Operational Research

Academic Year: (2023 / 2024) **Review date: 25/04/2023 17:50:59**

Department assigned to the subject: Statistics Department

Coordinating teacher: NIÑO MORA, JOSE

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Students are expected to have completed courses with contents in linear algebra, statistics, business administration and computer programming.

OBJECTIVES

1. Modeling decision optimization problems in the framework of Operations Research models.
2. Formulating, analyzing and solving linear optimization models, by the graphical method, the simplex method and computer software (in particular, spreadsheets).
3. Formulating, analyzing and solving integer optimization models, by the graphical method, the branch and bound method, and computer software.
4. Formulating, analyzing and solving basic Markovian queueing models.
5. Designing and performing computer simulation experiments by the Monte Carlo method.

1. Capacity for analysis and synthesis.
2. Mathematical modeling and problem solving.
3. Oral and written communication.

DESCRIPTION OF CONTENTS: PROGRAMME

-Topic 1. Linear optimization (LO).
1.1. Introduction to Operations Research; LO models, formulations, applications and computer-based solution.
1.2. Graphical solution and sensitivity analysis.
1.3. The fundamental theorem of LO; basic feasible solutions and vertices; the simplex method.
1.4. Problems with unbounded objetive; the two-phase simplex method.
1.5. Duality in LO; economic interpretation and application to sensitivity analysis.
1.6. Optimal network flow models.

-Topic 2. Integer optimization (IO).
2.1. IO models and applications; linear relaxations; optimality gap; optimality test; graphical and computer-based solution.
2.2. The Branch and Bound method.
2.3. Combinatorial optimization models. Strengthening formulations with valid inequalities.

-Topic 3. Queueing theory (QT).
3.1. QT models and applications; performance metrics; utilization factor and stability; Little's law; PASTA property.
3.2. The M/M/1 model; calculation of performance metrics.
3.3. The M/M/m model; calculation of performance metrics.

-Topic 4. Simulation.
4.1. Simulation models; Monte Carlo method and applications; computer generation of pseudo-random numbers.
4.2. Computer generation of discrete and continuous probability distributions.

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LEARNING ACTIVITIES AND METHODOLOGY

Theory (3 ECTS). Theory classes with supporting material available in the course web page. Practical classes (3 ECTS). Problem-solving classes. Computer labs. Weekly individual tutoring sessions.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

The course assessment is based on: two midterm exams, with a weight of 90% of the final grade, and hand-in exercises in the computing lab classes, with a weight of 10% of the final grade.

Students who have not followed the continuous evaluation will be allowed to take a final exam, with a weight of 60% of the final grade. Students who do not pass the course in the regular semester will have an extraordinary exam. If a student followed the continuous evaluation process, this exam will have the same weight than the regular exam. If a student did not follow the continuous evaluation process, the weight of the final exam will be 100% of the total grade. In any case, the final grade will be based on the more favorable weighing scheme.

BASIC BIBLIOGRAPHY

- F.S. HILLIER, F.S., G.J.LIEBERMAN Introduction to Operations Research, McGraw Hill.

- H.A. TAHA Operations Research, Pearson.

ADDITIONAL BIBLIOGRAPHY

- M.S. BAZARAA, J.J. JARVIS y H.D. SHERALI Linear Programming and Network Flows, Wiley.

- P. A. Jensen, J. F. Bard Operations research: models and methods, Wiley, 2003