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CPE 678/778

Applied Optimization Methods

Fall 2025

Individual Project

Your final project for CPE 678/778 will be to identify and solve an optimization problem which relates to an area of chemical or petroleum engineering (or for your major field if you're not a chemical or petroleum engineer). You will need to present a problem formulation, a computer-derived solution, and a written description of the project. In total, this project is worth 30% of your course grade. Note that if you are enrolled in C&PE 778, your final project submission should include a theory section, in which you explain the background of the method you use. For deterministic methods, this should include a mathematical description of how the algorithm guarantees local or global optimality. For stochastic methods, an in-depth analysis of the algorithm parameters as well as a mathematical explanation of the convergence properties of the algorithm is required.

Project identification: Preferably, your project should be based on some area of your field that you are familiar with, such as an area you are performing research in, or based on a course that you are strongly interested in. Each project should have a direct connection to a practical area of interest, and must be formulatable as a non-trivial optimization problem. Projects may also focus on a specific algorithm for optimization (including those not covered in class), but problems from your major field must be solved as examples. Many possibilities exist within the context of process design, such as optimal design of separation equipment, design of heat exchanger networks, and plant layout problems. Other possibilities include batch scheduling problems, product design/selection problems, and facility location problems. If you are having trouble identifying a project, please come see me. I have reserved a few challenging problems which could be used as projects.

**Timeline:** You will complete this project in two steps. Part 1 will be to define the problem, derive the equations required, and describe the assumptions you will make. This part may be hand-written, and should be 2-3 pages in length. Part 1 is due on **Friday, November 7** at the beginning of class. I will return this to you in the next lecture so that you get feedback on how to proceed with your project.

Part 2 of this project will be to solve the problem, either using the GAMS modeling system for an engineering problem-based project, or using a programming language for an algorithm-based project. In both cases, you will need to solve a specific instance of the problem, and give enough explanation such that a user could alter the constants within your program and solve a different instance.

The written report will give an overview of the problem and its solution, along with a hard copy of the code written. Things to be submitted are as follows:

- A ~5 page typed description of your problem, its solution and relevance
- A printout of the code, complete with comments including descriptions of each variable used
- Some sample output from a test with a real system

The final written report will be due on **Wednesday, Dec. 10** by 5:00 PM to my office (4148A Learned Hall).

**Grading:** Grading will be as follows:

15% Part 1, technical content only

85% Part 2, written report

- 2/3 technical
- 1/3 communications (grammar, spelling, clarity of writing, etc.)

You must work on this project independently of all other students, but you may have others proofread your writing.