Reading: AMPL Chapter 3

HW5: Exercise 1-3 from AMPL book.

The most common AMPL Model/Data notation

- set — index set (can be used in sums/other model entities)
- param — data/parameter (can be indexed, must have a value)
- var — decision variables (can be indexed, can be fixed, can specify lower and upper bounds)

- max(imize) / min(imize) — objective (must be named)
- subject to — constraints (must be named)

Some additional AMPL console commands

Chapter 11

- reset — clears model and data, keeps options
- let — set parameter
- drop (and restore) — drop a constraint or restore it
- fix (and unfix) — set value of variable or undo it

AMPL book index links to specific commands

ALL model and data files from the AMPL book can be found online!

Reading (if you want to work in Python):

AMPL MO-Book/Python: Chapters 1-3

get started with just Chapter 1

② Linear Models

Two common types of models used to categorize problems

Allocation Models

assumption: data/parameters are positive numbers

Allocation/Production Model with resource constraints

$$\max \sum_{j=1}^{n} p_j \cdot x_j \qquad p: \text{profit}$$

$$\text{s.t.} \sum_{j=1}^{n} a_{ij} \cdot x_j \leq b_i \qquad \forall i = 1, \dots, m \qquad \text{resources}$$

$$x_j \geq 0 \qquad \forall j = 1, \dots, n$$

x_j: production/allocation/activity of type j

b_i : availability of resource type i

a_{ij} : consumption of resource type i by production of type j

p_j : profit of production of type j

Blending Models

assumption: data / parameters are positive numbers

Blending / Mixing Models with covering / packing constraints

$$\min \sum_{j=1}^{n} c_j \cdot x_j$$

c : cost

$$\text{s.t. } l_i \leq \sum_{j=1}^{n} a_{ij} \cdot x_j \leq u_i \qquad \forall i = 1, \dots, m$$

covering

packing

$$x_j \geq 0 \qquad \forall j = 1, \dots, n$$

Classic examples : Packing → Knapsack problem

Covering → Diet problem

x_j : activity / use of resource of type j

l_i : lower bound on feature i of the blend / mix — demand

u_i : upper bound on feature i of the blend / mix — restriction

a_{ij} : contribution of resource type j to feature i

c_j : cost of activity / resource of type j

Cutting - Stock Problems

for scheduling

Famous problem with an important modeling idea

Problem: Cut large paper rolls of a given size (or shape / width) in order to meet demands of smaller rolls with as little left over ("trim loss") as possible.