

Handout 0: Information Sheet

Instructor: Anthony Man–Cho So

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1 General Information

- INSTRUCTOR: Professor Anthony Man–Cho So
 - OFFICE: ERB 604
 - OFFICE HOURS: Mondays 2:00pm — 3:45pm, or by appointment
 - EMAIL: manchoso@se.cuhk.edu.hk
- CLASS TIME & LOCATION: Tuesdays 2:30pm — 5:15pm, in HYS G05
- CLASS WEBSITE: <http://www.se.cuhk.edu.hk/~manchoso/0708/seg5520>

2 Course Objectives

In this course we will develop the basic machineries needed for formulating and analyzing various optimization problems. Applications from different fields will be used to complement the theoretical developments. No prior optimization background is required for this class. However, students should have workable knowledge in multivariable calculus, basic concepts of analysis, linear algebra and matrix theory.

3 Course Outline

- Part I: Introduction**
 - Problem Formulation
 - Classes of Optimization Problems
- Part II: Theory**
 - Elements of Convex Analysis
 - Optimality Conditions
 - Duality Theory
- Part III: Algorithms**
 - Unconstrained Optimization
 - Linearly Constrained Optimization
 - Elements of Interior–Point Method (time permitting)
- Part IV: Selected Applications**
 - Computational Economics and Finance
 - Combinatorial Optimization
 - Applications in Signal and Image Processing

4 Grading

- **HOMEWORK (60%)**: There will be about six homeworks during the term. They are due every other week at the *beginning* of the class. You may take up to two late days during the term. However, once you have used up the late days, **no more late homeworks will be accepted**.

You are allowed, and even encouraged, to discuss the homeworks with your classmates. However, **you must write up the solutions on your own**. Plagiarism and other anti-scholarly behavior will be dealt with severely.

- **FINAL EXAMINATION (40%)**: There will be an in-class final examination for this class. You may take an 2-page “cheat sheet” with you during the examination.

5 Reference Material

There is no required textbook for this class. Below is a list of material for further reading:

- [1] M. S. Bazaraa, H. D. Sherali, and C. M. Shetty. *Nonlinear Programming: Theory and Algorithms*. Wiley–Interscience Series in Discrete Mathematics and Optimization. John Wiley & Sons, Inc., New York, second edition, 1993.
- [2] A. Ben-Tal and A. Nemirovski. *Lectures on Modern Convex Optimization: Analysis, Algorithms, and Engineering Applications*, volume 2 of *MPS–SIAM Series on Optimization*. Society for Industrial and Applied Mathematics, Philadelphia, Pennsylvania, 2001.
- [3] D. P. Bertsekas. *Nonlinear Programming*. Athena Scientific, Belmont, Massachusetts, second edition, 1999.
- [4] D. Bertsimas and J. N. Tsitsiklis. *Introduction to Linear Optimization*. Athena Scientific, Belmont, Massachusetts, 1997.
- [5] J. M. Borwein and A. S. Lewis. *Convex Analysis and Nonlinear Optimization: Theory and Examples*, volume 3 of *CMS Books in Mathematics*. Springer Science+Business Media, Inc., New York, second edition, 2006.
- [6] S. Boyd and L. Vandenberghe. *Convex Optimization*. Cambridge University Press, Cambridge, 2004. Available online at <http://www.stanford.edu/~boyd/cvxbook/>.
- [7] M. Grötschel, L. Lovász, and A. Schrijver. *Geometric Algorithms and Combinatorial Optimization*, volume 2 of *Algorithms and Combinatorics*. Springer–Verlag, Berlin/Heidelberg, second corrected edition, 1993.
- [8] J.-B. Hiriart-Urruty and C. Lemaréchal. *Fundamentals of Convex Analysis*. Grundlehren Text Editions. Springer–Verlag, Berlin/Heidelberg, 2001.
- [9] D. G. Luenberger. *Linear and Nonlinear Programming*. Addison–Wesley Publishing Company, Reading, Massachusetts, second edition, 1984.

- [10] O. L. Mangasarian. *Nonlinear Programming*. McGraw–Hill, Inc., New York, 1969.
- [11] S. G. Nash and A. Sofer. *Linear and Nonlinear Programming*. The McGraw–Hill Companies, Inc., New York, 1996.
- [12] J. Renegar. *A Mathematical View of Interior–Point Methods in Convex Optimization*, volume 3 of *MPS–SIAM Series on Optimization*. Society for Industrial and Applied Mathematics, Philadelphia, Pennsylvania, 2001.
- [13] R. T. Rockafellar. *Convex Analysis*. Princeton Landmarks in Mathematics and Physics. Princeton University Press, Princeton, New Jersey, 1997.
- [14] C. Roos, T. Terlaky, and J.-P. Vial. *Interior Point Methods for Linear Optimization*. Springer Science+Business Media, Inc., New York, second edition, 2006.
- [15] A. Ruszczyński. *Nonlinear Optimization*. Princeton University Press, Princeton, New Jersey, 2006.
- [16] S. J. Wright. *Primal–Dual Interior–Point Methods*. Society for Industrial and Applied Mathematics, Philadelphia, Pennsylvania, 1997.
- [17] Y. Ye. *Interior Point Algorithms: Theory and Analysis*. Wiley–Interscience Series in Discrete Mathematics and Optimization. John Wiley & Sons, Inc., New York, 1997.