

# Lecture 0 for EE127 (Fall 2018): Optimization Models in Engineering

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01/01/01 (*Change This to Lecture Date*)

## 1 Scribing

This document provides a scribing template. Try to organize the sections/subsections for your lecture in a coherent way. Also please read the directions detailed in the *instructions.pdf* file contained in the Github (<https://github.com/nileshtrip/EE127Notes>).

### 1.1 What a scribe should do

What a scribe should do:

**Definition 1.1** (Good Scribe). A good scribe should follow the scribing instructions.

## 2 Convex functions

We care a lot about convex functions.

**Theorem 2.1** (The name of the theorem). *Although this class is not heavily proof-oriented if the lectures contain any important/useful theorems put them in a theorem environment.*

*Proof of Theorem 2.1.* An instructive proof (or reference to a proof in one of the course texts) about convexity might go here. ■

### 2.1 Examples relating to the aforementioned theorem

- You will learn to love linear spaces  $\{x \in \mathbb{R}^n \mid Ax = 0\}$  and halfspaces  $\{x \in \mathbb{R}^n \mid \langle a, x \rangle \geq 0\}$ .

- You will also encounter the cone of positive semidefinite matrices, denotes,  $S_+^n = \{A \in \mathbb{R}^{n \times n} \mid A \succeq 0\}$  later in this course. Here we write  $A \succeq 0$  to indicate that  $x^\top A x \geq 0$  for all  $x \in \mathbb{R}^n$ .
- See [BV04, Ch.2] for lots of other examples. This is how you should cite a reference. If the reference is not contained in the *refs.bib* file you should add the bibtex (Google Scholar is a good place to get these bibtex blurbs).

**Fact 2.2.** *A fun fact about convexity or linear algebra.*

A nice, multi-line equation about convexity,

$$f(1 - \gamma)x + \gamma y \leq (1 - \gamma)f(x) + \gamma f(y) \quad (1)$$

$$f(1 - \gamma)x + \gamma y \leq (1 - \gamma)f(x) + \gamma f(y) \quad (2)$$

An in-line equation  $f(x) \leq f(y)$ .

An equation without a label,

$$f(y) \geq f(x) + g^\top(y - x).$$

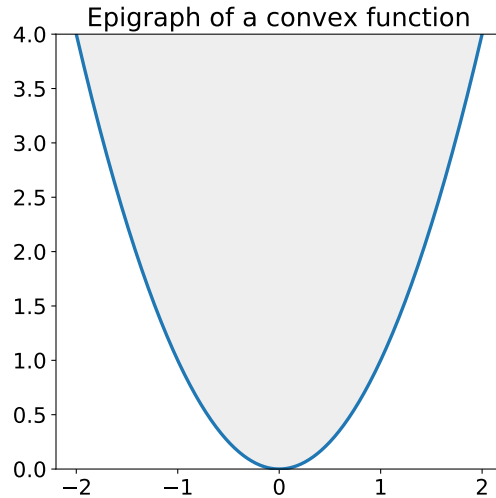


Figure 1: A fun figure about epigraphs completely unrelated to [Proposition 2.3](#).

## 2.2 An important characterization perhaps

**Proposition 2.3.** *Something important about differentiability and convexity.*

$$f(y) = f(x) + \nabla f(x)^\top(y - x) + \int_0^1 (1 - \gamma) \frac{\partial^2 f(x + \gamma(y - x))}{\partial \gamma^2} d\gamma$$

*Proof.* A nice proof. ■

### 3 Convex optimization

We care a lot about  $f: \Omega \rightarrow \mathbb{R}$  over a convex domain  $\Omega$  :

$$\min_{x \in \Omega} f(x)$$

**Remark 3.1** (Subgradients). subgradients *are great!*

$$f(y) \geq f(x) + g^\top (y - x).$$

*Maybe we need to reference [Theorem 2.1](#) here.*

Subgradients are useful for optimizing convex functions.

### References

[BV04] Stephen Boyd and Lieven Vandenberghe. *Convex optimization*. Cambridge university press, 2004.