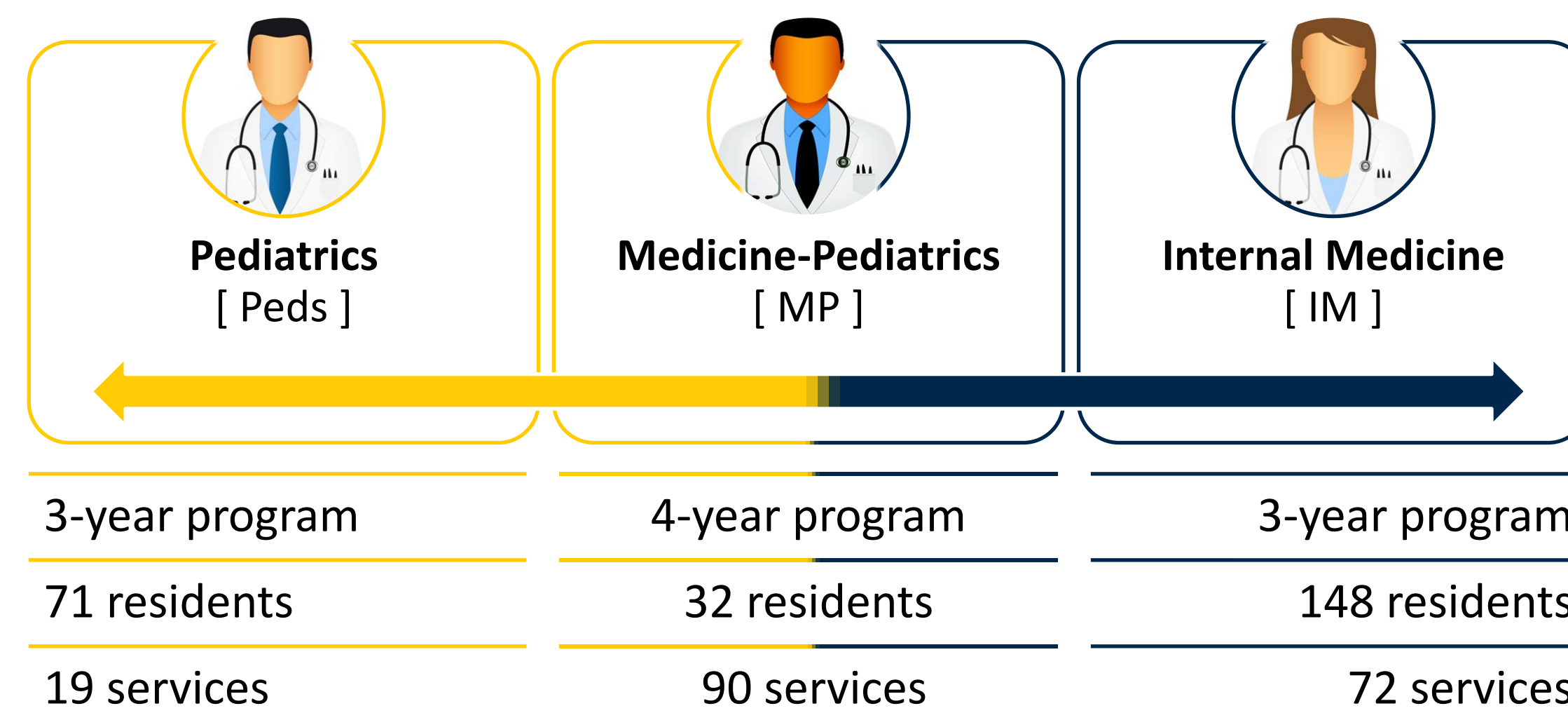


Improving Residency Annual Block Schedule Quality with Automation

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Problem Statement

- The University of Michigan Medical School offers residency programs across many disciplines.
- Schedulers must construct block schedules assigning residents to 2 week or 4 week 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.



Model & Solution Approach

In mid Fall, we meet with the chief residents to understand each program's service coverage and training program needs. Then, we transform the needs of each program into constraints.

In early Winter, we send a survey to the residents for their schedule preferences. In mid Winter, we first draft a schedule only including service coverage and training program requirements. Once feasible, we incorporate resident requests to the model as objective metrics

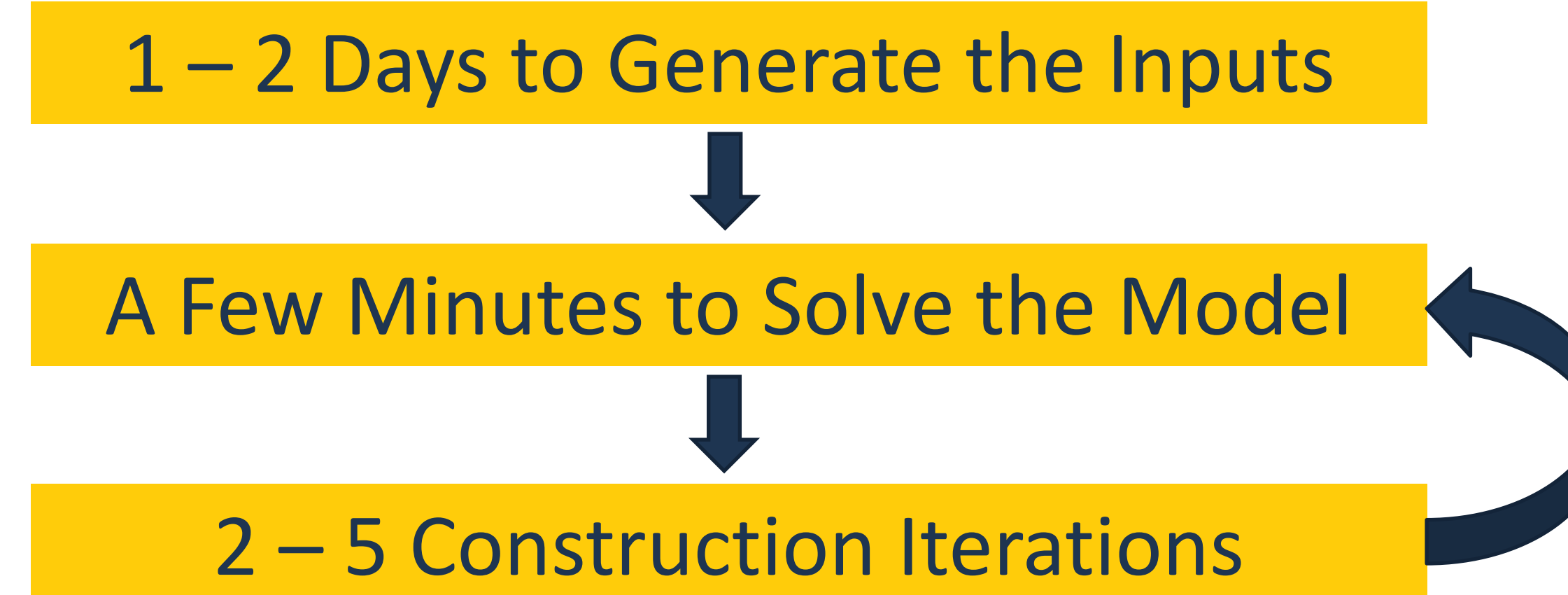
The final schedules are constructed in the following iterative procedure:

```
while satisfactory schedules have not yet been produced do
  Modify the model or inputs based on the chief resident feedback, if applicable;
  for each metric, ordered by their priority do
    Solve the integer programming model with just this metric as objective;
    Add an additional constraint to the model to avoid depreciating this metric
    from the optimal objective;
  end
  Deliver the results to chief residents for review;
end
```

In early Spring, the schedule is published to residents. On July 1, the schedule goes into effect for the next 52 weeks

Outcomes

Generated Schedules Quickly



Benefits

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

Improved Schedule Quality



Resident Requests

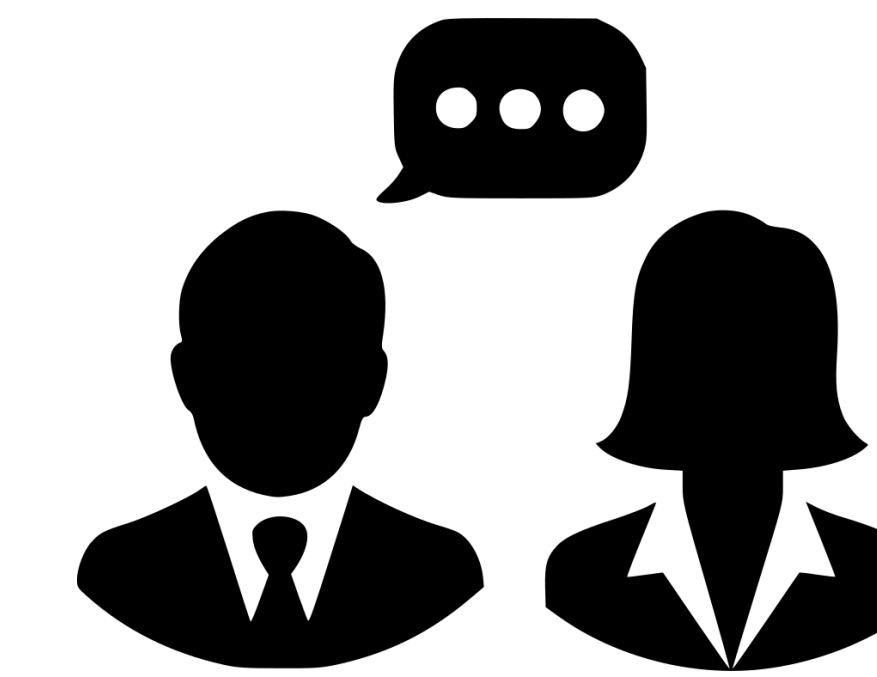


Program Balance

- Improved satisfaction for requests related to:
 - Vacations
 - Elective/research offerings
 - Fellowship interview and graduation season
- Improved program balance with respect to:
 - Spacing of difficult service rotations
 - Potentially challenging rotation sequences

Challenges

Each year, building the annual block schedule presents challenges tied to communication and evaluation.



Communication



Evaluation

Additionally, the residents, services, and rules change year-to-year. We are currently developing next year's schedule, which includes 11 more residents than this year, 3 new services, and many changing rules. The residencies are also switching to 26 two-week periods instead of 24 half-month periods. These changes present new challenges related to:

1. Updating educational and coverage requirements
2. Incorporating new administrative needs
3. Personalizing curriculum for new & returning residents

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
- Develop additional tools to aid review process
- Improve automation of input files
- Automate reporting for denied requests

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