



LAMAR UNIVERSITY

MEMBER THE TEXAS STATE UNIVERSITY SYSTEM™

Syllabus

Lamar University, a Member of The Texas State University System, is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools to award Associate, Baccalaureate, Masters, and Doctorate degrees (more details at <http://www.lamar.edu>).

Department Industrial Engineering

Course Number INEN 4375-01

Course Title Simulation of Industrial Systems

Professor **Dr. Weihang Zhu**

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Personal Introduction

Welcome to Lamar University. My name is Weihang Zhu, and I will be your instructor of record for INEN4375. By way of a very brief introduction, I earned my baccalaureate and master's degrees in Mechanical and Energy Engineering and my Ph.D. degree in Industrial and Systems Engineering. I joined the faculty at Lamar in 2005 and I am currently an Associate Professor for the Department of Industrial Engineering in the College of Engineering.

Course Description

Introduction to concepts of simulation modeling and analysis with application to manufacturing and service systems. Students will apply problem solving and process analysis techniques to an industrial engineering problem and propose an improved systems design.

Course Objectives and Student Learning Outcomes

Students who successfully complete this course will be able:

1. To analyze data from time studies for use in simulation
2. To design and implement computer simulation for industrial systems
3. To analyze data from simulation results and find ways to improve systems

Academic Prerequisites

INEN 4320 with minimum grade of C, or graduate standing.

Technology Prerequisites

The minimum technical skills and the system requirements for this course:

System Requirements

Computer/Technology Requirements

1. Students will need regular access to a computer with a broadband Internet connection. The minimum computer requirements are:
 - Any current Flash-compliant browser (recent versions of Firefox or Safari)
 - Please note that Blackboard may not support Internet Explorer or Chrome.
 - 2GB of RAM, 4 GB or more preferred
 - Broadband connection (cable modem, DSL, or other high speed) required – courses are heavily video intensive
 - Video display capable of high-color 16-bit display – 1024 x 768 or higher resolution
 - A sound card and speakers or headphones
 - Current anti-virus software must be installed and kept up to date.
 - Students will need some additional free software for enhanced web browsing. Be certain to download the free versions of the software.
 - Adobe Reader (<http://www.mozilla.org>)
 - Adobe Flash Player (<http://get.adobe.com/flashplayer>)
 - Java (<http://www.java.com>)
 - Most home computers purchased within the last 3-4 years meet or surpass these requirements.
2. At a minimum, students must have Microsoft Office 2003 or newer, or OpenOffice, or Student Office for Mac. Microsoft Office is the standard office productivity software utilized by faculty, students, and staff. Microsoft Word is the standard word processing software, Microsoft Excel is the standard spreadsheet software, and Microsoft PowerPoint is the standard presentation software. Copying and pasting, along with attaching/uploading documents for assignment submission will also be required. If you do not have Microsoft Office or Student Office for Mac, you can check with the bookstore to see if they have any student copies.
3. **Your computer must be compatible with Blackboard.** Please see the [Blackboard Supported Browsers and Operating System](#) page to make sure your system will allow you to use all the tools and features available.

Technology Skills Requirements

You need to be able to:

- Navigate websites, including downloading and reading files from them.
- Download and install software or plug-ins such as Adobe Reader, Window Media Player or Flash.
- Use e-mail, including attaching and downloading documents/files from e-mail.
- Save files in commonly used word processing formats (.doc, .docx, .rtf).
- Copy and paste text and other items in computer documents.
- Save and retrieve documents and files on your computer.
- Locate information on the Internet using search engines.
- Locate information in the library using the online catalog.

Remote Exam Proctoring

There are two exams that need to be proctored: midterm exam and final exam. You have three options in taking proctored exams:

1. Come to campus to take exams together with on campus students at the same time;
2. Find an exam center near you to proctor the exam: you need to make sure you have stable broadband Internet access for the exam;
3. Use ProctorFree, an online proctoring service to proctor your exam: you need to make sure you have stable broadband Internet access for the exam; you also must have a working webcam and a microphone.

Course Project Presentation

You will be asked to make a video to record your presentation for the course project. The video needs to be uploaded to Youtube. You will share the link to your Youtube video through the Blackboard Discussion Board for peer comments and discussions.

Course Materials

Required Text: Simulation with Arena, 6th Edition, Kelton, W. David, Sadowski, Randall P. and Zupick, Nancy B., McGraw-Hill, Boston, 2013, ISBN 978-0-07-340131-7

The book will be referred to as “Kelton Textbook” in this syllabus.

Disability Resource Center for Students with Disabilities

Lamar University is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center (DRC) is located in the Communications building room 105. Office staff collaborates with students who have disabilities to provide and/or arrange reasonable accommodations. If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact the DRC at [\(409\) 880-8347](tel:4098808347) or drc@lamar.edu to arrange a confidential appointment with the Director of the DRC to explore possible options regarding equitable access and reasonable accommodations. If you are registered with DRC and have a current letter requesting reasonable accommodations, contact your instructor early in the semester to review how the accommodations will be applied in the course.

Response Times

The response time to emails is usually within 48 hours. The response time to discussion is usually within 7 days. The feedback on assignments and exams is within 2 weeks.

Software Used in This Class

Rockwell Arena; Student Version can be downloaded for free from:

<https://www.arenasimulation.com/academic/students>

Most of the assignment problems can be completed with student version.

Lamar University provides access to full version of Rockwell Arena software on campus.

Services Used in This Class

Here are some commonly used services and their privacy policies:

Blackboard - <http://www.blackboard.com/Footer/Privacy-Center.aspx>

Adobe Connect - <http://www.adobe.com/privacy.html>

ProctorU - <http://proctoru.com/privacy-policy>

Youtube - https://www.youtube.com/static?template=privacy_guidelines

Student Services

Information on Student services can be located at <http://students.lamar.edu/student-services/index.html>

Academic Integrity Statement

Lamar University expects all students to engage in academic pursuits in a manner that is above reproach. Students are expected to maintain complete honesty and integrity in their academic experiences both in and out of the classroom. Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. Disciplinary proceedings may be initiated against a student accused of any form of academic dishonesty including, but not limited to, cheating on an examination or other academic work which is to be submitted, plagiarism, collusion, and the abuse of resource materials.

Plagiarism shall mean the appropriation of another's work or idea and the unacknowledged incorporation of that work or idea into one's own work offered for credit.

Collusion shall mean the unauthorized collaboration with another person in preparing work offered for credit.

Abuse of resource materials shall mean the mutilation, destruction, concealment, theft or alteration of materials provided to assist students in the mastery of course materials.

Academic work shall mean the preparation of an essay, report, problem, assignment, creative work or other project that the student submits as a course requirement or for a grade.

Students are specifically warned against all forms of plagiarism, which include "purchasing, or otherwise acquiring and submitting as one's own work any research paper or other writing assignment prepared by an individual or firm." Plagiarism is defined as, "the appropriation and the unacknowledged incorporation of another's work or ideas into one's own offered for credit" (82). Students seeking to avoid plagiarism should consult either the course instructor or the most recent addition of the *MLA Handbook for Writers of Research Papers*. The course instructor will complete a thorough and impartial investigation of any instance of academic. A student found guilty of academic dishonesty will be notified in writing by the instructor of the violation, the penalty, and the student's right to appeal the determination of dishonesty and/or the sanction imposed. Penalties for academic dishonesty in this course will result in either a lowered letter grade or failure of the course as determined by the instructor.

Copyright Policy Statement

Copyright is defined as the ownership and control of the intellectual property in original works of authorship which are subject to copyright law. As an institution of higher learning that values intellectual integrity, Lamar University prohibits the distribution of published materials (print or electronic) in violation of copyright law.

Netiquette (Online Etiquette) Statement

Please adhere to the same standards of behavior and professional respect online that you would follow in face-to-face communication with others, but most particularly when writing email and when taking part in collaborative and discussion board activities. Lamar provides access to network resources, including the Internet, in order to support learning and to prepare students for the 21st century world. Students, however, are expected to adhere to the *Lamar University Acceptable Use Policies when Using Networks*. More comprehensive student code of conduct can be found at <http://students.lamar.edu/student-handbook.html#generalprovisions>.

- **Acceptable Use**

Students must respect the integrity and security of LU's computer systems and network, and the privacy and preferences of other users. Responsibility for learning about and complying with LU's Acceptable Use Policy ultimately rests with the individual. The network may be used to download, copy, or store any software, shareware, digital media files or freeware, as long as the use complies with copyright law; licensing agreements, and campus policies such as storage space limitations and network bandwidth restrictions. The network may not be used for any activity, or to transmit any material, that violates United States or local laws.

- **Unacceptable use**

The network may not be used for commercial purposes. Advertising and sponsorships on LU web sites is restricted. In addition, students may not permit other persons to use their usernames, passwords, accounts or disk space, or disclose their usernames, passwords or account information to any third party. Students may not log on to someone else's account, internet address, or other network codes, or attempt to access another user's files. Students may not create false or dummy accounts to impersonate someone else. Students may not try to gain unauthorized access ("hacking") to the files or computer systems of any other person or organization. Students may not impersonate another person by forging e-mail, web pages or other electronic media. Students who maliciously access, alter, delete, damage or destroy any computer system, computer network, computer program, or data will be subject to disciplinary action by LU, and criminal prosecution as well. Students may not disrupt or attempt to disrupt network traffic, and they may not attempt to monitor or capture network traffic in any way. Finally, students may not intentionally create, store, display, print or transmit information that violates the university's Sexual Harassment Policy.

General Guidelines to Respect All Participants

- Respect the right of each person to disagree with others.
- Treat people the same as you would face-to-face.
- Respect the time of others

Guidelines When Communicating with Others (email, discussion, blogging, and etc.)

- Always sign your names to any contribution you choose to make.
- Be constructive in your responses to others in the class.
- Do not use all caps. (Doing so may be interpreted as shouting)
- Re-read your postings before sending them.
- Always think before you write.
- Respond respectfully.
- Use appropriate grammar and structure.
- Spell-check your postings.
- Use short paragraphs focused on one idea

- Use appropriate business language at all times

Distance Education Librarian

Distance education students and faculty have access to a dedicated distance education librarian. Contact information and a full account of services can be found at <http://vmlibweb.lamar.edu/distanceded/distedservice.htm>

Lamar University Privacy Policy Statement

Student records maintained by Lamar University comply with the Family Education Rights and Privacy Act of 1974 as amended (PL93-380). Detailed information should be accessed through this link: <https://sacs.lamar.edu/catalog/PrefMaterial/V.GenAcademicPol.htm#edurights>.

Grading Policy and Evaluation

Quiz (online assignment)	10%
Simulation exercise	20%
Midterm exam	20%
Final exam	25%
Course project	20%
Lecture and Lab attendance	5%
Total	100%

A student earned 90% will receive a grade of A. 80%, B. 70%, C. 60%, D. Otherwise, F.

Attendance Policy

The attendance on lectures is required because simulation concepts and practices can be best learned through interactive questions and answers. You are expected to attend all labs **on time**, unless you have Doctor's approval. You must be in the lab unless you finish all the assignments. Each unauthorized attendance costs 0.5% in the final grade. The total lost in points due to missing attendance will be up to 5% in the final grade.

Homework Collection and Make-up Work

Homework must be submitted on the due day. No late homework will be accepted. Please pay attention to Blackboard for the update.

Missed or late course work can only be made up if pre-approval is obtained. Otherwise, a grade of zero is assigned for the missed work.

Course Project

You will form a group of 1~3 persons and work on a course project. Details will be provided in a separate document.

Drop Dates

This course adheres to the add/drop standards for each term as stated by Lamar University. For more details, refer to the [Lamar Academic Calendar](#). If the link does not work, visit Lamar University at <http://www.lamar.edu>, and search the site with the term, "Academic Calendar."

Course Evaluation

Instruction as well as student performance is subject to evaluation. Procedures for evaluation will be provided near the end of this course.

LU Connect Portal

Students are asked to obtain a Lamar Electronic Account username and password so they can log onto the LU Connect Web site. Students may get information on how to get into the LU Connect Web site from the University's homepage (<http://www.lamar.edu>) by clicking on the LU Connect link on the left top corner of the screen. Follow the steps to secure your Lamar username and password. Access to library resources is available through the <http://www.lamar.edu>.

Emergency Procedures

Many types of emergencies can occur on campus; instructions for specific emergencies such as severe weather, active shooter, or fire can be found at [HTTP://WWW.LAMAR.EDU/ABOUT-LU/ADMINISTRATION/RISK-MANAGEMENT/INDEX.HTML](http://WWW.LAMAR.EDU/ABOUT-LU/ADMINISTRATION/RISK-MANAGEMENT/INDEX.HTML)

Severe Weather:

- Follow the directions of the instructor or emergency personnel
- Seek shelter in an interior room or hallway on the lowest floor, putting as many walls as possible between you and the outside
- If you are in a multi-story building, and you cannot get to the lowest floor, pick a hallway in the center of the building
- Stay in the center of the room, away from exterior walls, windows, and doors

Violence / Active Shooter (CADD):

- **CALL**- 9-1-1
- **AVOID**- If possible, self-evacuate to a safe area outside the building. Follow directions of police officers.
- **DENY**- Barricade the door with desk, chairs, bookcases or any items. Move to a place inside the room where you are not visible. Turn off the lights and remain quiet. Remain there until told by police it's safe.
- **DEFEND**- Use chairs, desks, cell phones or whatever is immediately available to distract and/or defend yourself and others from attack.

Academic Continuity Statement

In the event of an announced campus closure in excess of four days due to a hurricane or other disaster, students are expected to login to Lamar University's website's homepage (www.Lamar.edu) for instructions about continuing courses remotely.

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ABET Outcomes Achieved: 2 (P), 3 (P), 4 (P), 5 (P), 12 (P), 13 (P) P = Primary

OUTCOME 2. An ability to design and conduct experiments, as well as to analyze and interpret data. Criterion 3(b)

OUTCOME 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. Criterion 3(c)

OUTCOME 4. An ability to function on multidisciplinary teams. Criterion 3(d)

OUTCOME 5. An ability to identify, formulate, and solve engineering problems. Criterion 3(d)

OUTCOME 12. An ability to design, develop, implement, and improve systems that include people, materials, information, equipment, and energy. Criterion 3(l)

OUTCOME 13. The in depth instruction to accomplish the integration of systems using appropriate analytical, computational, and experimental practices. Criterion 3(m)

ABET category content as estimate by the faculty member who prepared this course description: Professional Component: 3 Credits of Engineering Topics

Course Content Outline

Course Content and Assignments	
Week 1	<p>Welcome and Course Introduction</p> <p>Online Homework and Textbook Registration</p> <p>Students are encouraged to introduce themselves via a discussion board during the first week of the course.</p> <p>Readings</p> <ul style="list-style-type: none"> • Review 'Getting Started' section in the course website in Blackboard • Introduction to the course • Introduction to Simulation • Course Syllabus • Chapter 1 and Chapter 2 in the Kelton Textbook • Lecture Notes • Download Book examples from the course website to your computer. <p>Videos</p> <ul style="list-style-type: none"> • Introduction to the course • Introduction to simulation • Simulation Fundamentals • Simulation Fundamentals 2 <p>Assessment</p> <ul style="list-style-type: none"> • Introduce yourself in the discussion forum • Chapter 2 Quiz
Week 2	<p>Readings</p>

	<ul style="list-style-type: none"> • Chapter 2 in the Kelton Textbook • Chapter 3 in the Kelton Textbook • Lecture Notes <p>Videos</p> <ul style="list-style-type: none"> • Simulation Fundamentals 2 • Simulation Fundamentals 3 • Process Modeling in Arena – 1 • Demo: Ch3 1 User Interface • Process Modeling in Arena - 2 • Demo: Ch3 Model 3-1 review <p>Assessment</p> <ul style="list-style-type: none"> • Chapter 2 Quiz • Chapter 2 hand simulation
Week 3	<p>Readings</p> <ul style="list-style-type: none"> • Chapter 3 in the Kelton Textbook • Chapter 4 in the Kelton Textbook • Lecture Notes <p>Videos</p> <ul style="list-style-type: none"> • Process Modeling in Arena - 3 • Demo: Ch3 Model 3-1 duplicate • Process Modeling in Arena – 4 • Basic Processes – Introduction • Model 4-1: Basic Processes – Model 4-1 • Model 4-1: Demo: Ch4 Model 4-1 Assign + Record • Model 4-1: Demo: Ch4 Model 4-1 Review <p>Assessment</p> <ul style="list-style-type: none"> • Chapter 3 Quiz • Chapter 3 duplicate simulation
Week 4	<p>Readings</p> <ul style="list-style-type: none"> • Chapter 4 in the Kelton Textbook • Lecture Notes <p>Videos</p> <ul style="list-style-type: none"> • Model 4-2: Basic Processes – Model 4-2 • Model 4-2: Demo: Ch4 Model 4-2 Schedule Failure Frequency

	<ul style="list-style-type: none"> • Model 4-2: Demo: Ch4 Model 4-2 Review • Basic Processes – Model 4-3, 4-4 and debug • Demo: Ch4 Model 4-3 Animation Skills • Demo: Ch4 Model 4-3 Animation Review • Demo: Ch4 Model 4-4 Station Route • Demo: Ch4 Model 4-4 Review • Demo: Ch4 Debug Basics <p>Assessment</p> <ul style="list-style-type: none"> • Chapter 4 Quiz • Chapter 4 simulation modeling exercise
Week 5	<p>Readings</p> <ul style="list-style-type: none"> • Chapter 4 in the Kelton Textbook • Chapter 5 in the Kelton Textbook • Lecture Notes <p>Videos</p> <ul style="list-style-type: none"> • Input Analysis • Demo: Ch4 Input Analyzer • Detailed Operation - Model 5-1 • Demo: Ch5 Model 5-1 1 Simple Record • Demo: Ch5 Model 5-1 2 Seize Delay Release • Demo: Ch5 Model 5-1 3 Simple Storage • Demo: Ch5 Model 5-1 4 Simple Storage with Delay Block • Demo: Ch5 Model 5-1 5 Shared Queue • Demo: Ch5 Model 5-1 5 Shared Queue with Priority • Demo: Ch5 Model 5-1 Review <p>Assessment</p> <ul style="list-style-type: none"> • Chapter 4 Quiz • Chapter 4 simulation modeling exercise • Project Abstract
Week 6	<p>Readings</p> <ul style="list-style-type: none"> • Chapter 5 in the Kelton Textbook • Lecture Notes <p>Videos</p>

	<ul style="list-style-type: none"> • Detailed Operations – Model 5-2 • Demo: Ch5 Model 5-2 1 Arrival Schedule • Demo: Ch5 Model 5-2 2 Resource Set • Demo: Ch5 Model 5-2 3 Counter Set • Demo: Ch5 Model 5-2 4 Specific Member of Resource Set • Demo: Ch5 Model 5-2 5 1D Variable Array • Demo: Ch5 Model 5-2 Review <p>Assessment</p> <ul style="list-style-type: none"> • Chapter 5 Quiz • Chapter 5 simulation modeling exercise
Week 7	<p>Readings</p> <ul style="list-style-type: none"> • Chapter 5 in the Kelton Textbook • Chapter 6 in the Kelton Textbook • Lecture Notes <p>Videos</p> <ul style="list-style-type: none"> • Detailed Operation - Model 5-3 • Demo: Ch5 Model 5-3 Compare Alternatives • Demo: Ch5 Model 5-3 Review • Output Analyzer: Terminating Simulations – 1 Output Analysis • Output Analyzer: Ch6 Model 6-4 Output Analyzer <p>Assessment</p> <ul style="list-style-type: none"> • Chapter 5 Quiz • Chapter 5 simulation modeling exercise • Chapter 6 Quiz • Chapter 6 simulation modeling exercise
Week 8	<p>Readings</p> <ul style="list-style-type: none"> • Chapter 6 in the Kelton Textbook • Lecture Notes • Midterm Review <p>Videos</p> <ul style="list-style-type: none"> • Terminating Simulation – 2 Process Analyzer • Demo: Ch6 Model 6-5 Process Analyzer • Terminating Simulations – 3 OptQuest • Demo: Ch6 Model 6-6 OptQuest

	<p>Assessment</p> <ul style="list-style-type: none"> • Chapter 6 Quiz • Chapter 6 simulation modeling exercise
Week 9	<p>Readings</p> <ul style="list-style-type: none"> • Chapter 7 in the Kelton Textbook • Lecture Notes <p>Videos</p> <ul style="list-style-type: none"> • Steady State Replications • Demo: Ch7 Model 7-1 Simple Sequence • Demo: Ch7 Model 7-1 Simple Sequence Set • Demo: Ch7 Model 7-1 Simple Variable Array <p>Assessment</p> <ul style="list-style-type: none"> • Midterm Exam • Chapter 7 Quiz • Chapter 7 simulation modeling exercise
Week 10	<p>Readings</p> <ul style="list-style-type: none"> • Chapter 7 in the Kelton Textbook • Chapter 8 in the Kelton Textbook • Lecture Notes <p>Videos</p> <ul style="list-style-type: none"> • Steady State Replications – Statistical Analysis • Entity Transfer – Basics • Demo: Ch8 Model 8-1 Review • Entity Transfer – 2 Transporter • Demo: Ch8 Model 8-2 Simple Transporter • Demo: Ch8 Model 8-2 Transporter Review <p>Assessment</p> <ul style="list-style-type: none"> • Chapter 7 Quiz • Chapter 7 simulation modeling exercise • Chapter 8 Quiz • Chapter 8 simulation modeling exercise

Week 11	<p>Readings</p> <ul style="list-style-type: none"> • Chapter 8 in the Kelton Textbook • Chapter 11 in the Kelton Textbook • Lecture Notes <p>Videos</p> <ul style="list-style-type: none"> • Entity Transfer – 3 Conveyor • Demo: Ch8 Model 8-4 Simple Conveyor • Demo: Ch8 Model 8-4 Conveyor Review • Continuous and combined modeling – 1 • Demo: Ch11 Model 11-1 Review • Demo: Ch11 Model 11-2ab Review <p>Assessment</p> <ul style="list-style-type: none"> • Chapter 8 Quiz • Chapter 8 simulation modeling exercise • Chapter 11 Quiz • Chapter 11 simulation modeling exercise
Week 12	<p>Readings</p> <ul style="list-style-type: none"> • Chapter 11 in the Kelton Textbook • Lecture Notes • Papers and Example Course Projects <p>Videos</p> <ul style="list-style-type: none"> • Continuous and combined modeling – 2 • Demo: Ch11 Model 11-3 Review • Paper Discussion <p>Assessment</p> <ul style="list-style-type: none"> • Chapter 11 simulation modeling exercise
Week 13	<p>Readings</p> <ul style="list-style-type: none"> • Chapter 9 in the Kelton Textbook • Chapter 10 in the Kelton Textbook • Lecture Notes <p>Videos</p> <ul style="list-style-type: none"> • Advanced Technique – Chapter 9

	<ul style="list-style-type: none"> • Demo: Ch9 Model 9-1 Review • Demo: Ch9 Model 9-3 Review • Advanced Technique – Chapter 10 • Demo: Ch10 Model 10-2 Text Review • Demo: Ch10 Model 10-3 Access Review • Demo: Ch10 Model 10-4 Excel Review • Demo: 3D Animation <p>Assessment</p> <ul style="list-style-type: none"> • Course Project
Week 14	<p>Readings</p> <ul style="list-style-type: none"> • Final Review • Other Student Groups' Presentations <p>Videos</p> <ul style="list-style-type: none"> • Other Student Groups' Video Presentations <p>Assessment</p> <ul style="list-style-type: none"> • Course Project
Week 15	<p>Readings</p> <ul style="list-style-type: none"> • Student Project Presentations <p>Videos</p> <ul style="list-style-type: none"> • Each student project group should upload one presentation video to Youtube and publish it in the Discussion Board <p>Assessment</p> <ul style="list-style-type: none"> • Discussion: course projects from all student groups
Week 16	<p>Final Exam - Comprehensive: if the semester is only 15 weeks long, then the final exam is in Week 15, and original Week 15 content is merged with Week 14.</p>