MODULE DESCRIPTION CARD – SYLLABUS

This module is a part of the Intensive International Education Programs in the field of the TODO organised at Poznan University of Technology as part of the „IMPACT – Innowacyjne Międzynarodowe Programy w AI, Cyberbezpieczeństwie i Teleinformatyce" project implemented SPINAKER Program of the National Agency for Academic Exchange, financed by the European Social Development Fund 2021–2027 (ESDF).

Module name:	Number of hours:	Lecturer:
ICT11 – Operations Research	10	Michał Tomczyk, PhD

Module Descriptions:

The course aims to introduce the students to the main topics in Operations Research (OR). These include linear programming, the simplex algorithm, the matrix form, the duality theory, and the sensitivity analysis. Students should become familiar with the basic methods, techniques, and algorithms for each of these subfields to apply them to practical problem-solving.

Purpose of the support under Module:

The overall objective of the Innovative International Education Program in Information and Communication Technology is to broaden and deepen students' knowledge on important topics related to ICT.

The specific objective of the module is to provide competencies and promote activities carried out at the Poznań University of Technology in the area of operations research.

Method of support under Module:

Support within the module is provided with the participation of the instructor and divided into the following elements:

- 6-week self-study program using teaching materials provided by the instructor on the e-learning platform;
- 6 weeks of support from the instructor in the form of online consultations using tools that enable meetings to be held;
- a test to verify the acquisition of competences.

Module-related learning outcomes:

The main objective of this module is to broaden and deepen students' knowledge related to operations research: linear programming, the simplex method, the matrix form, the duality theory, and the sensitivity analysis.

Descriptions of the new competences:

Upon completion of the course, the student will acquire the following specific competences:

Knowledge:

1. The student has knowledge related to linear programming, with a primary focus on problem modeling.
2. The student has knowledge related to problem augmentation, a necessary step for executing the simplex algorithm correctly.
3. The student gains knowledge related to the simplex algorithm, including the problem formulation, step execution, and the interpretability of the simplex tableau.
4. The student has knowledge related to more advanced usages of the simplex algorithm, which includes operating with models involving non-standard constraints.
5. The student possesses knowledge related to the matrix foundations of the simplex algorithm and its implications.
6. The student gains knowledge related to the duality theory, including the mathematical foundations of a dual problem and its interconnections with the primal one.
7. The student has knowledge related to sensitivity analysis, including its mathematical foundations, importance, and possible applications.

Skills:

1. The student can construct a linear programming problem from the problem description.
2. The student can solve a two-dimensional linear programming problem using a graphical approach.
3. The student can execute the model pre-processing required to initialize the execution of the simplex algorithm.
4. The student is capable of executing the simplex algorithm from start to finish without the aid of any software.
5. The student can construct a dual problem and identify relationships between the primal and the dual problem and their solutions.
6. The student is capable of performing a sensitivity analysis of the model.

Social competences:

1. The student understands the positive influence of the operational research methodology on various domains, such as industry or logistics.
2. The student understands the need to develop efficient optimizers.
3. The student understands the need to assess the credibility of the prepared mathematical model, as it is more important than deriving the optimum itself.
4. The student understands the need to constantly monitor the once-implemented solution and react suitably if the solution's optimality is to be compromised.

Criteria for verifying learning outcomes

Learning outcomes presented above are verified with the use of the final test.

Method of verification/validation of learning outcomes

The verification/validation of learning outcomes is based on answers to the test questions in the final test. The number of correct answers required to pass the test is >50% of the total number of questions.

Workload

25 h (including work with teaching materials provided by the lecturer, consultation, and the student's own work) – 1 ECTS point

Level of the European Qualifications Framework

TODO