Using Optimization Techniques to Improve the Shift Scheduling of Operating Room Staff

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Each month the Operating Room Clinical Nurse Supervisors at the University of Michigan Health System determine the monthly shift schedules for 200 surgical nurses and surgical technicians by hand. Due to the many requirements and restrictions governing the shifts that each individual staff member is allowed work, as well as the hospital policies regarding the composition of operating room staff that must be working at any particular time, this is a very time-intensive process that results in each of the Operating Room Clinical Nurse Supervisors spending roughly a quarter of their time on the scheduling process. Additionally, it is also often difficult to satisfy all of the necessary scheduling conditions when creating the schedule manually.

**Types of Staff**
- Surgical Nurse
- Surgical Technician

**Types of Specialties**
- Nurses & techs are trained in certain specialties (collectively called a pod)
- Need an adequate number of staff from each pod scheduled

**Types of Shifts**
- 23 Shifts
  - 7a-11a
  - 7a-7p
  - 9a-9p
  - 11a-11p
  - 3p-7p
  - 7p-11p
  - 7a-1p
  - 9a-3p
  - 11a-3p
  - 12p-8p
  - 3p-9p
  - 9p-11p
  - 7a-3p
  - 9a-5p
  - 11a-7p
  - 12p-10p
  - 3p-11p
  - 11p-7a
  - 7a-5p
  - 9a-7p
  - 11a-9p
  - 1p-9p
  - 5p-11p

**Creating a Schedule by Hand**
- Time consuming
- Each nurse supervisor spends 1 week/month creating the schedule

**Key Issues**
- Difficult to satisfy all requirements

**Example**

**Optimization Model**

**Goals & Methods**
- **Goals:**
  1) Reduce time to create schedule
  2) Improve schedule quality

- **Mixed-Integer Linear Programming Formulation**
  - **Objective:**
    - Minimize weighted deviations from requirements
  - 130,000+ Variables
  - ~3,000,000 Constraints

- Implemented in MS Excel
- Solved using Solver Studio with AMPL/CPLEX

**Impact**
- Significantly reduces the time to create schedule
- Provides a monthly schedule for 200 staff members in approximately 10 minutes
- Allows clinical nurse supervisors more flexibility in designing a schedule
- Allows the clinical nurse supervisors to spend more time on other duties, including patient care

**Future Work**
- Continue to work with the clinical nurse supervisors to ensure the model captures the necessary requirements
- Develop a user interface
- Work with clinical nurse supervisors to implement model

**Contact Information**
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