## 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  $f: A \to \mathbb{R}$
- Goal: Find  $x \in A$  that min/max f.

**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.

## 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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