UAB
Universitat Autònoma de Barcelona

Quantitative Methods for Logistics

Code: 101738
ECTS Credits: 6

2025/2026

Degree	Type	Year
Aeronautical Management	OT	4

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

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, manage and resolve conflicts.
12. Identify the principles behind constraint logic programming.
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

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

Activities and Methodology

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	12, 13, 19, 20
Type: Supervised			
Practical work followup sessions	8	0.32	3, 5, 10, 18, 11, 14, 15, 21
Type: Autonomous			
Development of practical work	48	1.92	1, 2, 7, 8, 9, 5, 4, 16, 10, 18, 17, 11, 12, 14, 13, 19, 15, 21, 22, 20
Personal study	30	1.2	7, 8, 6, 9, 4, 12, 13, 19, 22, 20
Practice exercise preparation	20	0.8	1, 5, 10, 13, 19, 21, 20

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.

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 small groups. It is recommended to attend all the practical sessions in order to be able to pass the validation exam of the practical part.

Use of AI

This subject recognises the growing use of generative artificial intelligence as a support tool, and therefore its use is admitted in a limited way. To all intents and purposes, the use of these tools will only be accepted to improve formal aspects of papers, such as writing, style, expository clarity, linguistic correctness or translation, and to obtain occasional assistance in technical aspects. It is not acceptable to use generative artificial intelligence tools to generate the content of assessed work, such as methodological approaches, designs, experiments, analysis or interpretation of results, elaboration of ideas, or formulation of conclusions. These tasks must be carried out entirely by the student, as they constitute the essential part of the intellectual and creative work required to pass the subject. Students will have to explicitly indicate, in each of the deliverables, whether generative artificial intelligence tools have been used, specifying which ones have been used, for what

purpose and to what degree. Irresponsible, excessive or unnecessary use of these tools may have a negative impact on the final grade of the subject. The detection of undeclared or inappropriate use of these tools may lead to failure of the subject.

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

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Practical Exercises	40%	0	0	1, 3, 6, 9, 5, 4, 18, 11, 12, 14, 13, 19, 21, 22, 20
Practical validation test	20%	2	0.08	2, 16, 22, 20
Theory part exam	40%	2	0.08	2, 7, 8, 9, 16, 10, 17, 12, 13, 19, 15, 20

The single assessment system is not foreseen in this subject.

a) Scheduled evaluation process and activities

The evaluation consists of the following activities:

- Delivery of practical exercises (40%). Set of individual practical exercises to be handed in on the dates set.
- Examination validation of the practical part (20%). Its purpose is to validate whether the student has acquired knowledge of the use of the optimization tools introduced in the course.
- Theory exam (40%). Examination of the theory part of the course.

It must be taken into account that the practical is not recoverable, therefore failing it with a grade lower than 4 out of 10, means not being able to pass the course. A practical assignment not handed in on the established date will not be assessed (except for duly justified reasons, in which case the maximum mark will be 5). In order to be assessed, all the practical assignments must be handed in

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

According to the UAB Academic Regulations, in order to participate in the recovery of a failed evaluation, he/she must have been previously evaluated in a set of activities, the weight of which is equivalent to a minimum of two thirds of the total grade of the subject or module.

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

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 mark = CE1 x 0,4 + CE2 x 0,2 + CE3 x 0,4

CE1: Grade for the practicals. Each practical averages the same weight in the calculation of CE1.

CE2: Examination validation practical part.

CE3: Theory exam.

If any of the components of the evaluation CE1, CE2 or CE3 has a value lower than 4, the final grade will be Failed with a 4 regardless of the numerical result of applying the formula

Awarding an honours mention (MH) is the decision of the lecturers responsible for the subject. UAB regulations state that MH may only be awarded to students who have obtained a final grade of 9.00 or higher. Up to 5% of the total number of students enrolled may be awarded MH

A grade of *Not Assessable (Not Submitted)* will only be assigned if no assessable work is submitted during the course..

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 will do the same assessment activities.

Bibliography

Hartmurt Stadlert and Cristoph Kilger (Eds.) Supply Chain Management and Advanced Planning. Third Edition. Springer, 2005. (Electronic version available at the university library)
https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991010559602806709

Ioannis T. Christou. Quantitative Methods in Supply Chain Management. Models and Algorithms. Springer, 2012. (Electronic version available at the university library)
https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991010405513506709

H. Paul Williams. Model Building in Mathematical Programming. Wiley. 2013 (5th edition).
https://bibcercador.uab.cat/permalink/34CSUC_UAB/1c3utr0/cdi_askewsholts_vlebooks_9781118506189

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) https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991010403666106709

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

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Spanish	first semester	afternoon
(PLAB) Practical laboratories	11	English	first semester	afternoon
(PLAB) Practical laboratories	12	English	first semester	afternoon
(TE) Theory	1	Spanish	first semester	afternoon