GEOG 8200 Frontiers in Geographic Information Science
Spatial Optimization: Theory, Methods, and Applications

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Room: 1186 Derby Hall
Time: Thursday 5:00 - 7:48 PM
Office hour: Friday 10 - 11 AM or by appointment

Spatial optimization problems represent a special set of challenges in disciplines such as geography, urban and regional planning, transportation, natural resources management, and public policy. In general, solving spatial optimization problems requires a careful process of understanding the decision making process, accurate mathematical formulation of the problem, choosing and developing efficient solution methods, and effective presentation of the results. It is also important to understand the nuances of the diverse solution methods that will greatly impact the outcome.

In this graduate seminar, we will conduct a comprehensive survey of the field of spatial optimization. We will discuss the theoretical underpinning of the need for optimization, problem representations, error propagation, and solution methods. A variety of applications from different domains will be discussed. More specifically, our discussions will include (but not limited to) the following topics:

- Theory: location theory, optimization, and spatial organization.
- Problem formulation: integer programming.
- Solution approaches: exact, heuristic, and metaheuristic methods.
- Applications from different fields.

The course is organized around two major activities. First, we will read and discuss a wide spectrum of research articles on (and beyond) the topics listed above. Each student will choose papers of their interests and prepare to present/discuss the papers. Though a list of papers will be provided at the beginning of the semester, students are greatly encouraged to choose their own discussion papers. Second, there will be a number of hands-on workshops that cover some of the practical issues about the use of specific solvers and libraries for developing heuristic/metaheuristic methods.

It is required that all students actively participate in the discussion and workshop sessions. Participation will have be worth 20 percent of the final grade. Each student will sign up to lead discussions. Each week students who present should include the context of the **reading** materials with respect to the general theme of this class, some details from the reading, and critical thoughts about the topic. The other students who are not leading the discussion must carefully read the papers/chapters and post questions and comments on the Carmen discussion board. Each student (not leading discussion) must post at least one question/comment for each paper. Questions and comments should be intellectually stimulating and/or critical. We will not accept trivial questions such as "what do you think of this paper?" or "what are the contributions of this paper?"

In addition to reading, for each method paper discussed, students are required to **implement** at least one of the methods. This can be coding from scratch, or using some existing libraries. Students can choose any programming language they are comfortable with.

To complete the course, each student should write a **final paper**. This paper will be either a review piece about the topics in a certain research area, or a research paper that reports the results from a final project related to the topics. At the end of the semester, each student will present the final paper to the class. Grade of the course will be based on participation and the final paper.