



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Operational Research [S1Inf1>BOP]

Course

Field of study

Computing

Year/Semester

2/3

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

24

Laboratory classes

0

Other (e.g. online)

0

Tutorials

24

Projects/seminars

0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge in algebra, calculus, probability theory, statistics and computational complexity. Student should be able to perform basic matrix operations, calculate derivatives and find extremes of a given real function, calculate conditional and total probability, estimate computational complexity of an algorithm and problem, acquire information from literature. Student should understand the need to extend his/her competences.

Course objective

1. Provide students knowledge regarding models and methods of operational research, related in particular to scheduling in computer and management systems. 2. Develop students' skills in solving problems related to modelling and solving simple problems in continuous and discrete optimization. 3. Develop students' skills in analysis and modelling of decision problems. Course related learning outcomes

Knowledge Students acquire knowledge in mathematics and mathematical modelling, solving complex optimization tasks using mathematical models and optimization methods; have wide and in depth knowledge necessary to understand and effectively apply quantitative decision support methods, be informed about trends and advances in operational research, in particular optimization methods and techniques.

Skills Students are able to acquire, integrate, interpret and evaluate information from literature, databases and WWW sources on optimization methods and techniques, are able to plan and arrange self education process in particular covering issues of operational research, are able to apply mathematical models and optimization algorithms in decision support tasks, are able to integrate knowledge coming both from different sub domains of computer sciences and operational research to formulate and solve engineering tasks, are able to use available software to solve simple optimization problems, are able to evaluate strong and weak points of algorithms and their implementation and assess their usefulness to IT tasks.

Social competences Upon completion of the course the student will develop the following attitudes: understands that knowledge and skills related to computer science and operational research quickly become insufficient, knows examples / case studies in quantitative decision support and understands their limitations, is able to correctly assign priorities to own tasks.

Course-related learning outcomes

empty

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Formative assessment:

- a) lectures: based on answers to question in two online test,
- b) tutorials: evaluation of doing correctly assigned tasks and two online tests,

Total assessment:

- a) verification of assumed learning objectives related to lectures: evaluation of acquired knowledge on the basis of two online tests; discussion of correct answers in the test;
- b) verification of assumed learning objectives related to tutorials: monitoring students' activities during classes, two online colloquia during the classes,

Additional elements cover: discussing more general and related aspects of the class topic, suggesting how to improve the instructions and teaching materials.

Programme content

Lecture: Scope and methods of Operational Research. Classification of decision models. Linear programming. Non linear programming. Discrete optimization. Project scheduling. Introduction to Game Theory.

Tutorials: Formulation of decision problems as mathematical programming models. Solving LP problems. Analytical methods of solving NLP problems: Project scheduling. Solving zero sum games.

Course topics

Lecture: Scope and methods of Operational Research. Classification of decision models. Linear programming: problem formulation and computational complexity, simplex method, dual problem (formulation, properties and interpretation). Non linear programming: Lagrange conditions and method, Karush Kuhn Tucker theorems and method, gradient and non gradient methods of solving NLP problems. Discrete optimization: Gomory's cutting plane method, local search algorithms. Project scheduling: PERT, CPM and CPM MCX methods, classification of resources, definition of RCSP. Introduction to Game

Theory: zero sum games, games against nature.

Tutorials: Formulation of decision problems as mathematical programming models. Solving PL problems with simplex. Finding initial basic solution. Formulation, solving and interpretation of dual LP problem.

Analytical methods of solving NLP problems: Langrange and KKT. Gomory"s cutting plane method. Project scheduling with CPM, PERT and CPM MCX methods. Solving zero sum games.

Teaching methods

Lecture: multimedia presentation, presentation illustrated with examples presented on black board, solving tasks, multimedia show case

Tutorials: solving tasks, practical exercises, discussion, teamwork, multimedia showcase

Bibliography

Basic

1. J. Józefowska, Badania operacyjne i teoria optymalizacji, Wyd. Politechniki Poznańskiej 2012.
2. M. Siudak. Badania operacyjne. Oficyna Wydawnicza PolitechnikiWarszawskiej, Warszawa, 1994.
3. Badania operacyjne, Ignasiak E.(red.), PWE, Warszawa, 1996
4. Badania operacyjne w przykładach i zadaniach, Jędrzejczak Z., Skrzypek J., Kukuła K., Walkost Anna, PWN, Wyd. IV zmienione, Warszawa, 2002

Additional

1. Handbook on Scheduling : From Theory to Applications, BłażewiczJ.i inni, Springer, Berlin, 2007
2. Introduction to Operations Research, Hillier F. S., Lieberman G. J., McGraw Hill, New York, 1990
3. J.G. Ecker, M. Kupferschmid. Introduction to Operations Research. John Wiley & Sons, New York, 1988.
4. P. D. Straffin. Teoria Gier. WN Scholar, Warszawa, 2001.
5. T. Trzaskalik. Wprowadzenie do badań operacyjnych z komputerem. Polskie Wydawnictwo Ekonomiczne, Warszawa, 2003.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	48	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	52	2,00