

Course guide 270090 - SIM - Simulation

Unit in charge: Teaching unit:	Last modified: 30/01/20 Barcelona School of Informatics 715 - EIO - Department of Statistics and Operations Research.)24
Degree:	BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2010). (Optional subject).	
Academic year: 2023	ECTS Credits: 6.0 Languages: Catalan	

LECTURER

Coordinating lecturer:	PAU FONSECA CASAS	
Others:	Primer quadrimestre: PAU FONSECA CASAS - 11, 12 JOAN GARCIA SUBIRANA - 11, 12 JORDI MONTERO GARCIA - 11, 12	
	Segon quadrimestre: PAU FONSECA CASAS - 11, 12, 13	

JORDI MONTERO GARCIA - 11, 12, 13

PRIOR SKILLS

Statistics.

REQUIREMENTS

- Prerequisite PE

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CES1.1. To develop, maintain and evaluate complex and/or critical software systems and services.

CES2.2. To design adequate solutions in one or more application domains, using software engineering methods which integrate ethical, social, legal and economical aspects.

CT2.1. To demonstrate knowledge and capacity to apply the principles, methodologies and life cycles of software engineering.

CT2.4. To demonstrate knowledge and capacity to apply the needed tools for storage, processing and access to the information system, even if they are web-based systems.

Generical:

G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

G3. THIRD LANGUAGE: to know the English language in a correct oral and written level, and accordingly to the needs of the graduates in Informatics Engineering. Capacity to work in a multidisciplinary group and in a multi-language environment and to communicate, orally and in a written way, knowledge, procedures, results and ideas related to the technical informatics engineer profession.

G9. PROPER THINKING HABITS: capacity of critical, logical and mathematical reasoning. Capacity to solve problems in her study area. Abstraction capacity: capacity to create and use models that reflect real situations. Capacity to design and perform simple experiments and analyse and interpret its results. Analysis, synthesis and evaluation capacity.



TEACHING METHODOLOGY

The course is designed taking into account cooperative learning and problem/project-based learning methodologies, complemented with some theoretical sessions intended to develop the set of deliverables with the best guarantees and achievement.

LEARNING OBJECTIVES OF THE SUBJECT

1.Being able to write a technical article and correctly express concepts in English language.

2. Ability to produce a consulting project.

3. Ability to develop a discrete event simulation system study.

STUDY LOAD

Туре	Hours	Percentage
Guided activities	3,0	2.00
Self study	87,0	58.00
Hours large group	30,0	20.00
Hours small group	30,0	20.00

Total learning time: 150 h

CONTENTS

Introduction

Description:

What is a simulation study? A practical approach by presenting a real project that will allow students to identify the phases that must be followed for the development of a valid and useful simulation study.

Simulation and Statistical methods

Description:

Randomness as the cornerstone of modeling and experimentation. Statistical distributions, generation of numbers and random variables.

Some known distributions and their application in simulation models. Monte Carlo Methods and simulation sampling process.

Simulation paradigms.

Description:

Introduction to the main paradigms in simulation and applicability of them. Introducing Netlogo, a specific IDE based on agentsbased models. ABM system development.

System modeling and related data.

Description:

How to build a simulation model using specification languages like UML, SDL ... Input data analysis. How to fit empirical data to random distributions.



Discrete Event Simulation (DES)

Description:

How a discrete event simulator works, what components are necessary for its development. Integration with third-party applications.

Verification and validation of simulation models.

Description:

Methodologies to buid verified, validated and credible simulation models.

Experimental design and output analysis.

Description:

Basic concepts and methods, the design of experiments in simulation: Scenarios and experiments. Results quality.

Presentation and defense of a simulation study

Description:

Multidisciplinary and team work. Presentation and defense of a simulation study for a client. Goals definition and results presentation quality, discussion and future work.

ACTIVITIES

Fonaments bàsics de la simulació

Description:

Introducció a l'assignatura, exemples de sistemes i de models. Revisió històrica.

En aquesta activitat l'estudiant aprendrà les diferents fases associades a un estudi de simulació i l'existència de simuladors específics i genèrics.

Motivar a l'alumne i explicar la importància de la disciplina a través d'exemples reals.

Specific objectives:

2,3

Related competencies :

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Full-or-part-time: 6h Theory classes: 2h Laboratory classes: 2h Self study: 2h



Aleatorietat i Simulació

Description:

En aquesta activitat l'estudiant identificarà l'estreta relació entre l'estadística i els seus mètodes i realitzar un estudi de simulació de qualitat.

Specific objectives:

2, 3

Related competencies :

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Full-or-part-time: 16h

Theory classes: 4h Laboratory classes: 4h Self study: 8h

Simulació basada en agents

Description:

Paradigmes de Simulació. L'estudiant aprendrà a utilitzar un IDE específic orientat a modelització basada en agents (ABM), un enfoc a la simulació social, i comprendrà la diferència entre simuladors event-schedulling i time-step

Specific objectives:

2, 3

Related competencies :

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Full-or-part-time: 24h Theory classes: 6h Laboratory classes: 6h Self study: 12h



Estudi de Simulació

Description:

L'estudiant aprendrà la importància d'establir clarament els objectius i els elements significatius a ser observats, modelats i validats, en l'estudi proposat.

Specific objectives:

1, 2, 3

Related competencies :

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Full-or-part-time: 16h Theory classes: 4h

Laboratory classes: 4h Self study: 8h

Discrete Event Simulation (DES)

Description:

Activitat principal del curs que permetrà a l'estudiant assolir els coneixements teòrics que l'ajudin a desenvolupar un simulador específic orientat a esdeveniments discrets.

Specific objectives:

1, 2, 3

Related competencies :

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Full-or-part-time: 36h Theory classes: 6h

Laboratory classes: 6h Self study: 24h



Verificació i Validació de models de simulació

Description:

Descriure les tècniques més usuals per poder Verificar i Validar (VV&A) els models de simulació. Es posa èmfasi en la necessitat d'utilitzar aquestes tècniques per tal de poder emprar el simulador amb garanties de qualitat.

Specific objectives:

1, 2, 3

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Full-or-part-time: 18h Theory classes: 4h

Laboratory classes: 4h Self study: 10h

Disseny d'experiments i Anàlisi de Resultats

Description:

L'estudiant realitzarà el disseny d'experiments que millor s'ajusti el seu estudi per, a posteriori, analitzar els resultats. Prèviament, adaptarà el seu motor de simulació específic per tal que suporti l'execució d'experiments.

Specific objectives:

1, 2, 3

Related competencies :

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Full-or-part-time: 16h Theory classes: 4h Laboratory classes: 4h Self study: 8h



Writing the final report

Description:

Compiling all the information generated during the course and creating the final report.

Specific objectives: 2, 3

Related competencies :

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Full-or-part-time: 18h

Guided activities: 3h 36m Self study: 14h 24m

GRADING SYSTEM

The subject follows a mixed assessment method, with reviews of the work developed in the laboratories and a final theoretical exam. Continuous student involvement in all activities is required in order to pass the course.

Final grade: 0.6*Simulation study 0.4 Exam

BIBLIOGRAPHY

Basic:

- Law, A.M. Simulation modeling and analysis. 5th int. ed. McGraw-Hill, 2015. ISBN 1259254380.

- Guasch, A. [et al.]. Modelado y simulación: aplicación a procesos logísticos de fabricación y servicios. 2a ed. Edicions UPC, 2003. ISBN 8483017040.

- Fonseca, P. (ed.). Formal languages for computer simulation: transdisciplinary models and applications. Information Science Reference, 2014. ISBN 9781466643697.

Complementary:

- Robinson, S. Simulation: the practice of model development and use. 2nd ed. Basingstoke, Hampshire, [England]; New York, [New York]: Palgrave Macmillan, 2014. ISBN 9781137328038.

RESOURCES

Hyperlink:

- http://www.wintersim.org/- https://plus.google.com/communities/101706154509075557846- http://www.flexsim.com/http://www.acm-sigsim-mskr.org/