SELECTED ADVANCED TOPICS

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Agenda

- ❑Big M
- ❑Shift Scheduling
- ❑MinMax Formulation
- ❑Multi-Criteria Formulation

Big M

We need to decide to open new facilities using the following binary variable:

$$Open_f \ \forall \ f \in \{1, .., 3\}$$

Assume The following variable models the amount of product to be produced at each facility:

$$Produce_f \ \forall \ f \in \{1, .., 3\}$$

Formulate the conditional relationship between these two variables.

Shift Scheduling

We need to schedule retail associates shifts. Each shift is 4 hours and store is open 10am through 6pm. The following table represents estimated number of associates needed at each time. Each associate gets paid $20/hr. Formulate the problem to minimize total payroll.

10am	2
11am	3
12pm	7
1pm	4

2pm	4
3pm	3
4pm	5
5pm	6

MinMax Formulation

In the shift scheduling problem, formulate as MILP to target having over/under scheduled employees = 0 instead of a hard constraint for required employees.

Multi-Criteria Formulation

A hospital outpatient clinic needs to decide how many full time physicians to hire. After running a daily simulation model, data was generated to understand the impact of number of physicians on patient waiting time:

- One physician has patients waiting in average for 130 mins
- Each additional physician reduces waiting time by 10 mins

Each physician costs the clinic $1400 per day, at least one provider needs to be hired and at most 4 can be hired. Provide the optimum number of physicians to:

1. Minimize Patient Waiting Time Cost
2. Minimize Cost

Note: The clinic is willing to deviate 20% from the minimum possible wait time.

Multi-Criteria Formulation

You need to select two days for shopping (need not be consecutive). The following are the weather forecasts:

	Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 4**
F	90	80	85	60	65
P(Rain)	0.8	0.5	0.7	0.1	0.15

What are the days that minimize the sum of probabilities of rain but maximize the sum of temperatures?

Assume you are bothered by rain a lot and need to make sure you don't deviate more than 10% from the lowest probability.