Nonlinear Constrained Optimization

We look at certain theoretical and practical aspects of constrained optimization to end with.

1. *Lagrange Multipliers* We had seen this in the past. We had already seen how constraints and objective are combined together to form a Lagrangian function.

   If you prefer, do revise with a light weight Khan Academy lecture on constrained optimization (you may know these already; good revision):

   - https://www.khanacademy.org/math/multivariable-calculus/applications-of-multivariable-derivatives/lagrange-multipliers-and-constrained-optimization/v/constrained-optimization-introduction

2. *KKT Conditions* A very popular idea in optimization. There are plenty of videos and material on internet on this topic. See minimum one and preferably more from:

   - Inequality-constrained optimization - first-order conditions: https://www.youtube.com/watch?v=Nbnd8KxRHG
   - Lecture 40 (multiple parts): https://www.youtube.com/watch?v=HIm3Z0L90Co
   - Crash couse on KKT condition: https://www.youtube.com/watch?v=TyfZaZSF5nA

3. *Relationship to Duality and Convex Optimization* We had seen different notions like Duality, Dual variables, Lagrangian, Weak and Strong duality in the past. Let us bring them together:

   - https://www.youtube.com/watch?v=thuYiebq1cE

At this stage, you should be able to:

- Appreciate the necessary and sufficient conditions for optimnality.

- Appreciate why convex optimization enjoys many advantages.

- Appreciate more general class of optimization problems (compared to LP and IP) and see how many of these ideas are applicable.

- Appreciate the role of duality and duality theory better.

- Appreciate the much wider gamut of optimization problems and the role of (i) theory (ii) optimization schemes.