Université d'Ottawa · University of Ottawa

School of Electrical Engineering and Computer Science (EECS)

CSI4124/SYS5110
Foundations on Modeling and Simulation (3, 0, 0)
Fall 2016

Instructor: Gilbert Arbez **Phone/Voice Mail: 6315**
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Office Hours: By appointment

Lectures:

Tues	LEC	17:00-22:00	SMD 226

- Class attendance is mandatory. As per academic regulations, students who do not attend 80% of the class will not be allowed to write the final examinations.
- All components of the course (i.e. laboratory reports, assignments, etc.) must be fulfilled otherwise students may receive an INC as a final mark (equivalent to an F).

CALENDAR DESCRIPTION

The modelling and simulation process from a project oriented perspective. The role of conceptual modelling in the discrete event dynamic system context. Dealing with randomness. Distinctive features of modelling and simulation for continuous time dynamic systems and overview of numerical procedures. Validation and verification. Simulation software and program development.

TEXTS/MATERIALS

The following book is required. Students are expected to complete reading assignments before class. The book is available from the Agora book store.

Louis G. Birta, Gilbert Arbez, **Modelling and Simulation: Exploring Dynamic System Behaviour**, Springer-Verlag London Limited, 2013, ISBN: 978-1-4471-2783-3

The following text was used to develop the Java self-study program. System Science Students should purchase the text.

Y. Daniel Liang, **Introduction to Java™ Programming, Brief Version, Tenth Edition,** Pearson/Prentice Hall, 2015**,**
https://www.vitalsource.com/products/introduction-to-java-programming-brief-8-e-liang-y-daniel-v9780133001839

REFERENCE TEXTS/MATERIALS

1) Averill M. Law and David W. Kelton. Simulation Modeling and Analysis. McGraw-Hill Science/Engineering/Math; 3rd edition (December 30, 1999).
2) Banks Jerry, Carson II, John S., Nelson, Barry L. and Nicol, Davis M., (2005), Discrete-Event System Simulation, 4th ed, Pearson Prentice Hall, Upper Saddle River, New Jersey
3) Arbez, Birta: CSI4124/SYS5110 Case Studies (available from the Blackboard)

STUDENT EVALUATION

	SYS Students	CSI Students
Project	40%	50%
Java Assignment	10%	
Mid-term Exam	15%	15%
Final Exam	35%	35%

Project: Groups of 4-6 students participate in a modeling and simulation project; the project experience will mimic a professional process including a methodology, programming standards and tracking time. The project deliverables are evaluated using a Rubric scheme (posted on Blackboard Learn).

Java Assignment (System Science only): This assignment shall be attempted after completing the Java study plan provided on Blackboard Learn. Only System Science students are required to complete the Java study and this assignment.

Midterm Exam: Closed book exam with questions on fundamentals of modelling with a focus on discrete event modelling.

Final Exam will be open book and consist of a small modelling and simulation project.

All components of the course (i.e. laboratory reports, assignments, quizzes etc.) must be fulfilled otherwise students may receive an INC as a final mark (equivalent to an F).

OTHER POLICIES

You are responsible for understanding and following the policies described below.

Announcements: Class announcements will be posted on BlackBoard Learn. You are expected to consult the site regularly.

E-mail correspondence: Received e-mail enquiries and questions will be answered on a daily basis whenever possible. Use the office hours (upon appointment) for consulting the professor. The time is reserved to help you. BlackBoard Learn also contains a discussion forum. Use it for discussion with your classmates.

LEARNING OUTCOMES

This course is mandatory in the System Science program and an elective course in the Computer Science program. The course allows interested students to explore how computer simulation can be used to solve problems related to the operation/design of real systems. Learning in this course means that

- You shall study and apply a modelling and simulation (M&S) framework and tools in solving a problem within the context of a modelling and simulation project.
- Modelling and Simulation projects are completed by teams of 4 to 6 members from both the System Science and Computer Science groups, that is a multi-disciplinary team.
- System Science students are required to review and update their computer programming skills. A study program on Java programming is provided and needs to be completed by the System Science students.

Theme	General Outcomes	Specific Outcomes:	Evaluation	Activities
Discrete event Modelling and simulation	• Understand the Modelling and Simulation Process • Understand Discrete Event Modelling and Simulation Principles • Understand Activity based modelling and simulation	*At the end of the course the student shall be able to* • Describe the various steps of a modelling and simulation process/project. • Explain the randomness found in systems using the concept of random processes and random variables. (data modelling, input/output) • Explain the basics of discrete event simulation, including the concept of events and the various constructs found in activity based simulation constructed from the concept of events. • Explain the differences between the traditional world views and the Activity Object World view. • Explain the process of output analysis concepts.	• Midterm exam	• Reading assignments • Flipped classroom discussions (including Lecture Note quizzes). • Optional class presentations on specific topics (for smaller classes) (10 minute presentations)
Solving a problem using computer modelling and simulation	• Analyse a problem. • Develop a conceptual model • Develop a simulation model aligned with the conceptual model and use it to solve the problem (and project goal).	• Evaluate and analyse a test case problem to be solved and develop a problem description which includes a clear statement of the problem and a clear description of the system to be studied (SUI – system under investigation). • Using a clear problem description, formulate a clear M&S Project Goal. • Based on the project goal, develop a high-level conceptual model and a detailed conceptual model using the ABCmod conceptual modelling framework . • Translate a detailed CM to a simulation model using the ABSmod/J toolbox to create a simulation program and carry out experimentation with the simulation program to verify and validate the model. • Carry out experimentation with the simulation program to solve the problem.	Project deliverables: • Problem description, • Project Goal, • High Level CM, • Detailed CM, • Simulation Model/Program (including verification and validation), • Experimentation and output analysis	• M&S Project • Blackboard Group • Rubrics for project deliverables • Peer review of team participation • Blackboard assignment submission (project deliverable evaluation) • Final exam

Theme	General Outcomes	Specific Outcomes:	Evaluation	Activities
OO Programming skills	• Update or develop object-oriented programming skills using the Java programming language (System Science)	• System Science students: Revise and complete programming skills with an object-oriented language (OO).	• Java Programming assignment	• Java self-study program.
Team and communication skills	• Contribute the course project as an effective team member • Develop communication skills	• As team member, complete assigned tasks according to given instructions. • As team leader, ensure a good progression in advancing the project (establish regular and special meetings, report progress to team and professor, deal promptly with issues, etc.). • As a team member, participate in all team activities (meetings, e-mail exchange, etc.). • Assess and develop one's capacity to learn independently. • Evaluate and develop one's ability to work interdependently with colleagues.	• Standard reports • Evaluation of deliverables (to follow instructions). • Time sheets • Group discussions.	• Class project. • Project evaluation: individual (deliverables assigned specific team members) • Peer evaluation • Individual reports (by responsible members). • Complete individual questionnaires. • Complete collective questionnaires.