OR 647: Queueing Theory
Course Overview, Spring 2021

We are all familiar with waiting in lines – in the grocery store, on the telephone, at the airport, on the road. Queueing theory is the mathematical study of lines. Because lines form from arrival and service processes that are typically random, queueing theory relies on the mathematical study of stochastic processes.

Some common types of questions that queueing theory can address are:

- What is the average time spent waiting in line?
- How long are the lines on average?
- How many customers wait more than 2 minutes?
- How many customers are turned away?
- How many servers are needed to achieve a target quality of service?
- How fast must the servers work?

Answers to these questions provide decision makers a way to efficiently allocate resources to reduce delay.

This course provides a survey of quantitative models used to analyze queueing systems. The focus is both on mathematical analyses of such models as well as practical issues in using such models to represent real systems.

The course assumes prior knowledge of calculus-based probability. The pre-requisite for this course is OR 542 (Stochastic Models), or STAT 544 (Applied Probability), or permission of the instructor. Knowledge of continuous-time Markov chains (CTMCs) is very helpful, but not required (key aspects of CTMCs will be presented briefly in class).

Class Hours: Wednesday, 4:30 – 7:10 pm, Enterprise Hall, room 173
Pre-requisites: OR 542, or STAT 544, or permission of instructor

Instructor: John Shortle
jshortle@gmu.edu
703-993-3571
Engineering Building, room 2210
Office hours: Tue 4-5 pm, Wed 3:30-4:30 pm, or by appointment.

Textbook: Shortle, J., J. Thompson, D. Gross, C. Harris. 2018. *Fundamentals of Queueing Theory*, 5th ed., Wiley, Hoboken, NJ.

Technological requirements

- Be able to access Blackboard to download course materials, upload homework assignments, etc.
- Have access to Excel and be able to run the freely available Excel-based QTS software (available on PC and Mac). Some coding may be expected and can be done in a language of the student's choice.
- *Online students must be able to stream class synchronously via Zoom and must own a web camera and use Respondus Lockdown Browser to take exams remotely.*

The companion ***Class Policies*** document specifies additional policies associated with the class.

Student Evaluation Criteria

Homework	15%
Project	15%
Midterm	35%
Final exam	35%

OR 647 Schedule

Last updated 1/19/21

Date	Lecture Topic	Assignments
Jan. 27	Introduction to queueing theory Little's law	
Feb. 3	Review of stochastic processes M/M/1 queue	Hmwk #1 due
Feb. 10	Lindley's equation Simulation of queueing models	
Feb. 17	Simple Markovian queues	Hmwk #2 due
Feb. 24	Simple Markovian queues	
Mar. 3	Simple Markovian queues	Hmwk #3 due
Mar. 11	** Midterm **	
Mar. 17	Advanced Markovian queues	
Mar. 24	Advanced Markovian queues	Hmwk #4 due
Mar. 31	Queueing networks	
Apr. 7	Queueing networks	Hmwk #5 due
Apr. 14	Fluid models	
Apr. 21	Models with general distributions	Project due
Apr. 28	Models with general distributions	Hmwk #6 due
May 5	** Final Exam **, 4:30 – 7:15 pm	