

# 1.041 Transportation Systems Modeling

*Prereq:* 1.00, 1.010

Introduces basic concepts of transportation systems modeling, data analysis and visualization techniques. Covers fundamental analytical and simulation-based methodologies. Topics include time-space diagrams, cumulative plots, queueing theory, network science, data analysis, and their applications. Provides students with an understanding of the current challenges and opportunities in different areas of transportation.

*M. González, C. Osorio*

## Schedule of lectures

### Unit 1: Traffic flow models

- L1 (2/5, Wed.): Introduction [MG, CO]
- L2 (2/10, Mon.): Time-space diagrams [CO]
- L3 (2/12, Wed.): Cumulative plots I [CO]
- L4 (2/18, Tues.): Cumulative plots II – Traffic flow theory I [CO]
- L5 (2/19, Wed.): Traffic flow theory II [CO]
- L6 (2/24, Mon.): Probabilistic Concepts [CO]
- L7 (2/26, Wed.): Quiz 1

### Unit 2: Networks Models and Analysis

- L8 (3/3, Mon.): Introduction to network science and networks properties [MG]
- L9 (3/5, Wed.): Numerical Exercises [MG]
- L10 (3/10, Mon.): Random graphs and small world networks [MG]
- L11 (3/12, Wed.): Group Exercises [MG]
- L12 (3/17, Mon.): Scale-free model [MG]
- L13 (3/19, Wed.): Group Exercises [MG]

### Unit 3: Probabilistic traffic flow models

- L14 (3/31, Mon.): Queueing models I [CO]
- L15 (4/2, Wed.): Quiz 2
- L16 (4/7, Mon.): Queueing models II [CO]
- L17 (4/9, Wed.): Queueing network models [CO]
- L18 (4/14, Mon.): Stochastic simulation models I [CO]
- L19 (4/16, Wed.): Stochastic simulation models II [CO]

### Unit 4: Analysis of Spatial Networks

- L20 (4/23, Wed.): Classes of Small World Networks [MG]
- L21 (4/28, Mon.): Weighted Complex Networks + Group Exercise (SF) [MG]
- L22 (4/30, Wed.): Quiz 3
- L23 (5/5, Mon.): Air Transportation Network + Group Exercise (Gephi) [MG]
- L24 (5/7, Wed.): Group Exercise (Fitting Properties) [MG]
- L25 (5/12, Mon.): Mini-project presentation [MG]
- L26 (5/14, Wed.): Mini-project presentation [MG]

- Problem sets

	<b>Covers</b>	<b>Assigned</b>	<b>Due</b>
<b>Problem Set 1</b>	Unit 1	Feb. 10	Feb. 18
<b>Problem Set 2</b>	Unit 1	Feb. 18	Feb. 24
<b>Problem Set 3</b>	Unit 2	March 10	March 19
<b>Problem Set 4</b>	Unit 3	April 7	April 23
<b>Problem Set 5</b>	Unit 4	April 23	May 5

- Exercise presentation: During unit 2 each student will be assigned an exercise and be asked to give an oral presentation of it to the class the following week.
- Assignments
  - 5 homework assignments (problem sets)
  - 1 exercise presentation
  - Three quizzes
  - One final mini-project: written report and oral presentation
  - Unless stated otherwise, problem sets should be solved individually. Paper-versions can be handed in. Electronic versions can be uploaded to the Stellar site. In both cases they are due before the start of the lecture. Late submissions will not be considered
- Grading
  - 8% for each problem set and the exercise presentation
  - 13% for each quiz
  - 13% for the mini-project
- Textbook: Handouts will be distributed as needed
- Lectures: Mon. 11-1pm, Wed. 11-12pm in 1-134.
- Recitations: Fri. 11-12pm in 1-134
- Contact information:
  - Prof. Marta C. Gonzalez  
Office hours: Mon. 1-3 PM  
Room 1-151; martag@mit.edu
  - Prof. Carolina Osorio  
Office hours: Mon. 1-3 PM  
Room 1-232; osorioc@mit.edu
  - Teaching assistants:
    - Serdar Colak  
serdarc@mit.edu
    - Linsen Chong  
linsenc@mit.edu  
Office hours: TBD  
Location: TBD

Refer to Stellar for the most up-to-date information:  
<https://stellar.mit.edu/S/course/1/sp14/1.041/index.html>