COURSE DESCRIPTION CARD - SYLLABUS

Course name
Operation research and optimization theory [N2Log2>BOiTO]

Course

Field of study
Logistics

Year/Semester
1/2

Area of study (specialization)
Production-logistics Systems

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
14

Laboratory classes
0

Other (e.g. online)
0

Tutorials
8

Projects/seminars
8

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Student knows basics of statistics and probability calculus.

Course objective

Teach student of planning decisions to optimize inputs or outputs under resouces constraints. To explain ideas of optimization methods and algorithms.

Course-related learning outcomes

Knowledge:
1. Student knows standard problems of Operations Research and terms (objective, constraint, coefficient, feasible solution, optimum) [P7S_WG_05]
2. Student knows linear, non-linear, dynamic problems [P7S_WG_04]
3. Student knows transportation problems, project's time-cost optimization, graphs [P7S_WG_04]
3. Student knows methods of multicriteria optimization [P7S_WK_01]
4. Student knows what is uncertainty and risk, uncertainty decision rule, expected value, standard deviation [P7S_WK_01]

Skills:
1. Student performs mathematical modeling of feasible quantitative solutions to a decision. Sets optimization method [P7S_UO_01]
2. Student calculations due to algorithm: graphical, simplex, network, graph and transportation [P7S_UW_04]
3. Student can optimize solution using software: Excel Solver, Treeplan, other [P7S_UU_01]
4. Student solves multi criteria decision tasks with appropriate method [P7S_UO_01]
5. Student optimizes solution under uncertainty or risk [P7S_UU_01]

Social competences:
Not concerning

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Formative assessment: mid-term test of solving problems. Summative assessment: test of theory and knowledge on the penultimate lecture.
Tutorial: Formative assessment: presentation of current results in solving worksheets (5 minutes) or assigned problem speech (10 minutes). Summative assessment: final test of solving problems.
Project: Formative assessment: presentation of current results in solving design tasks. Summative assessment: consultation and defense of the project implemented in a team of 2.

Programme content

Subject Operations Research and Optimization Theory covers for linear programming (LP), including sensitivity analysis of teh optimal solution. Special case of transportation problem and transportation algorithm for shipments optimization are presented.
Second part of clasess covers for uncertainty and stochastic programming of decisions under risk. Nonlinearity is introduced occasionally to one of analyzed cases. Similarly, is taught only general understanding of multicriteria decisions and other issues related to foundations of operational research like graphs, project analysis, que theory, inventory control.

Course topics

Lecture intoduces the theory and methods of OR programming: graphical and simplex. Transportation problem and algorithm. Application of network structure linear programme to other managerial decisions. Uncertainty and risk of decision with payoff and decision tree. Lecturer solves MaxiMin, MaxiMax, Hurwicz, Bayes and Savage (regret) decision rules. News-vendor is discussed under discrete or continous distribution of demand.
At tutorials we solve linear problems. In particular, we graphically solve assortment optimization problem. Tutotials are to explain simplex method tableau. We balance demand with supply and solve shipments network with transportation algorithm. Solution check is done with software and Internet solvers. Short speeches cover for extension topics like CPM, EOQ, network programming, traveling salesman.
Project starts with solving optimum product-mix(assortment) using MS Solver. Reading a report from sensitivity analysis. Assessment of the optimum uniqueness, reduced cost, unit profit and resource limit change. We minimize
Total Transportation Cost or the maximal shipment. We solve decision tree.
Final project covers for basic and extended problems: CPM, empty runs, transshipment problem, diet-mixture, multiperiod scheduling, portfolio
theory.

Teaching methods

Lecture: lecture focused at problem.
Tutorial: tutorial in solving tasks, case study.
Project: case study.

Bibliography

Basic:
1. Balakrishnan N., Managerial Decision Modeling: Business Analytics with Spreadsheets, Pearson, 2017.

2. Balakrishanan N., Managerial Decision Modeling with Spreadsheets, Pearson, 2007, 2011.
3. Brzęczek T., Gaspars-Wieloch H., Godziszewski B., Podstawy badań operacyjnych i ekonometrii, PP, Poznań, 2010.
4. Gruszczyński M., Kuszewski T., Podgórska M. (red. nauk.), Ekonometria i badania operacyjne, Wydawnictwo Naukowe PWN, Warszawa, 2022.
5. Sikora W. (red.), Przykłady i zadania z badań operacyjnych i ekonometrii, Wydawnictwo UEP, Poznań, 2005.
6. Trzaskalik T. (red.), Wprowadzenie do badań operacyjnych z komputerem - CD, PWE, Warszawa, 2008.

Additional:
1. Anholcer M., Gaspars H., Badania operacyjne z Excelem, Wydawnictwo UEP, Poznań, 2012.1.
2. Brzęczek T., Nowak D. (2013), Genetic Algorithm Modification for production scheduling. Foundations of Computing and Decision Sciences 4:299-3092
3. Józefowska J., Badania operacyjne i teoria optymalizacji, WPP, Poznań, 2011.6. Brzęczek T., Gaspars-Wieloch H., Godziszewski B., Podstawy badań operacyjnych i ekonometrii, WPP, Poznań, 2010.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	30	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	70	2,50