CDS 230 Modeling and Simulation I
Spring 2022

Class Meetings:

- Monday & Wednesday 10:30-11:45 @ G207

Instructor Information:

- Instructor: Dr. Sohyun Park, spark230@gmu.edu
- Office Hours: TR 14:00-16:00 @ G656

Prerequisite:

- No formal prerequisites. CDS 130 is recommended.

Course Description:

Modeling and simulation is an emerging engineering discipline that leverages techniques and tools from various other disciplines (e.g., computer science, systems engineering, mathematics) to develop computational models. Such models enable us to create cost-effective, safe, and large-scale experimentation capabilities of real-world systems. Modeling and simulation is heavily used in areas such as biology, healthcare, military training and operations planning, transportation, manufacturing, logistics, and aerospace, among others.

This course teaches the fundamentals of modeling and simulation and helps gain the necessary skills for developing computational models of real-world systems. Programming languages are commonly used in simulation model development. In this respect, the first half of the course covers the basic concepts of the Python programming language, which will be used in the second half of the course to develop computational models. Specific modeling techniques to be covered in the second half of the course are dynamical systems, Monte Carlo simulation, and discrete-event simulation.

The course is divided into weekly modules. All course materials (slides, reading materials, lab data and exam study guide etc.) will be provided online via Blackboard (https://blackboard.gmu.edu/). This is a 3-credit hour class. For each week, students should expect approximately 3 hours spent on online lectures and labs, and 6 hours of independent study such as textbook reading, online quizzes, lab assignments and preparation for the exam to earn a C grade.

Objectives

- To have a fundamental knowledge of modeling and simulation,
- To be able to write basic Python code,
- To be able to create and run basic simulation models,
- To gain experience with model development software.

Materials

- Textbook and reading materials:
    - No textbook is required for this course. Thanks to Dr. Carlos Cruz, we have lecture notes that are helpful for this class. Make sure to download the latest copy before using it. The following is a list of books that you may find helpful:
        - Lecture Notes by Carlos Cruz: http://hamdikavak.com/course-modsim-1/lecture_notes.pdf
        - Modeling and Simulation in Python by Allen B. Downey. Publisher: Green Tea Press. Free e-book: http://greenteapress.com/modsimpy/ModSimPy3.pdf
        - Learning Scientific Programming with Python (1st edition) by Christian Hill. Publisher: Cambridge.
        - Modeling and Simulation Fundamentals: Theoretical Underpinnings and Practical Domains by John A. Sokolowski and Catherine M. Banks. Publisher: Wiley.
        - Simulation by Steward Robinson. Publisher: Macmillan International.

Each week's reading materials, including lecture and readings, are organized in two modules on Blackboard. All content in each module is required for reading.

- Data storage:
    - A portable memory device (with 16GB or larger) or a cloud drive (OneDrive, Dropbox etc.) is needed for data storage.

Evaluation

- Labs – 50%
    - There will be 8 labs, each with an assignment. All lab assignments will count toward your final grade of the course.
    - A single homework may involve a combination of questions requiring you to write Python code and textual answers. Lab assignments are due ***one week after a lab is assigned.*** Please refer to the course schedule for detailed information.
    - Programming assignments:
        - should be submitted as a single Python (.py or .ipynb) file per homework named according to the format: firstname_last_name_HW_X.py or firstname_last_name_HW_X.ipynb.
        - please use homework templates (jupyter notebook or .py) located on the course website under the "References" section.

- Exams – 50%
    - The course includes mandatory midterm and final exams. You are responsible for all the content covered before the exam. Both the midterm and final exam will be conducted on paper. There will be no group work in the exam. You're not allowed to use other communication technologies. The honor code will be in effect in ensuring that all work turned in will be your own and that you followed the exam rules.
    - A student who cannot write a course examination or complete a course homework because of an incapacitating illness, severe domestic affliction, or other compelling reasons can apply for an extension of time. Note that such extensions will be evaluated case by case. There is no guarantee that the instructor will grant the extension.
- Attendance – extra 5%
    - 0.2% per every attendance will be added to your final grade.
    - An attendance sheet will be passed around the classroom.
- Grading Scale

A+	97.0-100%	B0	81.0-84.9%	C-	65.0-68.9%
A0	93.0-96.9%	B-	77.0-80.9%	D	60.0-64.99%
A-	89.0-92.9%	C+	73.0-76.9%	F	below 60.0%
B+	85.0-88.9%	C0	69.0-72.9%		

Software

This course will use Python version 3.7 (or later) distributed via Anaconda (https://www.anaconda.com/distribution/). Students are welcome to install other python distributions of their choice as long as the version number matches.

Course Policies

- Email correspondence policy
    - You are responsible for all course related emails, so be sure to check your inbox on a daily basis.
    - When emailing your instructor, please always begin the subject of the email with the course number (CDS230) and your name (first name followed by last name). This is important as your instructor teaches multiple classes and need to know to which class you are referring. A proper email subject should be like this:

      CDS230_Walter White_Questions on Lab 3
- Course website policy
    - You are responsible for all announcements, additional readings, assignments and other material posted on the course website. Be sure to check it frequently.
- Lab questions policy
    - If you have any questions on lab content (can't finish specific steps, tools are not working etc.), please contact your instructor via email.
    - Blackboard discussion boards will be created for all labs. You can also communicate with classmates, instructor via discussion boards.

    - If you have concerns on lab grades, please contact your instructor via email.
- Late submission policy
    - Assignments will be penalized 10% for each business day late. Thus, assignments submitted 10 business days after the deadline will be graded 0.
    - Extensions will not be granted due to lost work; be sure you back up and keep all your work.
- Exam policy
    - Exams must be taken at the scheduled time (detailed information can be found in Blackboard), unless you have informed your instructor ***before*** the exam with proper reasons and documents and got approved by the instructor. Please contact your instructor in advance of the scheduled exam to schedule a make-up exam, except in the case of emergency.
        - Make-up exams for excused absences will not be penalized.
        - Make-up exams for unexcused absences will be penalized 15%.
- Disability Services policy
    - Students with disabilities that have been certified by the Office for Disability Services (DS) will be appropriately accommodated and should inform the instructor as soon as possible of their needs.
        - Point of Contact: Jonna Park, Senior Coordinator for Student Care and Conduct (spark214@gmu.edu)
        - Website: https://ds.gmu.edu/ for more information
    - Please contact the instructor as soon as you are registered with DS for attendance, assignment and/or exam accommodations.
- Academic Misconduct policy
    - It is the responsibility of the Committee on Academic Misconduct (COAM) to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee. More information about the Honor Code, including definitions of cheating, lying, and plagiarism, can be found on the Committee of Academic Integrity's website at https://masonkorea.gmu.edu/resources-and-services/ cai/overview.
    - Collaboration for the purposes of troubleshooting is highly encouraged in this course, but everyone is expected to submit their own unique work. For example, asking a classmate how to resolve an unexpected error message is OK, but using another classmate's work (e.g. screen captures, etc.) as your own is NOT ok, regardless of whether or not they provide consent for the use of their materials. (Note: There are many other acceptable/unacceptable actions than those exemplified here.) If you have any questions or concerns about acceptable/unacceptable actions, ask your instructor for clarification/permission.
    - All open-ended responses to questions, prompts, etc. must be written entirely, nearly entirely, or at least in majority using your own words. Use credible sources,

and cite all sources, including those only referenced, those indirectly paraphrased, and those directly quoted, being sure to use quotation marks to identify excerpts from these credible sources. This expectation to cite all of your sources also extends to the textbook, the lab instructions, lecture slides, other course materials, online resources, etc. Please contact Center for the Academic Resource Center or the instructor if you have difficulties organizing language for assignments.

- Student Privacy
    - All course materials posted to Blackboard or other course sites are private; by federal law, any materials that identify specific students (via their name, voice, or image) must not be shared with anyone not enrolled in this class.
    - Video recordings of class meetings that include audio or visual information from other students are private and must not be shared.
    - Live Video Conference Meetings (e.g. Collaborate or Zoom) that include audio or visual information from other students must be viewed privately and not shared with others in your household
- Other Course Policy
    - Please refer to Student Academic Services for more academic services provided by MK.

Other Course Technology

Please contact GMU IT Service Desk for any help with password, university e-mail, Blackboard, or any other technology issues, questions, or requests.

- Phone: 032-626-5300
- Email: mkits@gmu.edu
- Self-Service and Chat support: https://masonkorea.gmu.edu/resources-and-services/it-services

Basic technical skills necessary for this course

- Basic computer and web-browsing skills
- Navigating and utilizing Blackboard

Ethical Discourse and Inclusivity

George Mason University is committed to social justice. I share that commitment and strive to maintain a positive learning environment based on open communication, mutual respect, and non-discrimination. In this class we will not discriminate on the basis of race, sex, age, economic class, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment will be appreciated and given serious consideration. Disability Accommodations If you are a student with a physical, learning, and/or psychological disability, I will gladly work with you to arrange academic accommodations for this class. Please note that reducing assignments or reducing the class participation requirement are not permitted as accommodations for a disability at the college level.

Tentative Course Content Schedule

Week	Date	Lecture	Assignment release	Readings	Due
1	M 2/21	M1: Course Overview			
	W 2/23	M1: Introduction to Modeling and Simulation			
2	M 2/28	M2: Getting started with Python		Ch 1, 2	
	W 3/2	M2: Getting started with Python	Lab 1		
3	M 3/7	M2: Getting started with Python			
	W 3/9	Presidential Election (no class)			
4	M 3/14	M3: Control Flow		Ch 3	Lab 1
	W 3/16	M4: Strings	Lab 2		
5	M 3/21	M5: Collections and Iteration		Ch 3,4,5	
	W 3/23	M5: Collections and Iteration	Lab 3		Lab 2
6	M 3/28	M6: Making your code organized		Ch 6, 11	
	W 3/30	M6: Making your code organized			Lab 3
7	M 4/4	M7: Using Third Party Packages		Ch 9, 10	
	W 4/6	M7: Using Third Party Packages	Lab 4		
8	M 4/11	Midterm preview			
	W 4/13	**Midterm**			
9	M 4/18	Midterm solutions			Lab 4
	W4/20	M8: Dynamical Systems			
10	M 4/25	M8: Dynamical Systems	Lab 5		
	W 4/27	M9: Representing uncertainty in models			
11	M 5/2	M9: Representing uncertainty in models	Lab 6		Lab 5
	W 5/4	M9: Representing uncertainty in models			
12	M 5/9	Make Up Day (no class)			
	W 5/11	M9: Representing uncertainty in models	Lab 7		Lab 6
13	M 5/16	M10: Discrete Event Simulation			
	W 5/18	M10: Discrete Event Simulation	Lab 8		Lab 7
14	M 5/23	Final exam preview			
	W 5/25	Study day (Q&A session)			Lab 8
15	M 5/30	***Final Exam***			
	W 6/1	Regional Election (no class)			