1 Foundation

1.1 Introduction

★ (mathematical) optimization problem

$$\begin{array}{ll} \text{minimize} & f_0(x) \\ \text{subject to} & f_i(x) \leq b_i, i = 1, \ldots, m \end{array}$$

- $x = (x1, \ldots, x_n)$: optimization variables
- $f_0 : \mathbf{R}^n \to \mathbf{R}$: objective function
- $f_i : \mathbf{R}^n \to \mathbf{R}, i = 1, \ldots, m$: constraint functions

optimal solution x^* has smallest value of f_0 among all vectors that satisfy the constaints

EX: portfolio optimization

- variables: amounts invested in different assets
- constraints: budget, **max./min.** investment per asset, minimum return
- object: overall risk or return variance

EX: data fitting

- variables: model parameters
- constraints: prior information, parameter limits
- objective: measure of misfit or prediction error

section name goes here

★ term definition

DEF: term - and it's definition

★ an example

EX: example heading

★ a system of equations

$$\begin{cases} 2x + 4y = 2 \\ 2x + 6y = 3 \end{cases}$$

⋆ working a multistep problem

$$\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix} \xrightarrow{R_1+R_2} \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix} \Rightarrow \begin{cases} x = 1 \\ y = 2 \\ z = 3 \end{cases}$$

⋆ a vector in R^3

$$v = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

⋆ a multi-step process

$$A \xrightarrow{\text{do stuff}} B \xrightarrow{\text{more stuff}} C$$

⋆ an enumerated list

1. this is the first item in an enumerated list
2. this is the second item in an enumerated list

⋆ manually broken lines

the first line
the second line
the third line

⋆ some math

$$\int_a^b f(x)\,dx \int f(x)\,dx \frac{\pi}{2} \sqrt{\theta}\; n = 1, 2, 3 \ldots 4$$