Universitat Autònoma de Barcelona

2023/2024

Quantitative Methods for Logistics

Code: 101738
ECTS Credits: 6

Degree	Type	Year	Semester
2501233 Aeronautical Management	OT	4	1

Contact

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Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject.
Please note that this information is provisional until 30 November 2023.

Prerequisites

It is recommended to have successfully completed the following courses:

- Optimitzation;
- System Modeling and Simulation
- Advanced Informatics

Objectives and Contextualisation

Modeling and simulation, as well as operation research, become a supportint tool in the decision-making processes to improve logistics processes. The main objective of the course is to deepen some quantitative methods that help improve the decision-making processes in the context of the management of operations in air transport. For example, airlines have used operational research techniques since the 1950s in the planning and management of their operations. Based on mathematical programming, the use of Constraint Logic Programming (CLP) is presented to solve problems in decision making or optimization. The guidelines for using CLP for different types of problems will be given with the following objectives:

- Characterize the available resources and the expected demand.
- To properly identify the decision variables and their domains.
- Form the problem restrictions
- Identify and program the method of solving feasibility and optimization problems.

Competences

- Allocate and manage aircraft turnaround resources efficiently.

- Apply specific software for solving problems in the aeronautical sector.
- Communication.
- Personal attitude.
- Personal work habits.
- Thinking skills.
- Use knowledge of the fundamental principles of mathematics, economics, information technologies and psychology of organisations and work to understand, develop and evaluate the management processes of the different systems in the aeronautical sector.
- Work in teams.

Learning Outcomes

1. Accept and respect the role of the various team members and the different levels of dependence within the team.
2. Communicate knowledge and findings efficiently, both orally and in writing, both in professional situations and with a non-expert audience.
3. Critically assess the work done.
4. Develop critical thought and reasoning.
5. Develop curiosity and creativity.
6. Develop independent learning strategies.
7. Develop scientific thinking skills.
8. Develop systemic thinking.
9. Develop the ability to analyse, synthesise and plan ahead.
10. Generate innovative and competitive proposals in professional practice.
11. Identify the principles behind constraint logic programming.
12. Identify, manage and resolve conflicts.
13. Improve performance indices in aircraft turnaround operations.
14. Maintain a proactive and dynamic attitude towards career progression, personal growth and continuous professional development. Have the will to succeed.
15. Make decisions.
16. Make efficient use of ICT in communicating ideas and results.
17. Manage information, critically appraising innovations in the field, and analyse future trends.
18. Manage time and available resources. Work in an organised manner.
19. Optimise the management of air transport operations using constraint logic programming.
20. Use software for modelling and solving problems through constraint logic programming.
21. Work cooperatively.
22. Work independently.

Content

Theory and Problems

MQL.T.1. Introduction to Decision Making:

- DM in LSCM:
- SCM Modeling
- Advanced Planning
- Quantitative Methods
- Planning and Scheduling
- Forecasting

MQL.P.1. Examples:

- Demand Forecast
- Production Mix

MQL.T.2. Planning and Scheduling. Optimization Methods:

- Mixed Integer Programming
- Constraint Programming
- AI methods

MQL.P.2. Introductory exercises to optimization problem modeling

MQL.T.3. Production Planning:

- Planning goals and activities
- Planificació dela producció
- Modelatge de les restriccions

MQL.P.3. Production Planning models. Optimization exercises.

MQL.T.4. Production scheduling:

- Advanced modeling constraints
- Programació d'activitats i objectius

MQL.P.4. Production Scheduling models. Optimization exercises.

MQL.T.5.Transport operations planning:

- Supply and Transport Networks
- Airline Operations
- Fleet Assginment Models
- Aircraft Routing

MQL.P.5. Exemples de problemes d'optimització en el transport aeri

Course Assay

The assay is a small practical project implemented by a team composed by3 strudents at most

Pratice sessions

MQL.L.1. Introduction to OPL:

- S/W configuration
- IDE introduction

MQL.L.2. OPL models:

- Mathematical Programming
- Constraint programming

MQL.L.3. Production Planning and Scheduling

MQL.L.4. Transport Network Models

MQL.L.5. Airline Operations

Methodology

The general methodological approach of the subject is based on the principle of multiple strategies, so it is intended to facilitate active participation and the construction of the learning process by the student. For this purpose, teaching activities will be organized as magisterial sessions with the whole group, and practical sessions and follow-up of the student work with reduced groups.

Teaching will be offered on campus or in an on-campus and remote hybrid format depending on the number of students per group and the size of the rooms at 50% capacity.

Specifically, the teaching activities included in this subject are the following:

Theory lectures

Presentation and discussion of the fundamental concepts of the subject (whole group).

Problem sessions

Resolution and discussion of exercises aimed to consolidate the theoretical concepts of the subject (whole group).

Practise sessions

Basically, introductory sessions will be held to:

OPL mathematical programming environment.
Constraint Programming Library of ILOG CP.

These activities will be carried out in smaller groups.

Course Assay (project)

This practical Assay consists in the development of a short project that, additionally, must be documented (brief report) and defended in front of the whole group. The goal of the Assay is to put in place a solution proposal using quantitative methods as a support tool for a decision-making processes in a realistic use case. This activity is done in teams composed by up to 3 memeber. Follow-up sessions will be carried out in small groups.

The proposed teaching methodology may undergo some modifications according to the restrictions imposed by the health authorities on on-campus courses.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of onelecture will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

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Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practise sessions	10	0.4	13, 19, 20
Problems sessions	12	0.48	13, 19
Theory sessions	18	0.72	11, 13, 19, 20

Type: Supervised			
Course Assay followup sessions	8	0.32	3, 5, 10, 18, 12, 14, 15, 21
Type: Autonomous			
Course Assay development	50	2	1, 2, 7, 8, 9, 5, 4, 16, 10, 18, 17, 12, 14, 13, 19, 15, 21
Personal study	24	0.96	7, 8, 6, 9, 4, 11, 13, 19, 22, 20
Practice exercise preparation	20	0.8	1, 5, 10, 13, 19, 21, 20

Assessment

The single assessment system is not foreseen in this subject.

a) Scheduled evaluation process and activities

The subject does not have written exams. The evaluation is based on the different works presented during the semester.

The submission deadlines for the different reports will be published in the moodle classroom of the virtual campus since the very beginning of the semester. Deadlines are subject to possible reschedules in case of later events. The Virtual Campus is the only channel to communicate the most updated schedule, since it is assumed that this is the only platform for exchanging information between faculty and students.

The evaluation consists of the following activities:

- Practice (40%). Set of practical exercises that are prepared in the classroom and are submitted on the scheduled due dates.
- Assay work (50%). Course team work to be developed during the semester.
- Oral presentation of the Assay (10%). Oral presentation and defence of the Assay.

Keep in mind that practice submissions can not be retaken beyond the given due dates, so failing them implies failing the whole course.

b) Programming evaluation activities

The schedule of the regular evaluation activities will be published on the virtual campus at the early beginning fo the semester. Dates for retaking process will be published at the examination section of the School of Engineering website.

c) Retaking process

In accordance with the Academic Regulations of the UAB, participating in retaking process requires the student to have been previously evaluated in the set of evaluation activities, having achieved a minimum of two thirds of the total gradeof the subject or module.

Practice work can't be retaken and must be submitted within the specified duedates.

An Assay course work failed in the first instance can be recovered on the examination date set by the programme coordination. Re-taking will consist in the presentation of the corrected work according to the indications received by the professor. In this case, as long as the work meets the MINIMUM requirements, the work will be graded with a 5.

d) Procedure to review qualifications

For each evaluation activity, a place, date and time in which the student can review the activity with the teacher will be indicated. The faculty responsible for the subject will assess the presented complaints regarding the awarded grade. The student can complain in the given date, but the activity will not be reviewed later.

e) Qualifications

The final grade is calculated as follows:

FINAL GRADE = CE1 x 0.4 + CE2 x 0.1 + CE3 x 0.5

CE1: Practice garde.

CE2: Oral presentation of practical work.

CE3: Assay course work grade.

If any of the components of the evaluation CE1 or CE3 has a value lower than 4, the qualification will be Fail

Detail of the practical work qualification. It will have two components:

- Overall evaluation of the work (90% of the score CE3). Both the report and the developed project will be evaluated. This note will apply equally to each member of the group.
- Individual work (10% of the CE3 note): Teacher's assessment of individual contribution to the team work.

Granting a distinction grade is the decision of the subject faculty. The regulations ofthe UAB indicate that distinctions may be awarded to students who have obtained a final grade equal or greater than 9.00. Distinction awards cannot exceed 5% of enrolled students.

The rating of "Assesment not possible" (Not Submitted) will be obtained only if no evaluation activity is delivered.

f) Irregularities by the student, copy and plagiarism

Without prejudice to other disciplinary measures deemed appropriate, and in accordance with current academic regulations, any irregularity committed by the student, which could lead to an alteration of the evaluation act, will be scored with a zero. Therefore, copying or allowing to copy a practice or any other activity spoiling the evaluation will imply failing with a zero, and if the activity is required to pass the subject, the whole course will be failed. The evaluation activities qualified in this way and by this procedure will not be recoverable, and therefore the subject will be failed directly without the opportunity to retaking it in the same academic year.

h) Evaluation of students retaking the whole subject

Those students retaking the whole subject must follow the same evaluation activities as for the first time.

The proposed evaluation activities may undergo some changes according to the restrictions imposed by the health authorities on on-campus courses.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assay Presentation	10%	8	0.32	1, 3, 2, 16, 12, 21

Course Assay	50%	0	0	3, 2, 7, 8, 9, 5, 16, 10, 17, 11, 12, 14, 13, 19, 15, 21, 20
Practical Exercises	40%	0	0	6, 9, 4, 18, 11, 13, 19, 21, 22, 20

Bibliography

Hartmurt Stadlert and Cristoph Kilger (Eds.) *Supply Chain Management and Advanced Planning*. Third Edition. Springer, 2005. (Electronic version available at the university library)

Ioannis T. Christou. *Quantitative Methods in Supply Chain Management. Models and Algorithms*. Springer, 2012. (Electronic version available at the university library)

H. Paul Williams. *Model Building in Mathematical Programming*. Wiley. 2013 (5th edition). https://ebookcentral-proquest-com.are.uab.cat/lib/uab/detail.action?docID=1120846

Kim Marriott and Peyer J. Stuckey. *Programming with Constraints. An introduction*. MIT Press.

Massoud Bazargan. *Airline Operations and Scheduling*. Ashgate. https://ebookcentral-proquest-com.are.uab.cat/lib/uab/detail.action?docID=5208383

Norman Ashford et Al. *Airport Operations*. McGraw-Hill

Further readings

Joseph Geunes, Panos M. Pardalos and H. Edwin Romeijn (Eds.) *Supply Chain Management: Models, Applications, and Research Directions*. Kluwer Academic Publishers, 2002. (Electronic version available at the university library)

F. Robert Jacobs, William L. Berry, D. Clay Waybark and Thomas E. Vollmann. *Manufacturing Planning and Control for Supply Chain Management*. McGraw-Hill, 2011 (6th edition)

F. Robert Jacobs and Richard B. Chase. Operation*s and Supply Chain management*. McGraw-Hill Irwing, 2011 (13 th edition)

Software

Specific software

During the course we will use the IBM ILOG optimization platform that you can install on your computers.

How to get the ILOG Student Edition platform.

When starting the course go to:
https://www.ibm.com/products/ilog-cplex-optimization-studio?mhsrc=ibmsearch_a&mhq=ilog

Register on the platform with your email address @ e-campus.uab.cat