Course Syllabus
IE 5357: Computer Simulation Applications (CRN: 24432)
Spring 2023

Instructor	Dr. Md Fashiar Rahman
Location	Liberal Arts Building, Room 122
Meeting Time	Thursday: 6.00 PM – 8.50 PM
Instructor's Office	A 243
Instructor's Office Hours	Monday and Wednesday: 12 PM to 1.00 PM
Email	mrahman13@utep.edu
Teaching Assistant	TBD

1 Course Web Page

We will use Blackboard as the platform to share the course contents. So, students must check the course homepage regularly through Blackboard using the following link using their UTEP credentials.

https://blackboardlearn.utep.edu/

2 Course Motivation

Simulation modeling solves real-world problems safely and efficiently. It provides an important analysis method for easy verification, communication, and understanding. Across industries and disciplines, simulation modeling provides valuable solutions by giving clear insights into complex systems. Simulation enables experimentation on a valid digital representation of a system. Unlike physical modeling, such as making a scale copy of a building, simulation modeling is computer-based and uses algorithms and equations. Simulation software provides a dynamic environment for analyzing computer models while running, including the possibility of viewing them in 2D or 3D. The uses of simulation in industries are varied, and it is often utilized when conducting experiments on a real system is impossible or impractical, often because of cost or time.

The ability to analyze the model as it runs sets simulation modeling apart from other methods, such as those using Excel or linear programming. By being able to inspect processes and interact with a simulation model in action, both understanding and trust are quickly built.

3 Course Description (3 Credits)

This course is an advanced course for graduate students. In this course, students will be introduced to the different concepts and methods of computer simulation. Students will investigate the use of discrete-event simulation (DES), pedestrian model, and agent-based simulation to solve mathematically intractable problems in stochastic modeling. The course emphasizes the fundamental concepts and interpretation of results from process and agent-centric models. The course includes topics such as 1) Queuing theory, 2) Introductory Java programming, 3) Several case studies for DES, 4) Pedestrian modeling, 5) Agent-based modeling, 6) Statistical distribution, 7) Statistical result analysis of simulation output, 8) Presenting simulation using a dashboard, and 9) Model verification and validation.

4 Prerequisites

Basic engineering probability and statistics. Having basic programming knowledge would be an advantage. However, this is not a course in mathematical probability or advanced statistics.

5 Course Objectives and Learning Outcomes

The primary objectives pursued in this course are as follows:

- be familiar with commonly used techniques in simulation, such as random number and variate generation, input modeling, events and event types, run-length issues, auto-correlated output, and presentation of simulation results.
- be able to identify problems from their specific domains suitable for simulation, and correctly approach the modeling of those problems, including identification of simulation goals and necessary real-world data.
- be able to implement and execute discrete-event simulation models and correctly interpret and present the results.

6 Required Book Reference

There is no specific textbook in this course. Necessary reading materials will be provided during the semester. However, students can use the following open-source learning materials.

- The Big Book of Simulation Modeling: Multimethod Modeling with AnyLogic 8 Authors: Andrei Borshchev, Ilya Grigoryev (https://www.amazon.com/Big-Book-Simulation-Modeling-Multimethod-ebook/dp/B00YO0K1ZQ)
- AnyLogic in three days – A quick course in simulation modeling by Ilya Grigoryev (https://www.anylogic.com/resources/books/free-simulation-book-and-modeling-tutorials/)

7 Technology Requirements

This course has been designated as a laptop course. Most class activities will require a laptop. Hence, you must bring your laptop to every class unless otherwise noted explicitly. In general, I assume that each student has a laptop with the appropriate software. You will need access to a computer/laptop, scanner, webcam, and microphone. You will need to download or update the software, including Microsoft Office, Adobe Acrobat Reader, Windows Media Player, QuickTime, and Java. Check that your computer hardware and software are up-to-date and able to access all parts of the course. Suppose you do not have word-processing software. You can download Word and other Microsoft Office programs (including Excel, PowerPoint, Outlook, and more) for free via UTEP's Microsoft Office Portal. Click the following link for more information about Microsoft Office 365 and follow the instructions.

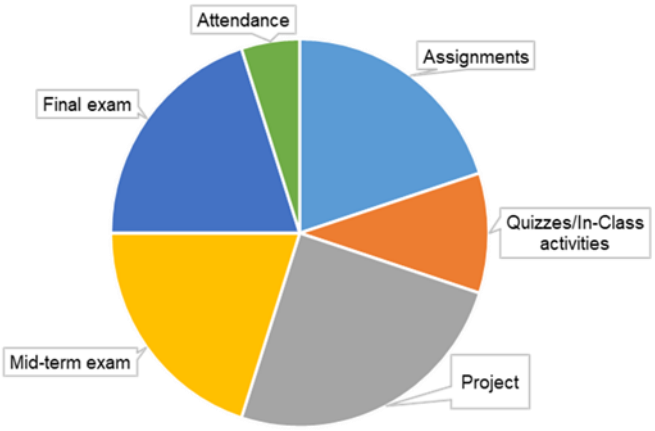
Students must also install AnyLogic personal learning edition (PLE) on their laptops. AnyLogic PLE is free and compatible with all kinds of operating systems. Click the following click to install the AnyLogic PLE version. Installing AnyLogic is easy and straightforward. If you have any download/installation issues, visit my office hours of further instructions.

IMPORTANT: If you encounter technical difficulties beyond your scope of troubleshooting, please contact the UTEP Help Desk, as they are explicitly trained in assisting with the

technological needs of students. Please do not contact me for this type of assistance. The Help Desk is much better equipped than I am to assist you!

8 Course Conducting Procedure and Course Materials

The instructor will meet every Thursday from 6.00 PM to 8.50 PM in the Liberal Arts Building, room 122. The instructor will post lectures, links to other relevant reading materials, homework questions, and project details on Blackboard before the class. Each week, we will cover a set of learning materials and progress through the semester according to the tentative course schedule mentioned on Pages 8 and 9. As we progress through the semester, students' progress will be evaluated based on six (6) measurable activities – 1) Assignments/Homework, 2) quizzes/In-class activities, 3) course projects, 4) mid-Term exams, 5) final exam, and 6) Attendance. All submissions (except the mid-term and final exams) MUST be submitted through Blackboard unless advised to submit a hard copy. Paper submissions or submissions through email will not be accepted. The point distribution of each of the assessment activities is shown below.



Graduate Student	
Assignment	20%
Quizzes/In-class activities	10%
Mid-Term Exam	20%
Final Exam	20 %
Course Project	25%
Attendance	5%

8.1 Homework/Assignments (20%):

There will be four (4) Homework/Assignments in this course. The homework will be posted at least one week before the due date. You will be required to submit your work through the Blackboard submission link. The instructor will create the submission link and notify you in due time. To prepare your assignment submission, you can compose your answer using a computer or handwrite your answer on paper. If you write your answer, you need to take clear photos and screenshots, and compile them in a word file or scan them into a pdf file. Remember that I will accept only pdf or word files for your submission (no image file will be acceptable).

Make-up work will be given only in the case of a documented emergency. Note that make-up work may be in a different format than the original work, may require more intensive preparation, and may be graded with penalty points. You will receive a zero if you miss an assignment and the reason is not considered excusable. It is, therefore, important to reach out to me—in advance if possible—and explain with proper documentation why you missed the due date. Once a deadline has been established for make-up work, no further extensions or exceptions will be granted.

8.2 Quizzes/In-class activities (10%)

The quizzes/In-class activities will be in class without previous notice. The contents of the quiz will be covered in the same class. Students must submit the in-class activities by the end of class as instructed. So, all the students are suggested to be regular in class. Note that there will be no make-up for the quizzes/in-class activities. So, if you miss a quiz without any reasonable excuse, you will receive a zero.

8.3 Course project (25%)

All students must complete a group project on a specific problem instructed by the instructor. As this will be a group project, students must form a group of two (2) members. If the class has an odd number of students, one group may have three members upon the instructor's approval. The purpose of the term project is to provide an opportunity for an in-depth understanding and application of simulation in a real-world problem. A brief description of the course project is described below.

Project Description: Healthcare systems, especially the emergency department (ED), struggle to accommodate patients with limited resources and capacity. Moreover, the uncertain patient arrival rate and resource unavailability make the systems more complex. The performance of health operations greatly depends on effective decision-making and management in consideration of uncertain situational invariants. This project is designed to perform a simulation-based optimization technique that captures the operational variances over time to deal with three key issues in healthcare management systems - 1) determining the utilization of resources (beds in the emergency room, doctors, and nurses) considering the uncertain behavior of healthcare systems; 2) identifying the optimal number of resources based on any target level of resource utilization, and 3) minimizing the patient length of stay to enhance the positive experience to patients in ED.

Remember that this is not a research project, but rather a class project for learning purposes. Hence, the project considers the plausible logic of patient flow, time distribution for different services, and the number of resources utilized within the ED. For step-wise understanding, the project is divided into three stages. Each stage has specific learning objectives and a set of tasks to accomplish. As we progress through the semester, the instructor will discuss the project stages in detail.

Each stage of the project must be accomplished by the due date (please refer to the tentative schedule of the course syllabus) using the AnyLogic simulation software. Upon completing the final stage, you will be required to submit

a. A final project report describing the simulation procedure (instructions will be given during the class)
b. PowerPoint presentation file on your results, outcomes, and decision (instructions will be given during the class)
c. AnyLogic source file.

8.4 Mid-term (20%) and final (20%) exams

There will be two (2) major exams in this course. The mid-term exam will be conducted on March 23, 2023, and the final exam will be on May 04, 2023. Both exams will be paper-based and conducted during class time from 6.00 PM to 8.500 PM (MST) on the specified date. Thus, you will get 2 hours and 50 minutes to complete the exams. There will be 25 to 30 questions, including multiple-choice (MCQs), true/false, short answer questions, fill-in-the-blanks, word pooling, calculated numeric, etc. The exam will be in a closed-book format, and you will not be allowed to discuss and communicate with your friends/peers. Any

indication/proof of peer discussion and sharing answers will be considered a violation of academic integrity. If there are any changes, the exam date will be announced well ahead of time, so manage your schedule accordingly. There will be no make-up exams.

8.5 Attendance (5%)

To be successful in this course, it is strongly recommended that you do not skip any class. Student attendance will be recorded using a sign-in sheet. Please remember that any student having an attendance below 60% of the total class will receive zero (0) points for the attendance category.

9 Assessment of Final Grade

Your final grade will be determined based on the points you achieved in the above-mentioned five categories of submissions – 1) Assignments/homework, 2) Weekly tests, 3) Mid-term exam, 4) Final exam, and 5) Course project. The points of each category will be scaled to 20% and thus will get a total of 100 points from the five categories. In the end, your final grade will be as follows:

Grade A	Grade B	Grade C	Grade D	Grade F
90 or above	80 to 89	70 to 79	60 to 69	0 to 59

10 Blackboard Submission

Students must submit all the assignments and deliverables through the Blackboard. Submission through email will only be accepted if it is asked for or pre-approved. I strongly suggest you submit your work with plenty of time to spare if you have a technical issue with the course website, network, and computer. If you are experiencing difficulties submitting your work through the course website, please get in touch with the UTEP Help Desk. It is your responsibility to submit the assignments on Blackboard before the due date.

11 Office Hours

The office hours are scheduled on each Monday and Wednesday from 12.00 PM and 1.00 PM. The instructor will host office hours both online and in person. The online meeting sessions will be hosted via Zoom video conferencing, and the links will be provided on Blackboard. If you prefer to meet me in person, you are welcome. My office number is A-243, located on the 2nd floor of the Engineering Building. You can take the stairs beside the dean's suite and turn left to find my office.

12 Contact Your Course Instructor

UTEP e-mail is the best way to contact me. I will make every attempt to respond to your e-mail within 24-48 hours of receipt. When emailing me, email from your UTEP student account, and please put the course number in the subject line. In the body of your e-mail, clearly state your question. At the end of your e-mail, be sure to put your first and last name and your university identification number. I am not active via MS Team. So, asking questions through MS Team will not guarantee my reply.

13 Netiquette

As we know, sometimes communication online can be challenging. It's possible to miscommunicate what we mean or to misunderstand what our classmates mean given the lack of body language and immediate feedback. Therefore, please keep these netiquette (network etiquette) guidelines in mind. Failure to observe them may result in disciplinary action.

- Always consider audience. This is a college-level course; therefore, all communication should reflect polite consideration of other's ideas.
- Respect and courtesy must be provided to classmates and to the instructor at all times. No harassment or inappropriate postings will be tolerated.
- When reacting to someone else's message, address the ideas, not the person. Post only what anyone would comfortably state in a face-to-face situation.
- Blackboard is not a public internet venue; all postings to it should be considered private and confidential. Whatever is posted on in these online spaces is intended for classmates and professor only.

14 Accommodations Policy

The University is committed to providing reasonable accommodations and auxiliary services to students, staff, faculty, job applicants, applicants for admissions, and other beneficiaries of University programs, services and activities with documented disabilities in order to provide them with equal opportunities to participate in programs, services, and activities in compliance with sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA) of 1990 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Reasonable accommodations will be made unless it is determined that doing so would cause undue hardship on the University. Students requesting an accommodation based on a disability must register with the UTEP Center for Accommodations and Support Services (CASS). Contact the Center for Accommodations and Support Services at 915-747-5148, or email them at cass@utep.edu, or apply for accommodations online via the CASS portal.

15 Scholastic Integrity

Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as ones' own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at El Paso must be reported to the Office of Student Conduct and Conflict Resolution (OSCCR) for possible disciplinary action. To learn more, please visit HOOP: Student Conduct and Discipline.

16 Plagiarism Detecting Software

Some of your course work and assessments may submitted to SafeAssign, a plagiarism detecting software. SafeAssign is used review assignment submissions for originality and will help you learn how to properly attribute sources rather than paraphrase.

17 Copyright Statement for Course Materials

All materials used in this course are protected by copyright law. The course materials are only for the use of students currently enrolled in this course and only for the purpose of this course. They may not be further disseminated.

18 COVID-19 Precautions

You must STAY AT HOME and REPORT if you (1) have been diagnosed with COVID-19, (2) are experiencing COVID-19 symptoms, or (3) have had recent contact with a person who has received a positive coronavirus test. Reports should be made at screening.utep.edu. If you know of anyone who should report any of these three criteria, you should encourage them to report. If the individual cannot report, you can report on their behalf by sending an email to COVIDaction@utep.edu. For each day that you attend campus—for any reason—you must complete the questions on the UTEP screening website (screening.utep.edu) prior to arriving on campus. The website will verify if you are permitted to come to campus. Under no circumstances should anyone come to class when feeling ill or exhibiting any of the known COVID-19 symptoms. If you are feeling unwell, please let me know as soon as possible, and alternative instruction will be provided. Students are advised to minimize the number of encounters with others to avoid infection. Wear face coverings when in common areas of campus or when others are present. You must wear a face covering over your nose and mouth at all times in this class. If you choose not to wear a face covering, you may not enter the classroom. If you remove your face covering, you will be asked to put it on or leave the classroom. Students who refuse to wear a face covering and follow preventive COVID-19 guidelines will be dismissed from the class and will be subject to disciplinary action according to Section 1.2.3 Health and Safety and Section 1.2.2.5 Disruptions in the UTEP Handbook of Operating Procedures.

19 Civility Statement:

Please be respectful of all students' right to learn without disruptions. In line with this statement please make an active effort to keep the talking to a minimum during lectures and presentations. Also make an active effort to either turn cell phones off or turn them to vibrate mode prior to the start of class. Appointments with instructor should be made in advanc

20 Class Recordings

Class may be recorded, if needed. The use of recordings will give you access to class lectures and group discussions in the event you miss a synchronous or in-person meeting due to illness or other extenuating circumstances. Our use of such technology is governed by the Federal Educational Rights and Privacy Act (FERPA) and UTEP's acceptable-use policy. A recording of class sessions will be kept and stored by UTEP in accordance with FERPA and UTEP policies. I will not share the recordings of our class activities outside of course participants. You may not share recordings outside of this course. Doing so may result in disciplinary action

Tentative Course Schedule (It may change, based on feedback or progress)

Week	Date	Contents	Learning objectives	Submission items posting/Task	Submission due*
1	01/19	▪ Course Introduction ▪ Intro to modeling and simulation	▪ Understand the course ▪ Basic understanding of simulation and modeling		
2	01/26	▪ Methods of simulation ▪ Intro to queuing theory	▪ Know simulation methods ▪ Understand the queuing concepts ▪ How to apply queueing theory in simulation		
3	02/02	▪ Intro to AnyLogic and Java Programming ▪ Discussion on the course project	▪ Be familiar with AnyLogic software ▪ Learn basic Java programming	▪ Assignment – 1 (Java programming) ▪ Create a project group	
4	02/09	▪ Learning process modeling library with DES – I (Call center model) ▪ Building simple simulation	▪ Understand basic building blocks in the simulation ▪ how to model different events in the simulation ▪ Use resource pool ▪ Adding a branch in the simulation ▪ How to collect data using charts	▪ Assignment 2 (Call center problem)	▪ Assignment 1
5	02/16	▪ Learning process modeling library with DES – II (Call center model) ▪ Building simulation and statistical analysis	▪ Understanding different types of branching blocks ▪ Use of different charts for statistical analysis ▪ Exploring other useful process blocks		▪ Submit your project group information
6	02/23	▪ Learning 2D and 3D animation (Job shop model) ▪ Discussion on project progress (Stage 1)	▪ Understanding probability distribution and its application in simulation ▪ Explore more process blocks for warehouse simulation ▪ Create 2D and 3D animation	▪ Assignment 3 (Simple warehouse system)	▪ Assignment 2
7	03/02	▪ Learning pedestrian library – I (Airport model)	▪ Understand the pedestrian flow ▪ learn the use of pedestrian flow blocks ▪ Develop a simple pedestrian simulation		▪ Assignment 3

8	03/09	▪ Learning pedestrian library – II (Airport model) ▪ Presentation on project (stage-1 Completion)	▪ Adding logic to the pedestrian flow ▪ Learn more about 2D and 3D animation ▪ Use of databases in simulation		▪ AnyLogic source file of the project (Stage 1)
9	03/16	Spring break			
10	03/23	Mid-Term Exam			
11	03/30	▪ Experimentation on simulation model – II (Pizzeria model) ▪ Discussion on project progress (Stage 2)	▪ Use of parameter ▪ Creating a dashboard ▪ Perform optimization experiment	▪ Assignment 4 (Pizzeria experiment using stochastic distribution)	
12	04/06	▪ Use of GIS in simulation and Agent-based modeling ▪ Presentation on project stage-2 Completion	▪ Use of GIS in simulation ▪ Understand the concept of AB modeling ▪ Develop a simple AB model and GIS animation		▪ AnyLogic source file of the project (Stage 2)
13	04/13	▪ Agent-based modeling – I (Market model)	▪ More understanding of agent behavior in the AB model ▪ Understand the agent population ▪ Perform a comparison experiment on the AB model		▪ Assignment 4
14	04/20	▪ Advance topic, exam review, and course wrap-up ▪ Discussion on project progress (Stage 3)	▪ Model debugging and troubleshooting ▪ Model validation and verification ▪ Explore advanced applications		
15	04/27	Final project presentation. Students must submit an AnyLogic source file of the project (Stage 3) and a PowerPoint presentation file.			
16	05/04	Final Exam			
17	05/11	Final project report due. Instructions will be given during the class.			

**All submissions will be due at 5.00 PM on Thursday*