Chapter 1 – Formulations

1.1 Introduction

Definition: An Abstract optimization problem (P) is a problem where we are given,

- **Goal:** A set $A \subseteq \mathbb{R}^n$ and a function $f\colon A \to \mathbb{R}$
- **Goal:** Find $x \in A$ that min/max f.

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Definition: We define different optimization problems;

- **Linear Programming (LP):** A is implicitly given by linear constraints, and f is a linear function.
- **Integer Programming (IP):** Similar to LP however now we optimize over integer points in A.
- **Nonlinear Programming (NLP):** A is given by non-linear constraints, and f is a non-linear function.

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1.2 Components of a Math Model

Definition: Components;

- **Decision Variables:** Capture unknown info.
- **Constraints:** Describe which assignments to variables are feasible
- **Objective function:** A function of the variables that we are minimizing/maximizing.

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