

Introduction to Mixed-Integer Linear Programming

Class 1: October 10th, 2016

Instructor: E. Camponogara

1.1 GENERAL INFORMATION

- **Course:** Introduction to Mixed-Integer Linear Programming
- **Instructor:**
Prof. Eduardo Camponogara
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1.2 GOALS

Develop modeling and problem-solving abilities in mixed-integer linear optimization with emphasis on piecewise-linear approximation. The specific topics are:

1. introduction to optimization;
2. proxy modeling;
3. fundamentals of mixed-integer linear programming;
4. branch-and-bound and cutting-plane algorithms;
5. piecewise-linear approximation;
6. AMPL modeling language;
7. applications in petroleum science and engineering;
8. introduction to mixed-integer nonlinear programming.

1.3 REFERENCES

- Lawrence Wolsey, *Integer Programming*, Addison-Wesley, 1998.
- Robert J. Vanderbei. *Linear Programming: Foundations and Extensions*, Springer, Second Edition, 2001.
- Christodoulos A. Floudas, *Nonlinear and Mixed-Integer Optimization: Fundamentals and Applications*, 1st Edition, Oxford University Press, 1995.

1.4 CLASS SCHEDULE

| Class | Date | Topic |
|-------|-----------|--|
| 1 | Monday | Fundamentals |
| 2 | | Introduction to modeling |
| 3 | | Practice session |
| 4 | | Review of linear programming |
| 5 | | Introduction to integer programming |
| 6 | | Practice session |
| 7 | Tuesday | Relaxations and bounding |
| 8 | | Branch-and-bound algorithm |
| 9 | | Practice Session |
| 10 | | Valid inequalities |
| 11 | | Cutting-plane algorithm |
| 12 | | Practice session |
| 13 | Wednesday | Piecewise-linear approximation: one dimensional |
| 14 | | Piecewise-linear approximation: multidimensional |
| 15 | | Practice session |
| 16 | | Gas-lift allocation problem |
| 17 | | Introduction to MINLP |
| 18 | | Practice session |
| 19 | Friday | Project presentations |
| 20 | | Project presentations |
| 21 | | Project presentations |
| 22 | | Project presentations |
| 23 | | Project presentations |

1.5 GRADING

To be discussed with Prof. Bjarne Foss.