Course Name and Number: DATA 604, Simulation and Modeling Techniques
Credits: 3
Prerequisite: DATA606, Statistics and Probability for Data Analytics

Instructor: Dr. Lawrence V. Fulton, Lawrence.fulton@sps.cuny.edu, 210-837-9977
Office Hours: Sat / Sun 0800-1100 and by Appointment

Course Description:
This course teaches students the basics of simulation, systems modeling, and related software applications. The objective is to introduce students to the theory, statistical aspects, and implementation of computational methods for stochastic simulation and event-driven systems modeling. Students will be exposed to topics such as random sampling, Monte Carlo integration, variance reduction, Markov methods, queuing theory, discrete-event systems simulation, input/output data analysis, and simulation-based optimization. Students will develop a contextual understanding of simulation and modeling techniques by implementing the covered methods.

Learning Objectives:

1. Create Simulation Models
2. Evaluate Simulation Models

Program Learning Outcomes/Competencies addressed by the course:

1. Business Understanding. Apply frameworks and processes to build data-analytic solutions from an understanding of business goals.
2. Data Programming. Use industry standard statistical tools and simulation packages.
3. Foundational Math and Statistics. Emphasis on probability, statistics, and computational methods.
4. Data Understanding. Collect, describe, model, explore and verify data.
5. Prescriptive Modeling. Selecting prescriptive modeling techniques, generating test designs, building and assessing models.
6. Model Implementation and Deployment. Students will learn to implement simulation models for the various prescriptive modeling techniques covered in the course.
7. Presentation. Students will deliver presentations of their project results.

How is this course relevant for IS and data analytics professionals?
Simulation and modeling techniques are essential skills in today's data-driven business environment where there is inherent uncertainty embedded in real-world decision-making processes. The material covered in this course lies at the heart of prescriptive data analytics, which suggests decision options on how to take advantage of a future opportunity or mitigate a future risk, while showing the implication of each decision option.

Assignments and grading:

1. Assignments: During the course, you will be completing a series of individual assignments. Your final assignment is the design and presentation of a simulation representing a pre-approved project. This assignment will include the working simulation code and a presentation.

2. Examinations: This course has one final examination.

3. Grade Evaluation: Grades in this course are determined by the percentage of points obtained.

Assignment	**Percentage , Points**
Final Project	30%, 6 graded areas x 5 points each = 30 points
Discussions	24%, 4 points x 6 discussions = 24 points

Homework	24%, 4 points x 6 homework = 24 points
Final Exam	22%, 22 questions x 1 point each = 22 points
Total	100%, 100 points

4. **Grading Rubric:** The grading rubrics follow.
   a) Each project (homework and final) will be graded based on the built-in rubrics in Blackboard.
   b) The final case rubric is posted to Blackboard.
   c) Discussions are applied analysis from the texts. You must post a response by Wednesday at midnight (ET) and respond to at least one of your colleagues' contributions, providing meaningful feedback on the analysis. The rubric for each discussion is posted to Blackboard.

5. **Late Policy for Assignments:** Not accepted during the summer session

6. **Communication Policy:** I respond to all emails within 48 hours. If you have a pressing issue, please feel free to text me at the phone number in the syllabus.

7. **Grades:** I assign grades based on the following table.

Quality of Performance	Letter Grade	Range %	GPA/ Quality Pts.
Excellent - work is of exceptional quality	A	93 - 100	4
	A-	90 - 92.9	3.7
Good - work is above average	B+	87 - 89.9	3.3
Satisfactory	B	83 - 86.9	3
Below Average	B-	80 - 82.9	2.7
Poor	C+	77 - 79.9	2.3
	C	70 - 76.9	2
Failure	F	< 70	0

Course Materials:

Required Textbooks:

Modeling and Simulation in Python. Free! https://greenteapress.com/wp/modsimpy/

Anaconda Python version 3.6 or better. Free software

Simulation Modeling with SimPy. Free: https://pythonhosted.org/SimPy/Manuals/Manual.html#id15

Course Meeting Time: Mondays, 6 pm ET via Zoom Software. I will post the invitation.

COURSE OUTLINE. HW=Homework, D=Discussion

Week of	Topics covered	Assignments
Week 1	Introduction / Modeling 101	HW1, D1, Read Chapters 0-3
Week 2	Population Models	HW2, D2, Read Chapters 4-5
Week 3	Growth Models	HW3, D3, Read Chapters 6-7

Week 4	Prediction, Analysis	HW4, D4, Read Chapters 8-9
Week 5	Case Studies, Epidemiology	HW5, D5, Read Chapters 10-11
Week 6	Optimization	HW6, D6, Read Chapters 12-13
Week 7	Final Project Presentations	Project 1, Final Project

ACCESSIBILITY AND ACCOMMODATIONS

The CUNY School of Professional Studies is firmly committed to making higher education accessible to students with disabilities by removing architectural barriers and providing programs and support services necessary for them to benefit from the instruction and resources of the University. Early planning is essential for many of the resources and accommodations provided. Please see:
http://sps.cuny.edu/student_services/disabilityservices.html

ONLINE ETIQUETTE AND ANTI-HARASSMENT POLICY

The University strictly prohibits the use of University online resources or facilities, including Blackboard, for the purpose of harassment of any individual or for the posting of any material that is scandalous, libelous, offensive or otherwise against the University's policies. Please see:
http://media.sps.cuny.edu/filestore/8/4/9_d018dae29d76f89/849_3c7d075b32c268e.pdf

ACADEMIC INTEGRITY

Academic dishonesty is unacceptable and will not be tolerated. Cheating, forgery, plagiarism and collusion in dishonest acts undermine the educational mission of the City University of New York and the students' personal and intellectual growth. Please see:
http://media.sps.cuny.edu/filestore/8/3/9_dea303d5822ab91/839_1753cee9c9d90e9.pdf

STUDENT SUPPORT SERVICES

If you need any additional help, please visit Student Support Services:
http://sps.cuny.edu/student_resources/