

## EMSE 3760/6760: Discrete Event Simulation

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<b>Office Hours</b>	Wednesday 2:00 – 4:00 pm	<b>Room &amp; Time</b>	<b>Wednesday 6:10 – 8:40 pm</b> 1957 E St, Room 315 <u>on 1/18/2012</u> <b>1776 G St, DSS Lab, as of 1/25/2012</b>

**Number of Credit hours:** 3

**Class web site:** <http://www.seas.gwu.edu/~dorpir/EMSE273/Intro.html>

### 1. Text:

*Simulation Modeling and Analysis with ARENA (2005)*, by Tayfur Altioek and Benjamin Melamed.  
[http://www.elsevier.com/wps/find/bookdescription.cws\\_home/711657/description#description](http://www.elsevier.com/wps/find/bookdescription.cws_home/711657/description#description)

### 2. Course Description:

An introduction will be provided to the application and theoretical background of systems simulation. Topics included modeling systems dynamics using discrete events, the modeling of manufacturing and materials handling systems and service systems through simulation. Theoretical topics include random variable generation, model verification and validation, statistical analysis of output. Simple simulation problems will be introduced using Microsoft Excel. A high-level simulation package ARENA will be utilized for more complex simulation problems.

### 3. Method of Instruction:

Two and half hour with a 10 minute break. Time permitting breakout session at the end of a lecture to start with simulation exercises in class. **Homework will have to be completed and handed according to the outline schedule.**

### 4. Prerequisite Knowledge:

A first course in calculus is needed as a prerequisite for this course as well **as introductory proficiency with Micro Soft Excel** in addition to

- 1) EMSE 6020 Elements of Problem Solving and Decision Making **or**
- 2) APSC 3115 Engineering Analysis III **or**
- 3) EMSE 6765 Data Analysis for Engineers and Scientists.

### 5. Software: [MicroSoft Excel](#) and [ARENA 11.0](#), Textbook comes with student License:

[http://www.arenasimulation.com/Academics\\_Textbooks.aspx](http://www.arenasimulation.com/Academics_Textbooks.aspx)

### 6. Grading:

Attendance	: 5%	Homework	: 20%
Midterm Exam	: 35%	Final Exam	: 40%

**7. Examinations:**

There will be one midterm exam during the semester and **a final exam given during the final exams period**. The midterm exam covers sessions before it as indicated in the class schedule. The final exam covers sessions as indicated on the class schedule with a focus on those sessions between the midterm and final exam. During the midterm exam student will be answering Excel questions and submitting an **Excel 2003 workbook**. During the final exam students will be asked to **build a simulation in Arena and hand in its ".doe" file**. **Exams cover all assigned reading, homework and class discussions**. Calculators may be used during all exams; Books and notes may **not** be used, with the following exceptions:

- Midterm Exam: you may prepare and use up to **2** sheets of 8 ½ by 11 inch paper;
- Final Exam: you may prepare and use up to **2** sheets of 8 ½ by 11 inch paper.

**You are required to hand in these exam notes with your exam and these exam notes may not contain any part of the homework solutions that have been provided during the course. No materials may be shared during the exams.**

**8. Homework:**

For each homework problem a student may be called upon to discuss their solution, so you must be prepared! The rest of the class should be involved in the discussion. Your level of effort will be graded. **Not handing in a homework problem will result in 0 points for that problem**. Homework that is handed in and **demonstrating an adequate level of effort will be awarded 1 point**. Intermediate levels of effort may be assigned. You should each bring electronic files of your homework to class in case you are called upon to show your work to the rest of the class.

**9. Academic Integrity:**

I support the GW Code of Academic Integrity. It states:

*"Academic dishonesty is defined as cheating of any kind, including misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate authorization, and the fabrication of information."*

For the remainder of the code, see: <http://www.gwu.edu/~ntegrity/code.html>

**10. Emergency Information:**

In the case of an emergency, if at all possible, the class should shelter in place. If the building that the class is in is affected, follow the evacuation procedures for the building. After evacuation, seek shelter at a predetermined rendezvous location.

## 11. COURSE OBJECTIVES

Each student should: (1) Understand how computer simulation can be used to model complex systems and solve related decision problems, (2) understand the assumptions made in building a discrete event simulation, (3) understand and apply statistical methods used in simulation analysis, (4) perform sensitivity analyses to test the effects of critical model parameters, (5) be able to run a simulation project from start to finish.

## 12. Course Schedule and Topics: **This Schedule is subject to change, please check frequently.**

Session	Date	Class Topic	Reading Assignments	Homework Assignments	Homework Due
1	1/18/2012	INTRO - Intro to Discrete Event Simulation (DES)	Chapter 1 - AM, Chapter 2 - AM	1.3 - AM	
2	1/25/2012	INTRO - Manual Simulations, Random Variate Generation	Chapter 2 BCN, Chapter 3 AM	2.2 - AM, 3.3 - AM, 4.4 - AM	
3	2/1/2012	EXCEL - Simulating a Simple Queue in MICROSOFT EXCEL	Chapter 3 - AM, Chapter 4 - AM	Proof Sampling Theorem, Derive Inverse CDF Triangular, Develop Triangular Sampler	1.3-AM, 2.2-AM
4	2/8/2012	EXCEL - Output Analysis in MICROSOFT EXCEL, Confidence Intervals and Half Widths	Lecture Notes Conf. Intervals	HW: Wait in Queue Prob, HW: Max in System	3.3 - AM, 4.4 - AM, Proof Sampling Theorem, Derive Inverse CDF Triangular, Develop Triangular Sampler
5	2/15/2012	EXCEL, Random Number Generation	Notes Random Number Generation	HW: KS Test RAND() Function, HW: Chi-Squared Test RAND() Function	HW: Wait in Queue Prob, HW: Max in System
6	2/22/2012	Midterm Review + ARENA - Simple Arena Examples	Chapter 5 - AM	5.1 - AM	HW: KS Test RAND() Function, HW: Chi-Squared Test RAND() Function
7	2/29/2012	<b>Midterm Exam - in Class (Session 1 - 6: Chapters 1, 2, 3, 4 AM + Handouts and</b>			
8	3/7/2012	ARENA - Inventory System Simulation	Chapter 5 -AM	5.3 - AM Handout Old Book	
	3/14/2012	<b>SPRING BREAK</b>			
9	3/21/2012	ARENA - Modeling of Production Lines 1	Chapter 11-AM	11.3 - AM	5.1 - AM, 5.3- AM Handout Old Book
10	3/28/2012	ARENA - Modeling of Production Lines 2	Chapter 11-AM	11.2 - AM	11.3 - AM
11	4/4/2012	ARENA - Input Analysis	Chapter 7-AM	7.3 - AM	11.2 - AM
12	4/11/2012	ARENA - Input Analysis	Chapter 7-AM	7.1 - AM	7.3 - AM
13	4/18/2012	ARENA - Output Analysis	Chapter 9 - AM, Lecture Notes Conf. Intervals	Output Analysis Arena Question 1 and 2	7.1 - AM
14	4/24/2012	Final Exam Review + ARENA - Output Analysis			Output Analysis Arena Question 1 and 2
15	5/8/2012	<b>Final Exam - In Class (Sessions 6, 8, 9, 10-14, Chapters 5, 7, 9, 11 + handouts)</b>			

**13. SUPPORT FOR STUDENTS OUTSIDE THE CLASSROOM**

- a. **DISABILITY SUPPORT SERVICES (DSS):** Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 in the Marvin Center, Suite 242, to establish eligibility and to coordinate reasonable accommodations. For additional information please refer to: <http://gwired.gwu.edu/dss/>
- b. **UNIVERSITY COUNSELING CENTER (UCC) 202-994-5300:** The University Counseling Center (UCC) offers 24/7 assistance and referral to address students' personal, social, career, and study skills problems. Services for students include:
- crisis and emergency mental health consultations**
  - confidential assessment, counseling services (individual and small group), and referrals**

For additional information please refer to:

<http://gwired.gwu.edu/counsel/CounselingServices/AcademicSupportServices>

**14. Contribution to professional component:**

This course is part of both the mathematics and engineering topics areas, and includes aspects of both engineering science and design.

**15. ABET Learning Outcomes (a-l) that apply to this course**

- a. **An ability to apply knowledge of mathematics, science and engineering.** This course applies the mathematics of probability and statistics to a variety of problems in simulation such as input analysis, sampling theory and techniques, and statistical output analysis of simulation experiment. This ability is primarily assessed by graded homework and exams.
- b. **An ability to design and conduct experiments, as well as to analyze and interpret data.** Design of simulation and conduction experiments therewith is inherent in the statistics portion of the course. Students are taught the difference between aleotory and epistemic uncertainty and simulation replications can effect only the latter.
- e. **An ability to identify, formulate and solve engineering problems.** For this course, students are given a system description, required to construct a simulation, evaluate and analyze output metrics to suggest potential improvements for system design.
- i. **A recognition of the need for, and ability to engage in life-long learning.** Objectives (1) through (v) apply here in that regardless of what the student learns in this class, they will be able to conduct basic simulation experiments for real life problems.
- j. **A knowledge of contemporary issues.** The students will learn to use simulation software.
- k. **An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.** See descriptions in outcomes a) and j).
- l. **An understanding of the integrated nature of the discipline.** By using examples from a variety of disciplines, the course demonstrates how simulation used in different disciplines.