Universitat Autònoma de Barcelona

2022/2023

Decision Making

Code: 42653
ECTS Credits: 9

Degree	Type	Year	Semester
4313489 Logistics and Supply Chain Management	OB	1	1

Contact

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Use of Languages

Principal working language: english (eng)

Teachers

Liana Napalkova

Prerequisites

None

Objectives and Contextualisation

Along a supply chain hundreds and thousands of individual decisions have to be made and coordinated every minute. These decisions are of different importance. They comprise the rather simple question "Which job has to be scheduled next on a respective machine?" as well as the very serious task whether to open or close a factory. The more important a decision is, the better it has to be prepared.

This preparation is the job of planning in its widest sense. Planning supports decision-making by identifying alternatives of future activities and selecting some good ones or even the best one. Planning can be subdivided into the phases:

- recognition and analysis of a decision problem,
- definition of objectives,
- forecasting of future developments,
- identification and evaluation of feasible activities (solutions), and finally
- selection of good solutions.

Supply chains are very complex. Not every detail that has to be dealt with in reality can and should be respected in a plan and during the planning process. Therefore, it is always necessary to abstract from reality and to use a simplified copy of reality, a so-called model, as a basis for establishing a plan. The "art of model building" is to represent reality as simple as possible but as detailed as necessary, i. e. without ignoring any serious real world constraints.

The main objective of this subject is to introduce quantitative methods and techniques aimed to help the planning activities and, therefore, to support the decision making process. These methods are based in the use of formal models and their corresponding solving techniques. The student will learn how to model the system and its decision making process and then how to apply the methods and techniques to select the optimal solutions. Basic case studies representing typical problems (e.g. planning, scheduling, distribution or routing) are used in the learning process.

Competences

- Address problems of management and coordination of logistics operations in production, transport and services in a holistic approach, by means of the consistent application of the supply chain management concepts and strategies, taking into account the pertinent aspects of environment, human capital, quality, technology, and economics.
- Analyse, organise and discuss situations in logistics in order to identify and model the dependency relationships, influence and impact that usually occur in the main performance indicators and quality factors as well as evaluating their complexity.
- Apply a rigorous and efficient approach to problem solving.
- Apply quantitative methods and techniques based on optimisation and/or simulation models in order to evaluate the different alternatives and select the most promising solution to be implemented
- Demonstrate abilities to document and reflect the problem-solving process in order to extract the lessons learned.
- Demonstrate information management skills: ability to retrieve and analyse information from different sources.
- Elaborate solid arguments based on quantitative models and analytical methods in order to convince and motivate decision makers, determine the adequate LCSM partners and then plan and coordinate the project to implement the solution.
- Face a new problem under a scientific perspective.
- Select and apply the most relevant analytical methodologies, strategies and current technologies for designing solutions to the problams of management and coordination of material, information and financial flows.
- Students should be able to integrate knowledge and face the complexity of making judgements from information which, being incomplete or limited, include reflections on the social and ethical responsibilities linked to the application of their knowledge and judgements
- Students should know how to apply the knowledge they acquire and be capable of solving problems in new or little-known areas within broader contexts (or multidisciplinary contexts) related to their area of study
- Work collaboratively in a group.

Learning Outcomes

1. Analyze, structure and propose mechanisms in order to identify and solve a decision problem in logistics systems
2. Apply a rigorous and efficient approach to problem solving.
3. Demonstrate abilities to document and reflect the problem-solving process in order to extract the lessons learned.
4. Demonstrate information management skills: ability to retrieve and analyse information from different sources.
5. Evaluate and compare the different alternatives to select the solution to be implemented, being able to assess beliefs and methods by combining intuition and analytical methods to identify the best solution.
6. Face a new problem under a scientific perspective.
7. Select and apply suitable methodologies and strategies to design a solution for a decision-making problem in LCSM.
8. Students should be able to integrate knowledge and face the complexity of making judgements from information which, being incomplete or limited, include reflections on the social and ethical responsibilities linked to the application of their knowledge and judgements
9. Students should know how to apply the knowledge they acquire and be capable of solving problems in new or little-known areas within broader contexts (or multidisciplinary contexts) related to their area of study
10. Understand how to model the system and the decision-making process
11. Understand the main methods and techniques supporting decision making
12. Work collaboratively in a group.
13. Work out arguments based on models and quantitative techniques

Content

THEORY

DM.T.1: Introduction to Decision Making:

- DM in LSCM:
  - SCM modeling
  - Advanced Planning
- Quantitative methods
  - Planning and scheduling
  - Forecasting

DM.T.2: Optimization methods:

- Linear and integer programming
- Constraint programming
- AI methods

DM.T.3: Production planning:

- Types of constraints
- Modeling structures

DM.T.4: Optimization of scheduling problems:

- Job sequencing
- Resource allocation
- Job and resource scheduling

DM.T.5: Heuristics and evolutionary methods:

- Introduction to evolutionary algorithms
- Heuristics in planning problems

DM.T.6: Heuristics and evolutionary methods

- Heuristics in Transport Planning

PROBLEMS

DM.P.1: Examples:

- Demand forecasting
- Production mix

DM.P.2: MILP modeling exercises

DM.P.3: Production planning models

DM.P.4: Production scheduling models

DM.P.5: Distribution: warehouses & inventory

DM.P.6: Transport network models

PRACTISE

DM.L.1: Introduction to OPL:

- S/W installation
- IDE overview

DM.L.2: OPL:

- MILP programming
- CP programming

DM.L.3: Productionplanning

DM.L.4: Production planning

DM.L.5: Heuristics and evolutionary methods

- Introduction to HeuristicLab
- Solving Job Shop Scheduling Problem in HeuristicLab

DM.L.6: Solving Transport and VRP problems

SEMINARS

Management Information Systems in Business: Role of IT in modern business

Methodology

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.

The course is organized by means of traditional lectures combined with seminars. The learning process will combine the following activities:

- Theory lectures
- Problem sessions
- Practise sessions: computer lab, teamwork and oral presentation
- Autonomous work

Practical case studies and optimization tools are used for promoting students hand on skills.

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 one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Problem sessions	8.5	0.34	1, 5, 13, 7
Seminars	10	0.4	11, 7, 4
Theory lectures	31.5	1.26	10, 11, 13
Type: Supervised			
Practise sessions	18	0.72	1, 5, 3, 13, 8, 9, 7, 6, 2, 4, 12

Type: Autonomous			
Personal study	50	2	1, 5, 10, 11, 13, 7
Problem solving and report writing	107	4.28	3, 8, 9, 6, 2, 4

Assessment

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 this information between faculty and students.

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 grade of 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 will be calculated from the assessment of the following evaluation activities:

- B1: Small project report related to the introduction to IT seminars (10%).
- B2: Combines an Assay (50%) or small project (team work) and the solution reports (20%) of four practical exercises (individual work) in the field of Planning & Scheduling, where MILP and CP optimization methods are used to solve the problems.
- B3: Solution reports of two cases where heuristics methods are used to solve the problem (20%).

In order to average all the evaluation activities, the mark of each of them must be above 5 points (out of 10). All the report-based activities must be submitted within the due dates specified by the professor. If a report-based activity is failed, the student will be asked to re-submit its report according to the corrections/indications provided by the professor.

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

The Assay qualification (belong to B2) has two components:

- Overall evaluation of the work (90% of the mark). 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 mark): Teacher's assessment during the oral presentation of the 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
B1-Introduction to IT project	10%	0	0	3, 8, 4
B2-Planning & Scheduling practical cases	70%	0	0	1, 5, 10, 11, 3, 13, 9, 7, 6, 2, 12
B3-Heuristics practical cases	20%	0	0	1, 5, 10, 11, 3, 13, 7, 6, 2

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 (5^{th} edition)

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)

Other relevant literature can be provided during the lecturing period.

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