System Modeling and Simulation
Information Engineering Program
Prof. Luiz Henrique Bonani do Nascimento
3rd Quarter 2025

Syllabus:

Introduction to simulation. Properties and classification of simulation models. Review of concepts: statistics, probability, stochastic processes. Examples of simulation systems. Random number generation. Basics of number theory. Generation and testing. Classical continuous and discrete distributions. Simulation of discrete and continuous systems. Model verification and validation. Statistical techniques for analyzing data and simulation model results. Simulation of simple queuing systems. Simulation of computer systems. Case studies.

References:
[1] F. L. Severance, "System Modeling and Simulation", Wiley, 2001. (main text)
[2] J. A. Sokolowski, C. M. Banks, "Principles of Modeling and Simulation", Wiley, 2009.
[3 Bratley R., "A Guide to Simulation", 2nd edition, Springer-Verlag, 1987, ISBN 0387964673
[4] Mchaney, R., "Computer Simulation: a Practical Perspective", Academic Press, 1991.

Course Dynamic:

Each week, theoretical content will be presented based on material provided through the Moodle platform. This material will consist of notebooks using Python and will be made available via Google Colab. The course materials include code for the examples that will be discussed in class. Therefore, all students must have a Google account to use Google Colab. The programming language used for the course is Python. However, it's important to understand that **this is not a Python course**, and the use of pre-built Python libraries will not be allowed, except in very specific situations.

For all theoretical content discussed during the first eight weeks of the course, there will be individual assignments consisting of problem sets (for study purposes only) and a Simulation Exercise (SE) that focuses on the specific topic of the class. Each SE will consist of some problems to be solved, which must be submitted in the form of an individual report created in the Colab environment, containing all explanations, codes, and figures. Each class will have one SE available, as scheduled. The report for each SE must be submitted through the Moodle platform, using the corresponding activity. The deadline for submission will always be one week, ending at the beginning of the immediately following class, when there will be a brief discussion of the expected results.

An individual final project must be prepared for presentation in the last week of the course (Week 12), and a report using Colab must be submitted using the Moodle platform.

Assessment Criteria:

Considering ME (the average grade assigned to the Simulation Exercises) and NP (the project grade), the final grade (NF) that will be used to assign individual grades will be calculated as:

$$NF = 0{,}60\ ME + 0{,}4\ NP$$

A ME ≥ 60 (on a scale of 100) is REQUIRED FOR APPROVAL. All activities in this course are INDIVIDUAL. Because this is a course that utilizes programming to solve problems, it is strongly recommended that group work be avoided, as code plagiarism will result in a zero grade for all activities detected for all participants.

Schedule:

Classes will be held every Thursday at 2:00 PM in Laboratory L503 (Block B), Santo André Campus. Theoretical content and Simulation Exercises will be presented and discussed.

Course Timeline:

Week	Class	Date	Content
1ª Week	01	18/09	Continuous Simulation Properties and Models (W01) Simulation Exercise #01 is available
2ª Week	02	25/09	Simulation and Modeling of Dynamic Systems (W02) Simulation Exercise #02 is available; Deadline for SE#01
3ª Week	03	02/10	Stochastic Generators and White Noise (W03) Simulation Exercise #03 is available; Deadline for SE#02
4ª Week	04	09/10	Simulation and Modeling of Discrete Systems (W04) Simulation Exercise #04 is available; Deadline for SE#03
5ª Week	05	16/10	Stochastic Data Representation (W05) Simulation Exercise #05 is available; Deadline for SE#04
6ª Week	06	23/10	Individual work (without class)
7ª Week	07	30/10	Simulation and Modeling of Time-Oriented Systems (W06) Simulation Exercise #06 is available; Deadline for SE#05
8ª Week	08	06/11	Markov Processes (W07) Simulation Exercise #07 is available; Deadline for SE#06
9ª Week	09	13/11	Simulation and Modeling of Event-Driven Systems (W08) Simulation Exercise #08 is available; Deadline for SE#07
10ª Week	10	20/11	Project Development I (without class) Deadline for SE#08
		27/11	Project Development II
11ª Week	11	04/12	Project Development III; Deadline for Extra SE
12ª Week	12	11/12	Project Presentations; Deadline for Project Reports