



Using Integer Programming to Schedule Surgeons in an Acute Care Surgery Department

Hannah Strat¹, Kristine Wang², Yizhou Cao¹, Daniel Cullen², Jacob Martin¹, Nicholas Zacharek¹, William Pozehl¹, Amy Cohn¹, Penny Trinkle³, Krishnan Raghavendran³

¹Industrial and Operations Engineering, ²Electrical Engineering and Computer Science, ³Acute Care Surgery, University of Michigan, Ann Arbor, Michigan

Introduction

- The Acute Care Surgery Faculty are assigned approximately 8-10 weeks across 5 different units over a 6-month schedule.
- The Division Chief currently creates the schedule by hand. After the chief sends out the schedules, faculty members can send their comments and the schedule is repeatedly revised until a final version is agreed upon. We aim to improve this process by automating the scheduling to produce faster and more equitable results.
- Once the weekly schedule has been finalized the Division Chief moves on to scheduling Night Call.

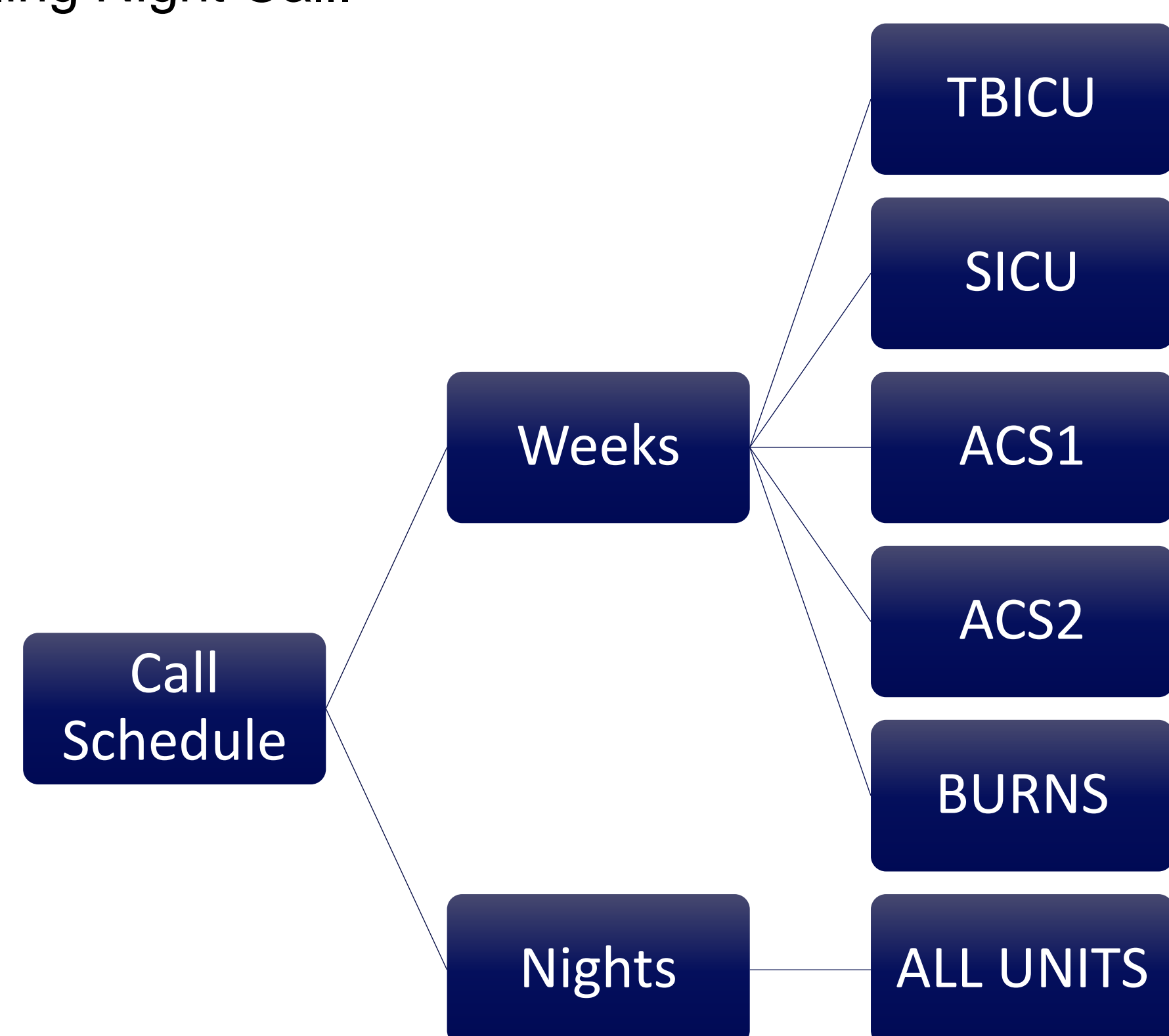


Figure 1: Breakdown of Call Schedule



Objectives

- To build tools and processes to support the development of call schedules and night schedules for attending faculty in Acute Care Surgery Department at the University Hospital
- To reduce the workload on Acute Care Surgery faculty and staff
- To improve physician satisfaction and perception of fairness.

Methods

- Formulated the problem as an integer programming model
- Developed constraints and metrics with Division Chief to ensure a feasible schedule of high quality
- Created a computerized tool to automate and optimize scheduling
- Engage in iterative process with Division Chief to create satisfactory schedule every 6 months

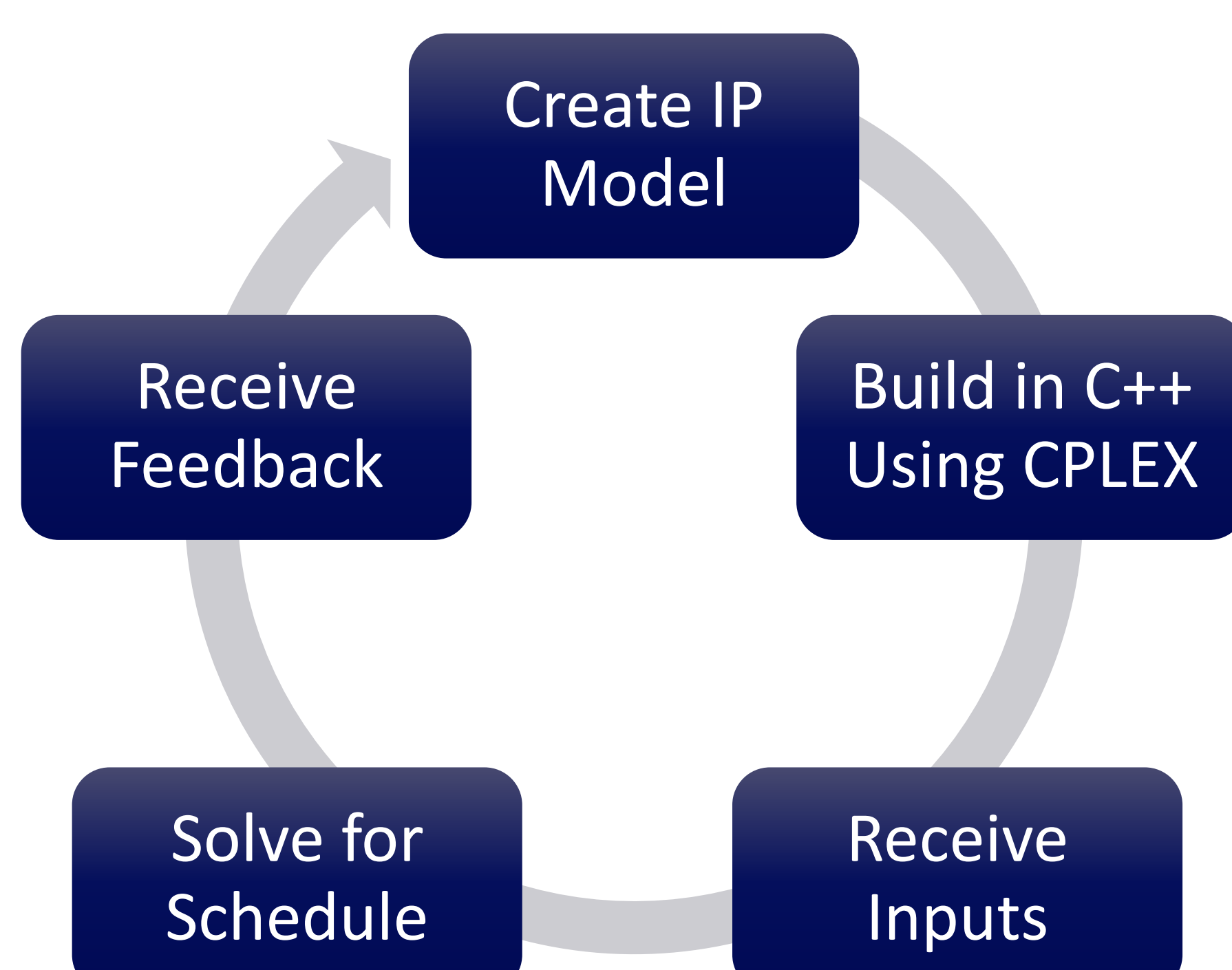


Figure 2: Process for creating Acute Care Surgery Call Schedule

Solution Approach

Decisions

Is attending a assigned to unit u on week w ?

$$x_{auw} \in \{0,1\}, \forall a \in A, u \in U, w \in W$$

Rules

There are certain constraints necessary to ensure a feasible schedule. These constraints were realized in discussion with the Division Chief, Administrative Assistant and CHEPS Trauma Call Team.

- Attending Assignments
- Valid Unit Pairs
- Maximum Consecutive Work Weeks
- Unit Coverage
- Bounds on Attendings' Total Unit Assignments
- Bounds on Attendings' Individual Unit Assignments
- Preassignments
- Prohibitions

Metrics

Metrics measure the quality of feasible schedules and determine which schedule is best for the Trauma Surgery Faculty. Following metrics were established in discussions with the Division Chief, Administrative Assistants and CHEPS Trauma Call Team.

- Week Off Requests Denied
- Absolute Deviation from Target Range of Concurrent Unit Assignments
- Exceedances of Target Maximum Number of Consecutive Weeks Off
- Changes to External Schedule Requests
- Changes from Previous Schedule

Results and Impact

July – December 2019					
	ACS-1	ACS-2	SICU	TBICU	Burns
July 1	Fitzgerald	Smith	Hernandez	Yang	Anderson
July 8	Adams	Smith	Jones	Yang	Anderson
July 15	Ling	Yin	Fitzgerald	Bennett	Brown
July 22	Adams	Yang	Brown	Yin	Saint
July 29	Fitzgerald	Ling	Hernandez	Bennett	Anderson
August 5	Jones	Hernandez	Fitzgerald	Yin	Anderson
August 12	Smith	Yin	Jones	Brown	Brown
...
December 23	Adams	Fitzgerald	Brown	Smith	Smith
December 30	Harris	Brown	Jones	Moore	Anderson

Figure 3: Example schedule created by scheduling tool

- Reduced production-time required for Division Chief and staff to create schedule from 3+ weeks to 3+ days
- Ensured maximum week off-requests were granted and even spacing in attending's call schedules
- Enabled experiences for student researchers with direct contact with providers and hospital

Future Work

- Develop constraint and metrics for the Nights schedule
- Create a computerized tool to automate and optimize Nights scheduling
- Further reduce manual work-time required for creation of schedules

Acknowledgements

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