ORI 390R.9 - Systems Simulation

- **Professor:** John J. Hasenbein
  - **Office:** ETC 5.128B
  - **Phone:** 471-3079
  - **Email:** *jhas@mail.utexas.edu* (This is the best way to contact me.)
  - **Office Hours:** Mondays, 10:30am-noon. You can also email me for an appointment.
- **Class Web Page:** All class materials will be posted on *Canvas*.
- **Texts:**
  - Required: *Simulation with Arena* by W.D. Kelton, R.P. Sadowski and N.B. Swets, 5th Edition, McGraw Hill, Boston, 2010
  - Optional: *Discrete-Event System Simulation*, by J. Banks, J.S. Carson, II, B.L. Nelson and D.M. Nicol, Prentice Hall, 5th edition, 2009
- **Grading:** Problem sets will be assigned every one to two weeks. There will be one mid-term exam and one final exam. Each exam will be worth 35% of your grade. Your homework average will comprise the other 30% of your grade.

  For the problem sets, you may discuss problems with your classmates and in fact are encouraged to do so. However, you should understand and write-up your own solutions. A good rule of thumb is that you should be able to explain to me the solutions you have submitted.
- **Exams:** You are required to take all exams at the scheduled time. Make-up exams will not be given without a valid medical excuse.

  The mid-term exam will be given on Thursday, March 9th, during class.

  The final exam will be given at the university scheduled time, which should be Tuesday, May 16th, 9am-12pm. No early final exams will be given. You must take the final at the university scheduled time to pass the class.
- **Grading Appeals:** If you believe a mistake has been made in grading a homework or exam, you must appeal within one week of receiving the graded homework or exam. After one week, no grading changes will be made.
- **Email Communication**: For this class, email will be used as an official form of communication for notifying you of new homework assignments and other class updates. For this class, email should be checked at least every other day. The University of Texas email policy can be found at
  `http://www.utexas.edu/its/policies/emailnotify.html`.
- **Prerequisites:**A graduate-level knowledge of probability, statistics, and stochastic processes.
- **Students with disabilities:** The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TTY.

- **Course Evaluation:** Near the end of the course you will have an opportunity to anonymously evaluate the course and instructor using the standard College of Engineering evaluation form.
- **Class Web Site and Privacy:** For this class, web-based, password-protected class sites will be available via the *Canvas* system. The syllabus, handouts, assignments and other resources are types of information that may be available within this site. Site activities could include exchanging e-mail, engaging in class discussions and chats, and exchanging files. In addition, a class e-mail roster will be a component of the site. Students who do not want their names included in this electronic class roster must restrict their directory information in the Office of the Registrar, Main Building, Room 1. For information on restricting directory information see:
  `http://registrar.utexas.edu/students/records/restrictmyinfo`.

Course Topics

The goal of this class is to provide you with a graduate level knowledge of discrete-event simulation methods. Although you will be modeling some simple systems in the *Arena* software, the lecture time will not be spent on learning how to use software. Rather, we will discuss the theory and methods needed to carry out simulation studies efficiently and rigorously. Much of this methodology is especially useful if you need to code your own simulation models from scratch, which is often the case.

Additional References

- S. Asmussen and P.W. Glynn, *Stochastic Simulation: Algorithms and Analysis*, Springer, 2007
- P. Bratley, B.L. Fox and L.E. Schrage, *A Guide to Simulation*, (second ed.) Springer-Verlag, 1987
- L. Devroye, *Non-Uniform Random Variate Generation*, Springer-Verlag, 1986. Out-of-print and now available for free download from: `http://www.eirene.de/Devroye.pdf`
- S.G. Henderson and B.L. Nelson, eds. Handbook of Simulation, Elsevier, 2006.
- A.M. Law, *Simulation Modeling and Analysis*, Fourth Edition, McGraw Hill, New York, 2007

Course Topics

1. Background and review
    - Philosophy and framework of discrete-event Monte Carlo simulation
    - Simulation project examples
    - A soupçon of queueing theory
    - Statistics review: estimators, confidence intervals, and hypothesis tests
2. Generating pseudo-random variates
    - Uniform random number generation
    - Non-uniform random number generation
3. Quadrature, quasi-Monte Carlo and Monte Carlo integration
4. Output analysis
    - Terminating simulations
    - Nonlinear functions of sample means
    - Comparing alternative system configurations
    - Steady-state simulations
5. Regenerative steady-state simulation
6. Input analysis: univariate and multivariate
7. Variance reduction
8. Simulation-optimization