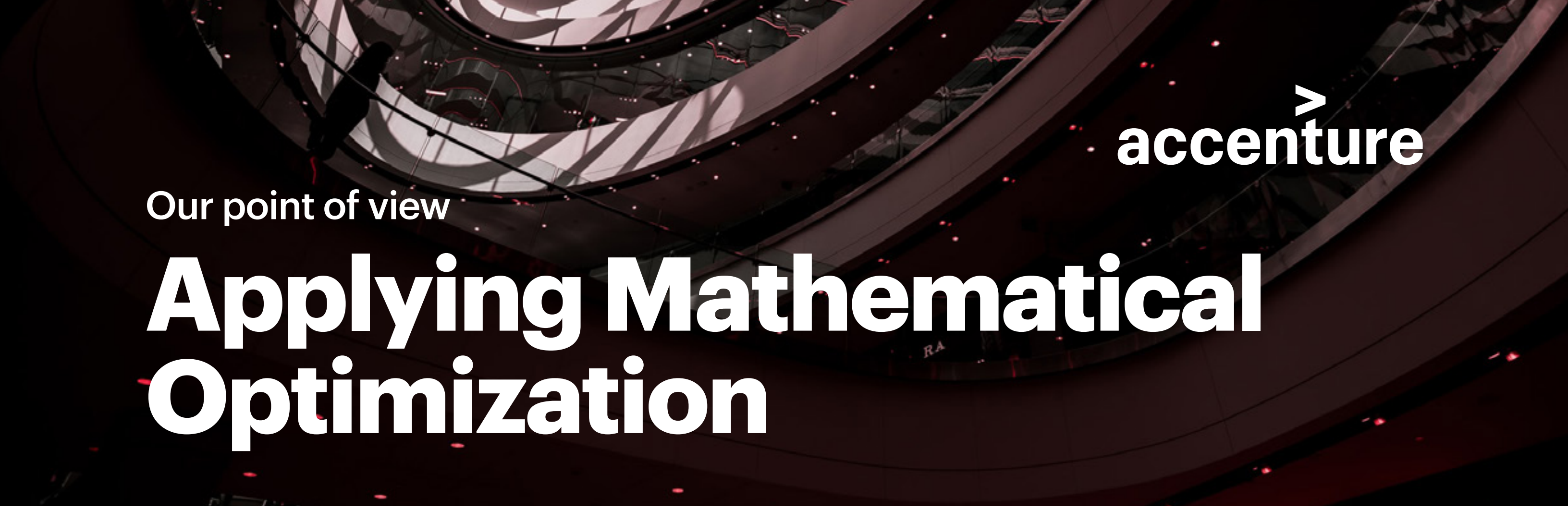

Our point of view

Applying Mathematical Optimization

Real-World Decision Problems

We often face complicated, interconnected decisions in our work. For example:

- Which factories should build which products in our portfolio?
- How do we schedule daily production at each of those factories?
- How do we route delivery drivers to keep drive times down?
- How should we allocate promotion spending to maximize profit?

Big problems like these are hard to solve. Moreover, the stakes are usually high. Less-than-perfect solutions can cost a company millions.

Ad Hoc Approaches vs. Optimization

Business teams often attempt to solve problems like these with ad hoc approaches. This typically means following simple heuristics and applying incremental manual tweaks to address critical pain points. In some cases, ad hoc approaches are enough. Often, though, an ad hoc approach will fail to satisfy the business needs.

Mathematical Optimization, properly applied and integrated into the business process, typically outperforms ad hoc efforts. Optimization algorithms always find the best possible solution among all the alternatives, while ad hoc approaches have no such guarantee. Optimization generally outclasses ad hoc approaches in terms of speed, reliability, and repeatability as well.

The Science and Art of Optimization

Problems suited for Mathematical Optimization have these three characteristics:

A set of quantifiable decisions to be made by the business.
How many of each product should we build?
Who works what days?

An objective quantifying value to the business.
Are we trying to maximize margin?
Minimize overtime?

Clearly defined business constraints.
What is our maximum capacity?
What labor laws apply?
What is our budget?

A surprisingly large number of common business problems can be framed this way, including production scheduling, product mix selection, engineering design, and promotion planning.

Optimization can deliver immense value, but there is no simple recipe for success. Every business faces unique decisions, objectives, and constraints, so problem formulations must be developed with care. Solving an Optimization problem requires considerable science but also insight and art.

Case Study

A national retailer faced highly variable customer foot traffic in its stores. Their simplistic staffing rules led to costly idle staff during slow periods and staffing shortages (and at least some lost sales) during peaks.

An Optimization model helped the chain build staffing models for each store. The model included the costs of full- and part-time staff. It included limits on weekly work hours and overtime pay. Finally, it included a penalty for sales lost at understaffed stores.

The model created a new company-wide staffing schedule in 20 minutes. The client reduced annual staffing cost by 10% and headcount by 20%. Sample outputs from the model are shown in Figures 1 and 2.

Figure 1 - Optimize Daily Store Staffing

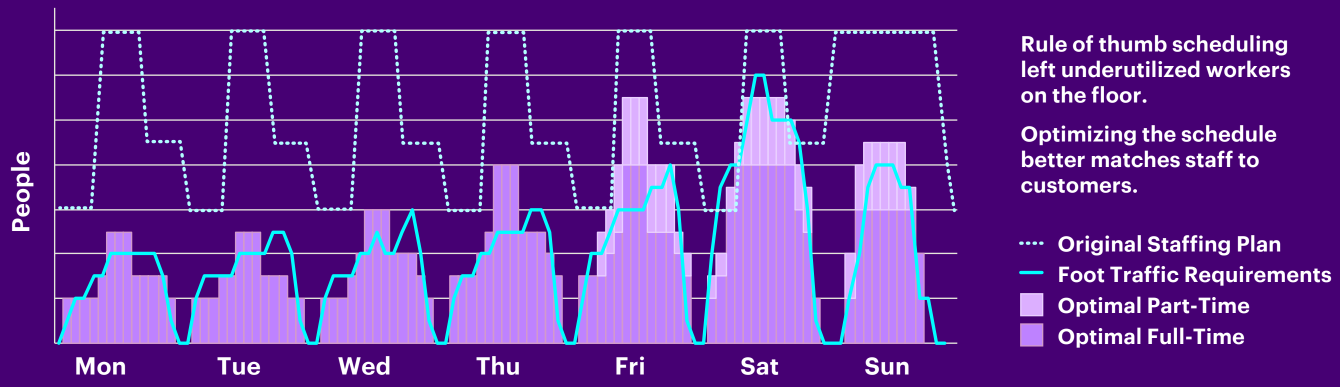

Figure 2 - Optimize Employee Schedules

Employee ID		Mon	Tue	Wed	Thu	Fri	Sat	Sun
	A	8		8	8	8	10	8
	B		8	8	8	8	10	8
	C		8	8	8	8	10	
Full-Time	D	8	8		8	8	10	8
	E	8	8		8	8	10	8
	F		8	8	8	8	10	
	G	8		8	8	8	10	8
	H	8		8	8	8	10	8
	I					9	9	6
Part-Time	J					9	8	7
	K					9	8	7

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