UNIVERSITAT POMPEU FABRA

Teaching plan:

Operations Research

1. Description of the course

- Name of the course: Operations Research
- Academic year: 2012-2013
- Quarter: first
- Degrees: IBE, ADE, ECO
- Course code: 21959 (ADE/ECO) i 21219 (IBE).
- ECTS: 5
- Student hours dedication: 125 hours
- Teaching language: English
- Professor: Daniel Serra

Professor	Group	Group	Seminars
Daniel Serra	1	1	
Adela Pagès		1	101 102 103

Daniel Serra
Office 20.293
daniel.serra@upf.edu
Office hours: Monday-tuesday 18:30-19:30

2. Course presentation

The area of quantitative methods for decision making uses the scientific method as the basis to research and help make decisions on complex problems of the organizations. The purpose of this course is to equip the participants with the relevant tools and techniques for applications in solving managerial problems. The focus of this course will be on applications of quantitative methods in business situations.

The methodology of the course is based on what is known as Operations Research, a science that offer to the decision maker different quantitative methodologies in order to make decisions. The objective of the course is to learn the fundamental concepts, the quantitative models, up to date solution techniques in problem solving and complex decision making. During the course we will see how to apply these techniques in different areas of an organization, such as marketing, production and operations, logistics, finance, etc. Emphasis will be made on practical and real world applications. Excel spreadsheet together with the module "Solver" will be intensively used.

3. Competences to be achieved

The objective of the course is to provide the fundamental concepts, quantitative models, solution methods and up to date techniques in decision making.

General competences	Specific competences
Instrumentals • Organization and planning capacities. • Knowledge of software. • Problem solving. • Information search and processing Interpersonals • Oral communication in public. • Team work. • capacity to write technical reports. Systematics • Critical reasoning skills in both reading and writing communication. • Good analysis of qualitative and quantitative information. • Adaptation yo new situations and environments.	Academic and professionals • Recognize the relevance of quantitative methods in decisión making within management organizations. • To be able to know when these tolos can be used, and in which environments, and when not to use them. • To learn how to apply these tools and methodologies of quantitative methods in managerial problems. • To be able to use information system technologies and optimization software as a support for complex decisión making situations. • To develop the understanding of the results obtained and how to implement them in “real world” situations

4. Course program

1. Linear Programming:
   1.1. Structure of the problem.
   1.2. Mathematical conditions.
   1.3. Objectives and constraints.
   1.4. Examples of formulations: human resources problems, capacity problems, transportation problems.

2. Solution methods in LP
   2.1. Graphical method
   2.2. The simplex algorithm
   2.3. Solver and other software.

3. Integer programming
   3.1. Problem formulation.
   3.2. The branch and bound procedure.
   3.3. The knapsack problem.
   3.4. Assignment problems.

4. Multiobjective programming
   4.1. Objective space.
   4.2. Efficiency in solutions.
   4.3. The weighting method and constraint methods. Case studies.
   4.4. Goal programming.

5. Solution methods for large-scale problems: introduction to metaheuristics.
   5.1. The modelling process
   5.2. Algorithms and Decision Support Systems
   5.3. Metaheuristics: Local Search and Tabu Search
   5.4. Example 1: Travelling Salesman Problem
   5.5. Example 2: Capacitated Location Problem

6. Network Models
   6.1. Network notation
   6.2. Maximal flow
   6.3. Shortest Path
   6.4. Location modelling and logistics

7. Project Management
   7.1. Critical Path Model
   7.2. PERT
   7.3. PERT/CMP
   7.4. Probabilistic PERT
   7.5. Case study

8. Waiting Lines and Queuing Theory and Modelling
   8.1. Waiting line characteristics
   8.2. Arrivals
   8.3. Service
   8.4. The M/M/1 model
   8.5. The M/M/m model
   8.6. Case studies

9. Simulation modelling
   9.1. When to use simulation?
   9.2. MonteCarlo simulation
   9.3. Simulation of a queuing problem
   9.4. Case studies

5. Evaluation

- Final exam: 60% of the grade. You need to obtain in this exam at least a 4 out of 10 to pass the course.
- Continuous evaluation: 40% of the grade:
  - 30% homeworks and case studies
  - 10% participation in class (seminars are compulsory)

6. Bibliography

Basic textbook:

- Render, B., Stair, R. & Hanna, M.E. (2011). Quantitative Analysis for Management, 11th edition. Pearson Prentice Hall.

Additional references

- Hillier F., Hillier M. y Lieberman, G.(2008). Introduction to Management Science: A Modeling & Case Studies Approach McGraw Hill.
- Powell, S.G. & Baker, K.R. (2010). The Art of Modelling with Spreadsheets: Management Science and Modelling Craft, 3rd edition, Wiley
- Winston, W. (2004). Excel Data Analysis and Business Modeling, Microsoft Press

Other references

Quantitative Analysis For Management
Charles P. Bonini , Warren Hausman , Harold Bierman
McGraw-Hill/Irwin; 9 edition (January 1, 1997)

Quantitative Methods for Decision Makers (4th Edition)
Mik Wisniewski
Prentice Hall; 4 edition (February 27, 2006)

Quantitative Business Modeling
Jack R. Meredith , Scott M. Shafer , Efraim Turban
South-Western College Pub; 1 edition (October 8, 2001)

An Introduction to Management Science: A Quantitative. Approach to Decision Making
David R. Anderson , Dennis J. Sweeney , Thomas A. Williams , R. Kipp Martin
South-Western College Pub; 12 edition (April 19, 2007)

Spreadsheet Modeling and Decision Analysis
Cliff Ragsdale

South-Western College Pub; 5 edition (May 3, 2006)

Quantitative Techniques
T Lucey
Int. Cengage Business Press; 6 edition (September 12, 2002)

Quantitative Methods: A Short Course
Jon Curwin , Roger Slater
Int. Cengage Business Press; 1 edition (March 4, 2004)

Study Guide to accompany Introduction to Management Science: Quantitative Approaches to Decision Making
David R. Anderson , Dennis J. Sweeney , Thomas A. Williams
South-Western College Pub; 11 edition (March 22, 2004)

Handbook of Metaheuristics
Glover F. & G. A. Kochenberger
Springer New York, 2003

Software

- Excel Solver
- GLP (Windows graphic visualization program for 2-dimensional linear programming models).

7. Methodology

The teaching activities during the course will be as follows:

- 20 sessions of 1:30 hours each, twice a week. Full class.
- 3 seminar groups, with six sessions of 1:30h each, where case studies will be discussed, together with problem solving. Students will have to hand out the homework at the beginning of the class. Case studies can be presented by groups of 3-5 students. Homeworks are done on an individual basis.

Attention: Homework and case studies have to be presented by ALL students at most before the first session of the seminars, without exceptions.

Course Material, homeworks and case studies will be posted in the intranet of the course.

Group	Quarter	Class Hours	Seminars	
1	1	from 24.09.2012 to 27.11.2012 Monday from 17:00 to 18:30 Tuesday from 17:00 to 18:30	101	Thursday 16:00 to 17:30
			102	Thursday 18:00 a 19:30
			103	Thursday 19:30 to 21:00

8. Schedule

Week 1:

1. Linear Programming:
   - 1.1. Structure of the problem.
   - 1.2. Mathematical conditions.
   - 1.3. Objectives and constraints.
   - 1.4. Examples of formulations: human resources problems, capacity problems, transportation problems.

Week 2

2. Solution methods in LP
   - 2.1. Graphical method
   - 2.2. The simplex algorithm
   - 2.3. Solver and other software.

Week 3

3. Integer programming
   - 3.1. Problem formulation.
   - 3.2. The branch and bound procedure.
   - 3.3. The knapsack problem.
   - 3.4. Assignment problems.

Seminar session 1: Homeworks on linear programming formulation and the Simplex

Week 4

4. Multiobjective programming
   - 4.1. Objective space.
   - 4.2. Efficiency in solutions.
   - 4.3. The weighting method and constraint methods. Case studies.
   - 4.4. Goal programming.

Seminar session 2: Homeworks on integer programming.

Week 5

5. Solution methods for large-scale problems: introduction to metaheuristics.
   - 5.1. The modelling process
   - 5.2. Algorithms and Decision Support Systems
   - 5.3. Metaheuristics: Local Search and Tabu Search
   - 5.4. Example 1: Travelling Salesman Problem
   - 5.5. Example 2: Capacitated Location Problem

Seminar session 3: Homeworks on multiobjective programming

Week 6

6. Network Models
   - 6.1. Network notation
   - 6.2. Maximal flow
   - 6.3. Shortest Path
   - 6.4. Location modelling and logistics

Seminar session 4: Presentation of case studies

Week 7

7. Project Management
    7.1. Critical Path Model
    7.2. PERT
    7.3. PERT/CMP
    7.4. Probabilistic PERT
    7.5. Case study

Seminar session 5: Presentation of case studies. Homework on network models

Week 8

8. Waiting Lines and Queuing Theory and Modelling
    8.1. Waiting line characteristics
    8.2. Arrivals
    8.3. Service
    8.4. The M/M/1 model
    8.5. The M/M/m model
    8.6. Case studies

Seminar session 6: Presentation of case studies. Homeworks on project management

Week 9

9. Simulation modelling
    9.1. When to use simulation?
    9.2. MonteCarlo simulation
    9.3. Simulation of a queuing problem
    9.4. Case studies

Week 10

"wrap up" of the course. Conclusions. Questions and answers.