Métodos Cuantitativos para la Decisión 2018-19

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Course information	
Name	Quantitative Decision Methods
Code	DOI-IIND-581
Degree	Máster en Ingeniería Industrial (MII), Máster en Ingeniería de Telecomunicación (MIT), Máster in Business Administration (MBA)
Year	1st
Semester	1st (Fall)
ECTS credits	6 ECTS
Type	Basic
Department	Industrial Organization
Area	Statistics and Operations Research

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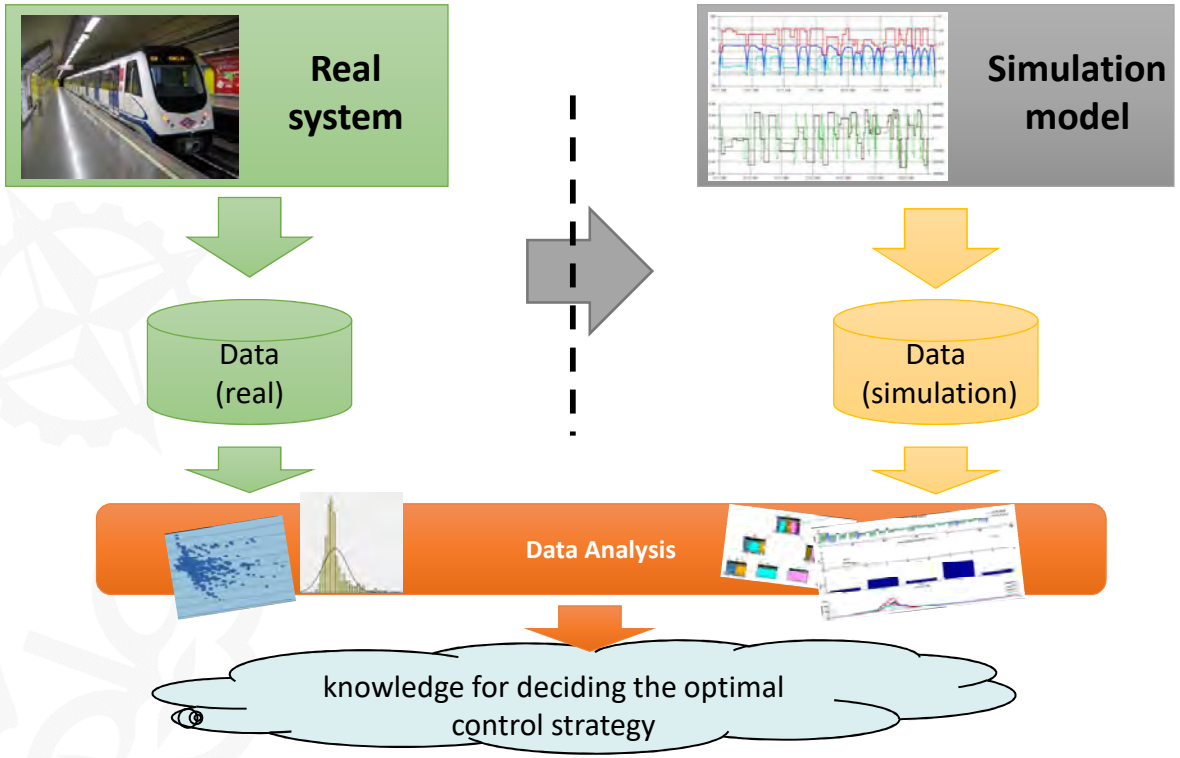
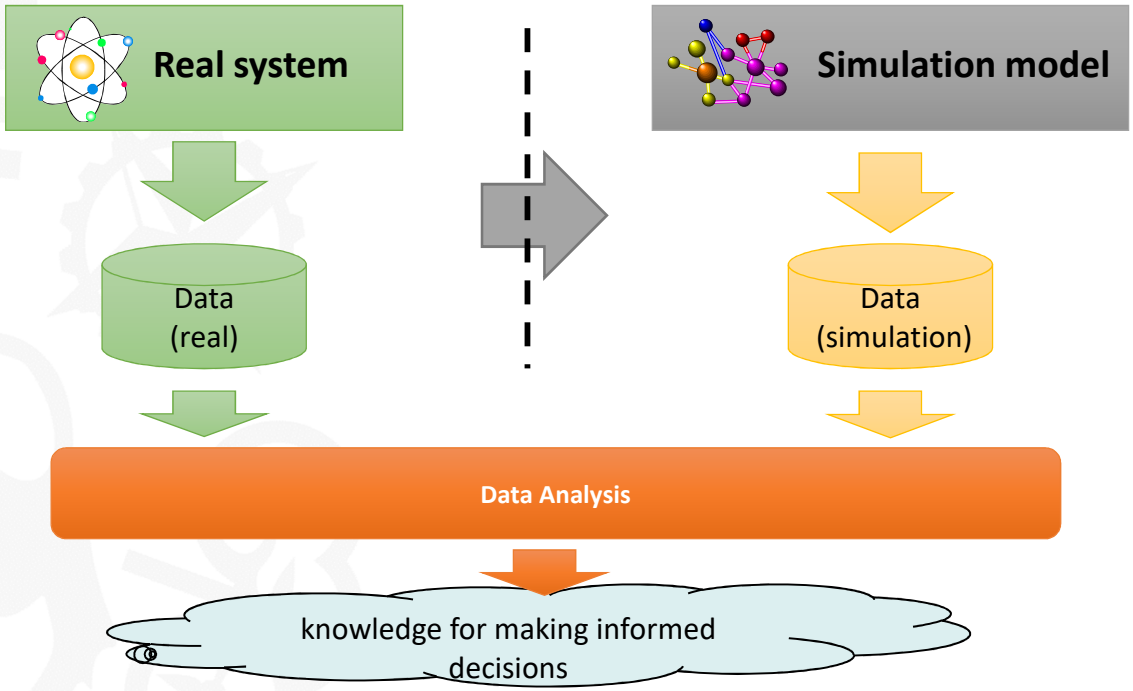
Motivation (i)

- Example: Design a **new traffic control system for the metro**



Motivation (ii)

- Engineers require tools to analyze and extract the maximum knowledge about real systems to make informed decisions



Objectives

- Learning of concepts of
  - Discrete Event Simulation
  - Queueing Theory
  - Analysis of Multivariate Data Sets
  - Analysis of Time Series
- Practicing in Laboratory
  - Simulation Modeling
  - Multivariate Data Analysis

Competences (i)

Generic competences

CG1. Know scientific and technologic topics such as mathematical, analytical and numerical methods for engineering, electrical engineering, energy engineering, chemical engineering, mechanical engineering, electronics engineering, …

CG4. Research, develop and innovate products, processes and methods.

CG11. Get self learning and studying capabilities.

Competences (ii)

Specific Competences and Learning Results

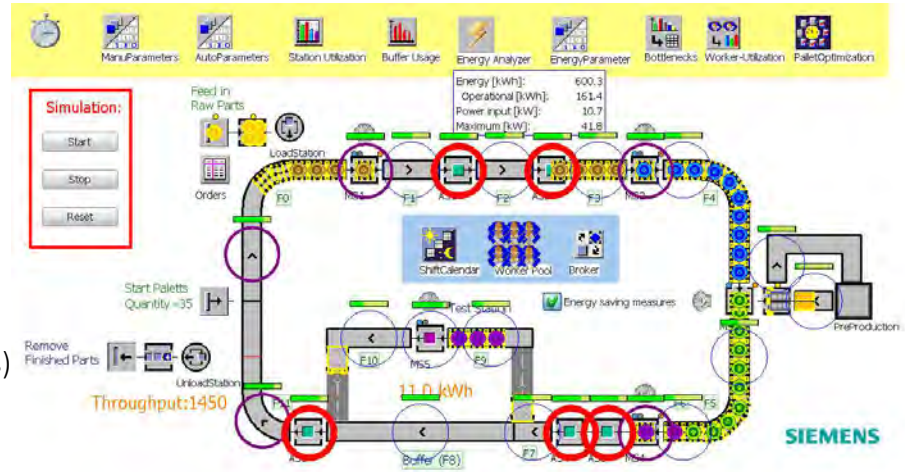
CMG1. Know how to organize and manage companies.

CMG2. Know about strategic actions and planning of different organization structures.

CMG5. Know about information systems applied to industrial management, manufacturing and logistic systems and quality control systems.

Contents (i)

- **Discrete Event Simulation Modeling** (6 h class + 1 h lab)
  - Components and Processes
  - Modeling by Simulation
  - Simulation Software
- **Simulation Output Analysis** (3 h class + 2 h lab)
  - Finite and Infinite Horizon Analysis
  - Comparison of System Designs
- **Queueing Theory** (4 h class)
  - Poisson processes
  - Queueing models
- **Simulation Case Study Development** (2 h lab)
- **Simulation Case Study Presentations** (2 h class)



Contents (ii)

- **Multivariate Data Analysis** (5 h class)
  - Introduction to Data Analysis
  - Analysis of Variance
  - Principal Components Analysis
- **Clustering and Classification** (4 h class + 2 h lab)
  - k-means
  - Classification Trees
- **Regression** (5 h class + 2 h lab)
  - Linear Regression
  - Additive Models
  - Neural Networks
- **Time Series Forecasting** (4 h class)
  - Decomposition Methods
  - Exponential Smoothing
  - ARIMA
- **Data Analysis Case Study Development** (2 h lab)
- **Data Analysis Case Study Presentations** (2 h class)

Methodology

- **Regular Classes**: 43 hours (80% theory and 20% exercises resolution).
- **Laboratory classes**: 11 hours. Practices with Simulation and Data Analysis examples in groups of two students. Case study development
- **Exercises**: solved by individual students during off-class time and solved in class by instructors: 4 hours.
- **Case Study Projects**: Technical report and final presentation by each group of two students.

Assessment Method

To pass this course the examination grade should be at least 4.0

Final grade:

- Examination Grade (60 %)
  - Mid-term exam (10 %)
  - Final exam (50 %)
- Continuous Assessment Grade (40 %)
  - Case study projects:
    - Technical report and class presentation (25 % + 10 %)
  - Class participation (5 %)

Extraordinary session:

- The examination grade weights 60% and is given solely by the final exam. The continuous assessment grade weights 40% and is the previously obtained.

Bibliography

- Basic
  - Rossetti, M. D., ***Simulation Modeling and Arena***. Ed. Wiley. 2015
  - Peña, D., ***Análisis de datos multivariantes***. Ed. McGraw-Hill. Madrid. 2002

- Complementary
  - Law, A.M., ***Simulation Modeling and Analysis***. Ed. McGraw-Hill. 2015
  - Kelton, W.D., Sadowski, R.P., and Zupick N.B., ***Simulation with Arena***, 6th. Ed. McGraw-Hill, 2015
  - G. James, D. Witten, T. Hastie, R. Tibshirani, ***An Introduction to Statistical Learning with Applications in R***, Springer, 2013 (http://www-bcf.usc.edu/~gareth/ISL/ISLR%20Seventh%20Printing.pdf)
  - T. Hastie, R. Tibshirani, J. Friedman, ***The Elements of Statistical Learning: Data Mining, Inference and Prediction***. 2nd Ed., Springer, 2009 (http://web.stanford.edu/~hastie/ElemStatLearn/printings/ESLII_print12.pdf)

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