University of Cincinnati  
Department of Operations, Business Analytics, and Information Systems  
BANA 7035: Simulation Analysis – Spring Semester 2013 (second half, 3/2/2012 – 4/22/2012),  
219 Lindner Hall

Syllabus

Instructor:
- Dr. W. David Kelton, Professor and MS – Business Analytics Program Director  
  (http://business.uc.edu/programs/graduate/msbana.html)  
- david.kelton@uc.edu, 525 Lindner Hall, 513-556-6834,  
  http://www.cba.uc.edu/faculty/keltonwd/  
- Office hours: Thursdays 3:00-3:45pm; Saturdays 8:00-8:45am; by appointment; and ongoing by  
  e-mail (please set your e-mail account or client to copy back all prior messages when replying or  
  forwarding).

Website: http://blackboard.uc.edu/ and use your UC login and password to access, then select this  
course. Check frequently for announcements, material, and updates.

Catalog Description: 4 graduate semester credits. Probabilistic and statistical underpinnings of  
simulation modeling and analysis. Topics include advanced modeling techniques, advanced methods for  
modeling input processes, random-number generators, generating random variates and processes,  
design and analysis of simulation experiments, variance-reduction techniques, gradient estimation, and  
optimizing simulated systems.

Objectives: This is a second course in computer simulation. Study the underlying probabilistic and  
statistical aspects of computer simulation. Modeling and estimating input processes, random-number  
generators, variate and process generation, statistical analysis of simulation output, ranking and  
selection of simulation models, variance-reduction techniques, designing simulation experiments,  
gradient estimation, and optimization. By the end of the course, students should be able to start  
reading (and contributing to) the simulation research literature, as well as do a much better job of  
designing and analyzing simulation experiments.

Prerequisites
- A first course in simulation modeling (with a general-purpose programming language or a  
simulation language). This must have been an entire course devoted to simulation modeling; it  
is not sufficient to have had only a brief introduction to simulation as part of an operations-  
research survey course.
- Calculus (through multivariate) and linear algebra.
- Probability and statistics (calculus-based).
- Computer and programming skills (FORTRAN, Pascal, C, C++, Java, or MATLAB, etc.).
Materials

- Course notes will be distributed under Course Documents on Blackboard.

Grading

- Mid-term Exam (Saturday March 30, 9:00–11:00am) = 30%
- Final Exam (Saturday April 20, 9:00am–12:50pm) = 40%
- Individual Project/Presentation/Paper = 30% (more information below, including milestones)

Both the Mid-term and Final Exams are open-book and open-notes; no other materials permitted. Homework will be assigned but not collected, and solutions (not just answers) will be provided; collaboration on the homework is fine, even encouraged!

Computing: You may use any computer you like, either your own or in a lab or office, provided that it has the software you’ll need. Instructions for installing Arena 12 (and running the licensed commercial version on your computer) are on the Blackboard course site under Course Documents. There are also instructions there for installing the Palisade suite of Excel add-ins, including @RISK to support static spreadsheet simulation much better than Excel can on its own.

Topics

- Introduction and overview of simulation analysis
- Modeling and estimating input processes
- Random-number generation
- Generation of random variates, vectors, and processes
- Statistical analysis of simulation output
- Comparison, ranking, and selection of simulation models
- Variance-reduction techniques
- Designing simulation experiments, gradient estimation, and optimization

Specific reading and homework assignments will be made in each class, and will depend on our progress.

Individual-Project Information

This will be a simulation application or methodological study of your own choosing. It should be a study with (probably) one of the following two approaches:

- Application of appropriate and effective simulation methodology (e.g., variance reduction, ranking and selection, the effect of non-independent input distributions) in another field like manufacturing, health care, logistics, or telecommunications (many others are possible).
- A methodological study about simulation itself; e.g., comparing two different algorithms for ranking and selection, or different methods for random-variate or random-process generation, on the basis of accuracy or efficiency or some other relevant criteria.

If you have an idea for a project that doesn’t clearly fit into one of the above categories, feel free to propose it ... I’m pretty easy to convince, as long as it involves simulation, and more than just building another simulation model.
This project is *individual* — it must be done by yourself without consultation with anyone but the instructor. The project must involve some amount of computer work. The "product" is a written paper and a presentation in class on the last class day.

Individual-Project Milestones:
- Saturday March 16, 6:00pm: Submit a one-"page" proposal (e-mail to instructor).
- Saturday April 13, 11:10am-12:50pm: Presentation in class.
- **Monday** April 22, 6:00pm: Written report due (e-mail to the instructor).

### Schedule

<table>
<thead>
<tr>
<th>Class Number</th>
<th>Mostly Saturdays, 9:00am – 12:50pm, 219 Lindner Hall</th>
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<tbody>
<tr>
<td>1</td>
<td>Saturday March 2</td>
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<td>2</td>
<td>Saturday March 9</td>
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<td>3</td>
<td>Saturday March 16 – <strong>Project proposal due 6:00pm (e-mail to instructor)</strong></td>
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<td>Spring Break March 17-24</td>
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<td>4</td>
<td>Saturday March 30 – <em>Mid-term exam 9:00am-11:00am (lecture 11:10am-12:50pm), all in regular classroom</em></td>
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<td>5</td>
<td>Saturday April 6</td>
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<td>6</td>
<td>Saturday April 13</td>
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**Finals Week**
- Saturday April 20 – **Final Exam 9:00am-12:50pm, regular classroom**
- **Monday** April 22, 6:00pm – Written project report due (e-mail to instructor)

### Links
- Winter Simulation Conference [http://www.wintersim.org](http://www.wintersim.org)
  - Full papers, free and open-access, for the entire history of the conference (back through 1968 to now, every year) via Paper Archive link on the top right
- EUROSIM, the Federation of European Simulation Societies [http://www.eurosim.info/](http://www.eurosim.info/)
- DoD Modeling and Simulation Coordination Office (M&SCO) [http://www.msco.mil/](http://www.msco.mil/)
- Rockwell Software, the vendor of Arena [http://www.arenasimulation.com](http://www.arenasimulation.com)
- Simulation of the Buffon Needle Problem, one of many such sites [http://www.angelfire.com/wa/hurben/buff.html](http://www.angelfire.com/wa/hurben/buff.html)
- The original “bug” and more on Grace Murray Hopper (who coined the term) [http://vcencyclopedia.vassar.edu/index.php/Grace_Murray_Hopper](http://vcencyclopedia.vassar.edu/index.php/Grace_Murray_Hopper)
- Don’t even think about daring to go here if you’re too young to have used punchcards [http://www.facade.com/legacy/punchcard/](http://www.facade.com/legacy/punchcard/)