COURSE DESCRIPTION CARD - SYLLABUS

Course name
Operation research and optimization theory [S2Log2>BOiTO]

Course

Field of study
Logistics

Year/Semester
1/2

Area of study (specialization)
Manager of a Transport and Forwarding Company

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
0

Other (e.g. online)
0

Tutorials
15

Projects/seminars
15

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 problems (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

Lecture: Intoduction to OR. Classification of optimization at example - cutting problem. Graphical presentation of data and solutions. Optimum uniqueness. Linear Programming methods: simplex and graphical. Transportation problem and potentials algorithm. Multigoal efective solution and other methods. Rank. AHP. Uncertainty and risk of decision. Histogram vs theoretical distribution. Chosen network programming tasks including CPM. Chosen dynamic and non-linear programming tasks from: traveling salesman, resource dynamic assignment, concave revenue function, portolio analysis.
Tutorial: Problem classification due to data anayzis and visualization. Modelling feasible solutions of product-mix (assortment). Assessment of solution optimality. Drawing feasible set and objective values isoquants map. Reading solution from simplex tableau. Solving better solution in terms of objective. Total Transportation Cost from suppliers to receivers and its minimum for balance and unbalance between supply and demand. Solving multiobjective tasks. MaxiMin, MaxiMax, Hurwicz's, Bayes's, Savage's(regret) strategies. Expected Value of Information. News-vendor. Spare parts stock. CPM, PERT, Gantt and time-cost analysis of a project or spinning tree, shortest path, maximum flow.
Project: Solving optimum product-mix(assortment) using MS Solver. Chosen graphs in Excel. Reading a report from sensitivity analysis and Solver for another optimum solution search. Empty runs minimization. Transshipment problem. Review of applications and selection of project topics. Including: mixture-problem, interperiod planning of production and inventory, convex revenue, modern portfolio theory. Solving decision trees in treeplan. Non-linear and conditional functions of Excel in optimization. Simplex solutions of networks. MS Project. Consulting of projects

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	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	55	2,00