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# SC 607 Optimization
## Spring 2015
**I optimize, therefore I am**

**Course Description**   The urge to optimize is fundamental to our being. If we exist, we think. If we think, we make choices. If we make choices, we want to optimize. Indeed, optimization may also be fundamental to what *makes* our being. Laws governing the behavior of physical (and hence biological) systems seem to have the character of seeking to optimize some energy functional.

This course will provide an understanding of the theory of mathematical optimization and some landmark algorithms. Throughout the emphasis will be on the geometry of the problem and uncovering geometric obstructions to the success of algorithms.

**Course Content**   I will endeavour to cover the following topics

- Convex analysis and review of real analysis
- Optimization in Euclidean space: linear programming, duality, convex optimization, constrained optimization and KKT conditions, geometric theory of duality (Lagrangian, Fenchel duality)
- Algorithms for optimization in Euclidean space
- Nonconvex optimization
- Discrete optimization, brief overview of complexity theory towards an appreciation of "hard" and "easy" problems.
- One of the following

  - Optimization by vector space methods
  - Semi-definite programming
  - Continuous formulations of discrete problems
  - Variational analysis

**References**

- S. Boyd and L. Vandenberghe, *Convex Optimization*, Cambridge University Press, 2004 (**available online**)
- D. Luenberger, *Optimization by Vector Space Methods*, John Wiley & Sons, 1997
- D. Luenberger, *Linear and Nonlinear Programming*, Addison-Wesley, 1984
- H. Jongen, K. Meer, and E. Triesch, *Optimization Theory*, Springer, 2004

**Formalities and fine print**

- **Audience:** This is a research level course and not meant for a general audience.
- **Prerequisites:** Linear algebra, real analysis, comfort with or willingness to learn mathematical reasoning. **For UGs, consent of instructor is a must.**
- **Credits:** 6. For slot and room information, please check `http://asc.iitb.ac.in`. However due to personal constraints, I would like to reschedule to a more convenient slot. Please register only if you are prepared for large scale rescheduling throughout the semester.