ProcedureIQ

User Guide & Quick Reference

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Overview

ProcedureIQ is a browser-based OR scheduling intelligence tool powered by **Google OR-Tools CP-SAT** — an industry-grade constraint programming solver. It optimally allocates surgical cases across operating rooms using real operative data, accounting for procedure-level duration distributions, skewness, variability, and percentile-based buffering. The demonstration version uses aggregated, PHI-free data. When deployed for your institution, ProcedureIQ uses your own operative data for scheduling decisions.

Quick Start — Three Steps

1

Select Cases

Use the **Service** and **Class** dropdowns to filter procedures, then use **+ /** – to set how many cases of each type to schedule. The footer bar tracks total cases, estimated OR-hours, and average duration in real time.

2

Configure the OR

Go to the **OR Config** tab to set number of rooms, shift start/end times, OT ceiling, turnover time, and solver penalty weights. Choose a **Duration Buffer Mode** (P50, P75, or P90) to control scheduling conservatism.

3

Run & Export

Click **Run CP-SAT Optimizer**. The solver completes in seconds and switches to the **Schedule** tab, displaying a Gantt chart, utilization metrics, and room timelines. Export to **PDF** or **Excel** with one click.

Tab 1 — Select Cases

Filter Controls

Control	Purpose
Service dropdown	Filter cards to a single surgical service (e.g., Orthopedics, ENT, General)
Class dropdown	Filter by case class: Scheduled (SC), Elective (EL), or Urgent (UR)
Search box	Free-text search within currently filtered results
Select all visible	Adds 1 case to every procedure currently showing after filters
Clear all	Resets all case quantities to zero

Procedure Cards

Each card displays the procedure name, surgical class badge, service line, and key statistics derived from real operative data:

- **n** — number of historical cases
- μ — mean case duration (minutes)
- σ — standard deviation
- **CV** — coefficient of variation (σ/μ); higher values indicate more variable cases
- **skew** — distributional skewness; OR times are typically right-skewed (cases run long more often than they run short)
- **P75** — 75th percentile duration used as the default scheduling buffer

> ■ **High-Skew Warning**
>
> A triangle icon appears on cards where skewness exceeds 1.5. These procedures carry higher overtime risk because their duration distributions have long right tails — outlier cases run significantly longer than the mean. Consider using P90 buffer mode on high-acuity days.

Tab 2 — OR Configuration

Setting	Default	Description
Number of OR rooms	6	Operating rooms available for the scheduling day
Turnover time (min)	20	Cleaning and prep time between cases in the same room
Gap-filler threshold (min)	30	Minimum gap size to attempt inserting a Pain/filler case
Shift start	07:00	Start of the OR day (expressed in minutes from midnight)
Regular end	15:30	End of standard shift; cases ending after this accrue OT cost
OT ceiling	18:00	Hard cutoff; no cases scheduled to end beyond this time
OT penalty (per min)	5	Cost weight applied per minute of overtime
Unscheduled case penalty	1,000	Cost weight for each case that cannot be scheduled

Idle time penalty	1	Cost weight for unutilized room time between cases

Duration Buffer Mode

Mode	Percentile Used	When to Use
P50	50th percentile (median)	Optimistic days; low acuity; well-controlled services
P75	75th percentile (default)	Standard scheduling; buffers against ~25% of cases overrunning
P90	90th percentile	High-acuity days; high-skew services; conservative planning

Tab 3 — Schedule

Summary Metrics

Four metric cards appear at the top of the Schedule tab:

- **OR Utilization %** — scheduled case time as a percentage of total available room-hours
- **Adj. Utilization %** — utilization adjusted for gap-fill (Pain) cases
- **Total OT (min)** — aggregate overtime minutes across all rooms
- **Unscheduled** — number of cases that could not fit within the configured parameters

Gantt Chart

The Gantt chart shows each OR room as a horizontal row. Cases are color-coded by procedure type. The shaded zone beyond the regular shift end indicates overtime. Dashed-border blocks represent gap-fill cases (typically Pain procedures) inserted into idle time between scheduled cases.

Room Timeline

Below the Gantt, each room is listed with its cases in sequence, showing start time, end time, procedure name, and any OT flag. Unscheduled cases are listed separately at the bottom.

Understanding the CP-SAT Optimizer

ProcedureIQ uses **Google OR-Tools CP-SAT**, an industry-grade constraint programming solver developed by Google. CP-SAT models the scheduling problem as a set of hard constraints (one case per room at a time, cases must fit within the OT ceiling) and an objective function to minimize. It systematically searches the solution space using a portfolio of parallel techniques — including clause learning, linear relaxation, and local search — to find provably optimal or near-optimal solutions.

The objective function minimizes a weighted sum of three costs:

Cost Component	Default Weight	Meaning
Overtime	5 per minute	Penalizes cases running past the regular shift end

Unscheduled cases	1,000 per case	Strongly penalizes any case that cannot be placed
Idle time	1 per minute	Lightly penalizes unused room time between cases

Adjust the penalty weights in the **Solver Weights** panel to reflect your operational priorities. Increasing the OT penalty produces tighter schedules; decreasing the unscheduled penalty allows the optimizer to leave more cases out rather than force overtime.

Tips for Best Results

- Start with **P75 buffer mode** for a realistic baseline schedule.
- For high-skew services (skew > 2.5), consider bumping to **P90** or reducing case count.
- If many cases are unscheduled, try **adding a room** or **extending the OT ceiling** first.
- Pain procedures are treated as **gap-fillers** — they are inserted into idle time rather than competing with primary cases for room slots.
- Use **Select all visible** after filtering by service to quickly build a single-specialty day.
- The solver runs in seconds — results appear immediately and the log panel shows progress in real time.
- This is a **proof of concept** using 2014–2016 data. Results should be validated against current case mix and OR capacity before operational use.