# MGT 3045: Advanced Topics in OM: Location Analysis

Tuesday 10:00 am-12:00 pm
RC470

**Oded Berman**

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## Course Objectives

The main objective of this course is to provide the students with a rigorous introduction to the modeling and quantitative approaches of selected topics in Location Analysis. The course will acquaint the students with both the classical and current results in this field, and will also cover related analytical techniques such as Integer Programming, Complexity Analysis of algorithms, Stochastic Processes, etc.

## Prerequisites

The course assumes knowledge of basic concepts in Operations Research, ability to do basic proofs and follow mathematical arguments.

## Reference Materials

There is no formal textbook for the course. We will draw on different papers throughout the course. The papers will be distributed to the students where possible.

## Student Presentations

Each student will be expected to prepare several 45 minutes to-1hour seminar-style presentations that should cover the following:

- Overview of the main contributions of the paper
- Presentation of the key results

To prepare a successful presentation you should:

**1.** Closely read the paper and gain a thorough understanding of the results. This usually requires a lot of work involved in tracking down and understanding background sources, filling in the missing mathematical details, etc.

**2.** Carefully select the material you will present. The most common mistake is to try to present all the results in the paper and their proofs. For a typical paper, this would take about a week—you are still likely to be in the middle preliminary result by the time your hour is up. The trick is to present intuition and main ideas behind the proofs, rather than the details. Generally, you can only present proof outlines for one or two major results, skipping the mathematical details. However, you have to be careful in presenting convincing intuitive arguments behind the results—otherwise there will be too many questions asking for technical clarifications, and you will get bogged down once again.

**3.** Try to understand where the papers fit in within the context of the results presented in the course.

**Grading Policy**

The course grade will be computed as follows:

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| Homework Grade: | 50% |
| Presentations Grade: | 50% |

Presentations Grade: Will be based on the oral paper presentations by each student and the homework problems they will be required to submit based on their presentation. The grade will be determined as follows:

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| Presentation style/clarity: | 40% |
| Mastery of material: | 40% |
| Homework problems: | 20% |

**Tentative List of Topics and Readings**

**1. Classical Location Theory—The Median and Centre Problems**

a. Hakimi, S.L. (1964) "Optimal Location of Switching Centers and the Absolute Centers and Medians of a Graph," *Operations Research,* 12, 450-459. **Oded**

b. Hakimi, S.L. (1965) "Optimum Distribution of Switching Centers in a Communication Network and Some Related Graph Theoretic Problems," *Operations Research*, 13, 462-475. **Oded**

c. Berman, O., D. Einav, and G. Handler (1991) "The Zone-Constrained Location Problem on a Network," *European Journal of Operations Research,* 53, 14-24. **Oded**

d. O. Berman and Z. Drezner, "The p-Median Problem under Uncertainty," *European Journal of Operational Research,* Vol. 189, 2008, pp.19-30.

**2. Maximal Cover Problems**

a. O. Berman and D. Krass (2002) "The Generalized Maximal Covering Location Problem," *Computers & Operations Research*, Vol. 29, pp.563-591. **Oded**

b. O. Berman, D. Krass and Z. Drezner (2003) "The Gradual Covering Decay Location Problem on Networks, "*European Journal of Operations Research*, Vol. 151, pp. 474-480.

c. O. Berman, Z. Drezner and D. Krass, "The Variable Radius Covering Problem," *European Journal of Operational Research*, Vol. 196, 2009, pp. 516-525.

d. O. Berman, Z. Drezner and D. Krass, "Cooperative Cover Location Problems: The Planar Case," *IIE Transaction*, Vol. 42, 2010, pp. 232-246.

e. O. Berman, I. Hajizadeh and D. Krass, “The Maximum Covering Problem with Travel Time Uncertainty,” *IIE Transactions*, Vol. 45, 2013, 81-96. **Oded**

## 3. Flow Interception Problems

a. O. Berman, D. Bertsimas and R.C. Larson (1995) “Locating Discretionary Service Facilities, II: Maximizing Market Size, Minimizing Inconvenience,” *Operations Research*, 43, 4, 623-632. **Oded**
b. Averbakh, I. and O. Berman (1996) “Locating Flow-Capturing Units with Multi-Counting and Diminishing Returns to Scale,” *The European Journal of Operations Research*, 91, 495-506.

## 4. Congestion Location Models

a. Larson R.C. (1974) “A Hypercube Queuing Model for Facility Location and Redistricting in Urban Emergency Services,” *Computers and Operations Research*, Vol. 1, 67-95. **Oded**
b. Berman, O., R.C. Larson and S. Chiu (1985) “Optimal Server Location on a Network Operating as an M/G/1 Queue,” *Operations Research*, 33, 4, Jul-Aug, 746-77. **Oded**
c. Chiu, S., O. Berman and R.C. Larson (1985) “Locating a Mobile Server Queuing Facility on a Tree Network,” *Management Science*, 31, 6, June, 764-772.
d. Berman, O., R.C. Larson and C. Parkan (1987) “The Stochastic Queue p-Median Problem,” *Transportation Science*, 21, 3, August, 207-216.
e. O. Berman, D. Krass and J. Wang, “Locating Service Facilities to Reduce Loss Demand,” *IIE Transactions*, Vol. 38, 2006, pp. 933-946. **Oded**

## 5. Traveling Salesman Location Problems

a. Berman, O. and D. Simchi-Levi (1986) “Minisum Location of a Travelling Salesman,” *Networks*, 16, 239-254. **Oded**
b. Berman, O. and D. Simchi-Levi (1988) “Minisum Location of a Travelling Salesman on Simple Networks,” *European Journal of Operations Research*, 36, 2, 241-250.
c. Simchi-Levi, D. and O. Berman (1988) “A Heuristic Algorithm for the Travelling Salesman Location Problem on Networks,” *Operations Research*, 36, 3, 478-484. **Oded**
d. Simchi-Levi, D. and O. Berman (1987) “Heuristic and Bounds for the Travelling Salesman Location Problem on the Plane,” *Operations Research Letters*, 6, 5, 243-248.

## 6. Practical Competitive Location Problems

a. O. Berman and D. Krass, "Locating Multiple Competitive Facilities: Spatial Interaction Models With Variable Expenditures," Recent Developments in the Theory and Applications of Location Models Part II, Annals of Operations Research, 111, 2002, 197-225. **Oded**
b. O. Berman and D. Krass (1998) "Flow Interception Spatial Interaction Model: A New Approach to Optimal Location of Competitive Facilities," *Location Science*, Vol. 6, pp. 41-65.
c. R. Aboolian, O. Berman and D. Krass, "Competitive Facility Location Model with Concave Demand," *European Journal of Operational Research*, Vol. 181, 2007, pp. 598-619. **Oded**
d. R. Aboolian, O. Berman and D. Krass, "Competitive Facility Location and Design Problem," *European Journal of Operational Research.*, Vol. 182, No.1, 2007, pp. 40-62.

## 7. Reliability Facility Location

**a.** O. Berman, D. Krass and M. Menezes, "Facility Reliability Issues in Network p-Median Problems: Strategic Centralization and Co-location Effects," *Operations research*, Vol. 55, No.2,, 2007, pp. 332-350. **Oded**
**b.** O. Berman, D. Krass and M. Menezes, "Optimal Location in the Presence of Disruptions and Incomplete Information," *Decision Sciences*, Vol. 40, 2009, pp. 845-868. **Oded**
c. Snyder, L.V. and M.S. Daskin (2005), "Reliability Models for Facility Location: The Expected failure cost Case," *Transportation Science*, 39(3), 400-416. **Read**
d. Berman and D. Krass, "On n-Facility Median Problem with Facilities subject to Failures Facing Uniform Demand," *Discrete Applied Mathematics*, Vol. 159. 2011, pp. 420-432.
e. O. Berman, E. Ianovsky and D. Krass, "Optimal Search Path for Service in the Presence of Disruptions," *Computers & Operations Research*, Vol. 38, 2011, pp. 1562-1571.

## 8. Location Problems with Stochastic Weights

a. O. Berman and J. Wang (2004) "Probabilistic Location Problems with Discrete Demand Weights," *Networks*, Vol. 57, pp. 47-57. **Oded**
b. O. Berman and J. Wang, "The Network p-Median Problem with Discrete Probabilistic Demand Weights," *Computers & Operations Research*, Vol. 37, 2010, pp. 1455-1463.