



Aalto University
School of Business



Simulation 30E00400

Course syllabus

2022

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Overview and prerequisites

- This course provides an introduction to simulation methods relevant to business analytics, managerial decision making, operations management, industrial engineering, supply chains, logistics, marketing, finance and accounting, as well as economics in general.
- The course is aimed at second year Master's students at Aalto Business School, but could be taken by students from other schools, assuming they have a relevant background and interests.

Course prerequisites

- **Fundamentals of Business Knowledge**, as required in the Bachelor's Program at Aalto Biz, especially:
- **Basic knowledge in statistics and probability as well as in matrix algebra, differential and integral calculus**, are essential! Two courses in university statistics/ probability and one in university math is the minimum.
- **Good knowledge of Excel**
- **If taken before, other quantitative courses would be helpful, especially courses covering probability, as well as those including mathematical analysis and modelling, and those where Excel is employed.**

Learning objectives and outcomes

1. To learn the logic of mathematical modeling using simulation techniques which can be used to support management decision making, especially in operations management, finance, and logistics, when uncertainty is involved.
2. The course emphasizes random event simulation (stochastic or Monte Carlo simulation).
3. To learn when simulation is useful and when not.
4. To develop expertise in using simulation models with computers and related software, especially Excel.
5. To give experience in analyzing results and making decisions through assigned homework exercises and case analyses.

Teachers

- **Instructor (lectures):**
 - **Tomi (tomi.seppala at aalto.fi)**

Course assistants:(exercises and grading)

- **Ellis Saavalainen(ellis.saavalainen at aalto)**
- **All course information, materials and the latest course news will be stored on the course home page in MyCourses; you should follow MyCourses permanently for announcements and updates**

Course essentials

- Teaching **on Campus** during period 1
- Lectures: Mondays 14:15-17:00; Wednesdays 14:15-16:00 (The lecture rooms will be changing from week to week)
- Hands-on exercise sessions and homework solutions: Fridays 10:15-12:00
- 5 homework assignments will be graded: Deadline is on Fridays by 10:00 am (starting second week)
- Students need to finish MyCourses weekly quizzes before being able to access weekly homework assignments
- On week 1 you need to pass the pretest, which is required to be able to continue the course; it is due Friday Sept. 9 at 10:00 am.
- Guidelines for the homework solutions – but not full solutions – will be published in the exercise session and partially on the web page

Completing the course

- **On-campus exams:**

Individual Exam (75 %): 20.10.2022, 13:00-16:00

Make-up exams: **13.12.2022**

- **5 Individual Homework Assignments (25 %)**

- **No copying** is accepted; discussion of materials is allowed between students.

- Free-riders will not be able to pass the exam anyway, so the best strategy to learn and understand is to do the homework carefully and as individually as possible and discuss issues when needed.

- Assistant or teacher will answer questions related to the material during the class (or to some extent by email)

- **1 % bonus** for submitting the course evaluation

Completing the course

Teaching

- **Lectures** (voluntary, but highly recommended)
- **Exercise sessions** (voluntary, but highly recommended)
- **Attendance will be kept on participation of the events, but no extra points are given for that**
- **All students are accepted to participate, but**
- **Everyone has to do the **pretest** and fill a **background questionnaire** during the first week**
- **To check that you have studied the lecture material before starting **homework assignment**, you need to do **weekly quizzes** before being able to access the homework assignments**

Approximate Workload (for an average student to obtain grade 3/5):

- Lectures 30 h (5 h/ week)
- Exercise sessions 12 h (2 h/ week)
- Independent study and Homework preparation
66 h (11 h/ week)
- Preparation for the exam 51 h
- Exam 3 h
- Total 161 h (average student to obtain grade 3)
- Theoretically workload in seven weeks is
 $161/7=23$ hours per week

Preliminary timetable and topics

Week 1

- **Introduction to simulation models**
- **Probability and Statistics**
- **Spreadsheet modeling**
- **Simulation of discrete random variables**

Week 2

- **Simulation with Inverse function method**
- **Generating random numbers**

Week 3

- **Input modeling: Special methods for Generating random variables**
- **Waiting time distributions**

Preliminary timetable and topics

Week 4

- **Multivariate distributions and their simulation**

Week 5

- **System simulation of service processes**

Week 6

- **Stochastic processes and simulation**

Week 7

- **Exam**

Purpose of teaching

Pretest

- To make sure that you have the preknowledge required for the course

Lectures

- Explain theory and how it can be applied in practice
- Students can ask questions related to theory

Exercises

- Learn to use Excel for simulation
- Students can ask questions related to Excel

Quizzes

- To check weekly that you have understood the main concepts

Homework assignments

- Practice to understand and how to use theory to develop simulation models
- Practice Excel to develop simulation models
- To deepen your understanding through practical problems

Exam (You have to pass!)

- Check what you have learned and understood

Other ways to study

Textbooks

- **Help you to deepen your knowledge**
- **Give you a broader understanding of theory**
- **Give you a broader understanding of applications**
- **You do not need to sit in front of computer all the time**

Internet:

- **You can find information on specific topics and concepts
e.g. from Wikipedia**
- **You may find study materials**
- **You can find out about different applications**
- **Discuss forums: but be careful, the information may not be
always be correct**

Textbooks

- **Theory** will be mostly taken from the book
- **Ross, S.: *Simulation*. 4th edition, Academic Press 2006, selected parts from Chapters 1-7 (more mathematical approach)**
- **Excel instructions and practical examples can be found in**
- **Evans, J.R. & Olson, D.L. *Introduction to simulation and risk analysis*. 2nd edition. Prentice Hall 2002. Chapters 1-6.**
- **Newer editions of both books may be used**
- **Reading book will deepen your understanding**

Why is Excel used in the course

Pros:

- **Excel is a good visual tool for teaching and learning purposes**
- **Excel is familiar beforehand to most students**
- **Surprisingly, Excel has many capabilities useful for modelling and simulation that most people do not know**

Cons

- **Excel is not very flexible for programming loop like structures**
- **Excel is slow for complicated simulations**

Some other simulation tools:

- **R, Matlab, Python**

Grading

Percentage	Grade
86%	5
77%	4
68%	3
59%	2
50%	1
Below 50 %	Fail