

**MODELLING AND SIMULATION**  
**Applied Mathematics 3911/9570**  
**An Introduction to Mathematical Modelling and Simulation.**

Instructor:  
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**Text:** ( Don't buy book use online access )

"In Introduction to Computer Simulation Methods", 3rd Edition, H. Gould and J. Tobochnik,  
Addison-Wesley Publishers, 1996, ISBN 0-201-50604-1

See below for free version of text:

<http://www.opensourcephysics.org/items/detail.cfm?ID=7375&Attached=1>

I may introduce other books and papers as topics arise.

**Evaluation:**

up to 8 assignments or quizzes-> 60% ( biweekly )

Major Project Write-up > 30% (Students must hand in an acceptable project write-up to pass course )

Major Project Class presentation -> 10% (Students must make an acceptable presentation to pass course )

Note: This course is offered as an undergraduate course (AM3911) with shared lectures. The assignments/quizzes for AM9570 will include additional questions beyond those set for AM3911. If you miss one assignment/quiz with permission (or SRA) then I will re-weight the remaining assignments to provide 60% of your grade. If you miss more than one assignment/quiz then the grades associated with the missed assignments/quizzes will be equally distributed to the quiz grade and the Major Project Write-up grade.

**Class: Tuesday 2:30pm to 5:30pm SSC 3014 Attendance is mandatory!**

**Office Hours:** Thursday 10:00am 12:00 noon

Any other time you can find me is also fine, if I'm not busy. Please make an appointment by email for times other than the above.

**Learning Outcomes:**

Students should be able to

1. Generate, test and appreciate a sequence of pseudo-random numbers.
2. Appreciate the steps required to model and simulate a real physical system in an effective and systematic manner.
3. Implement a simple stochastic simulation of radioactive decay, compare to exact analytic solutions, finite difference solutions and appreciate the benefits and deficiencies of the various methods.
4. Implement a simple discrete event simulation and understand how one might enhance the simple model to optimize a more complicated problem.
5. Implement a Monte Carlo integration scheme.

6. Program a Monte Carlo simulation of the Ising Model and calculate energy and magnetization as functions of temperature using a simple Metropolis algorithm.
7. Research and implement a simple computer simulation on a topic of interest and present that topic to their peers.
8. Understand the basics of random walks and how they may be used in Monte Carlo simulations, and other methods to solve partial differential equations.

**Some topics/methods we may cover:**

1. Random Number Generators
2. Monte Carlo Integration: Hit/Miss Integration
3. Random Walks (RW)
4. Solving Laplace's Equation (and other DE's) using RW
5. Percolation and modelling of Forest Fires
6. Cellular Automata: Lattice Gas, Kauffman Model
7. Monte Carlo Simulation: Ising Model
8. Damage spreading, Fractals, Chaos
9. Molecular Dynamics: Hard Spheres and more
10. Other interesting things I like.

**Accommodation and Accessibility:** If you are unable to meet a course requirement due to illness or other serious circumstances, you must seek approval for the absence as soon as possible. Approval can be granted either through a self-reporting of absence or via the Dean's Office/Academic Counselling unit of your Home Faculty. If you are a Social Science student, the Academic Counselling Office of the Faculty of Social Science is located in SSC 2105, and can be contacted at [ssaco@uwo.ca](mailto:ssaco@uwo.ca). If you are a Science student, the Academic Counselling Office of the Faculty of Science is located in NCB 280, and can be contacted at [scibmsac@uwo.ca](mailto:scibmsac@uwo.ca). For further information, please consult the university's policy on academic consideration for student absences.

**Academic Policies:** The website for Registrarial Services is <http://www.registrar.uwo.ca>. In accordance with policy, the centrally administered e-mail account provided to students will be considered the individual's official university email address. It is the responsibility of the account holder to ensure that email received from the University at his/her official university address is attended to in a timely manner.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf). We will clearly indicate the level of acceptable collaboration on assignments and projects. All assignments and papers may be checked for textual similarity for detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service for papers is subject to the licensing agreement currently between The University of Western Ontario and Turnitin.com ( <http://www.turnitin.com> ). Programming assignments may be checked for similarity using MOSS (Measure of Software Similarity).

**Support Services:** Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Student Accessibility Services (SAS) at 661-

2147 if you have any questions regarding accommodations. The policy on Accommodation for Students with Disabilities can be found here:[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic%20Accommodation\\_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_disabilities.pdf)

The policy on Accommodation for Religious Holidays can be found here:  
[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_religious.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf)

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning HelpCentre, and year-round through individual counselling. Students who are in emotional/mental distress should refer to Mental [Health@Western](mailto:Health@Western) ([http://www.health.uwo.ca/mental\\_health](http://www.health.uwo.ca/mental_health)) for a complete list of options about how to obtain help. Additional student-run support services are offered by the USC, <http://westernusc.ca/services>.