COURSE DESCRIPTION CARD - SYLLABUS

Course name
Decision support [S1Inf1>WDEC]

Course

Field of study
Computing

Year/Semester
3/5

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
30

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

A student starting this subject should have basic knowledge of discrete mathematics, linear algebra, combinatorial optimization and operations research. Should have the ability to solve basic programming problems mathematical, especially linear, and the ability to obtain information from the indicated ones sources. He should also understand the need to expand his competences in the field mathematical modeling of real decision-making problems and using tools IT to solve them. In terms of social competences, the student must demonstrate attitudes such as honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture, respect for other people.

Course objective

The overall goal is for students to learn theoretical and practical aspects of computing decision support, in particular: - Distinguishing classes of decision-making problems: classification, selection, ranking. - Acquiring the ability to model decision-making problems from the above classes in categories analytical (mathematical programming) or symbolic (artificial intelligence); definition decision variants, attributes and criteria for assessing decision variants. - Understanding the analyst's role in the decision-making process as an IT specialist supporting the solution decision-making problem consistent with the decision-maker's value system. - Learning the methods of obtaining information about the decision-maker's preferences and methods of modeling them preferences for individual and group decision-makers in the form of value functions, binary relations and a set of logical rules. - Learning the basic elements of usability theory, multi-criteria decision support, multi-criteria optimization, social choice theory and intelligent support systems decisions with rule-based knowledge representation. - Acquiring the ability to model imprecision, uncertainty and inconsistency in problems decision-making based on elements of fuzzy set theory and rough set theory. - Developing the ability to solve real decision-making problems.

Course-related learning outcomes

Knowledge:
Has structured, theoretically based general knowledge in the field of support methodology
decisions, algorithms and complexity, elements of artificial intelligence, and IT tools for
decision support (K1st_W4)
Has knowledge of important development directions and the most important achievements in computer science and others
related scientific disciplines in the field of computer decision support (K1st_W5)
Has basic knowledge of the life cycle of IT systems in the field of computer systems
decision support (K1st_W6)
Knows the basic techniques, methods and tools used in the solving process
basic decision-making problems in the field of key computer science issues, such as
computational complexity of algorithms and problems, construction of computer systems, or elements
artificial intelligence (K1st_W7)

Skills:
Is able to obtain information from various sources, including literature and databases, both in language Polish and English, integrate them properly, interpret them critically
assessments, draw conclusions, and fully justify the opinions they form (K1st_U1)
Is able to plan and conduct experiments, including measurements and computer simulations,
interpret the obtained results and draw conclusions (K1st_U3)
Is able to use appropriately selected methods when formulating and solving IT tasks, including:
including analytical, simulation or experimental methods (K1st_U4)
Is able - in accordance with the given specification - to design and implement a simple IT system for decision support, using appropriate methods, techniques and tools (K1st_U10)
Has the ability to formulate algorithms and program them using at least one of
popular tools (K1st_U11)
Is able to prepare a well-documented study of the course in the native language
sample decision-making process (K1st_U16)
Is able to plan and implement the process of his own permanent learning and knows the possibilities of further learning
further education (second and third cycle studies) (K1st_U19)

Social competence:
Understands that in IT knowledge and skills become obsolete very quickly (K1st_K1)
Is aware of the importance of knowledge in solving decision-making problems and knows examples and understands the causes of malfunctioning IT systems that led to serious problems
financial or social losses or serious loss of health or even life (K1st_K2)
Able to think and act in an entrepreneurial manner, including: finding commercial uses for
computer decision support systems, taking into account not only business benefits, but also
also social aspects of the business (K1st_K3)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The learning outcomes presented above are verified in the following way:
Formative assessment:
a) in terms of lectures:
- based on answers to questions about the material discussed during lectures;
b) in terms of exercises:
- based on the assessment of the current progress of task implementation.
Summary rating:
Checking the assumed learning outcomes is carried out by:
- assessment of the student's preparation for individual laboratory sessions and assessment of skills related to the implementation of laboratory exercises;
- evaluation of the report prepared partly during classes and partly after their completion; this assessment also includes the ability to work in a team;
- assessment of knowledge and skills related to the implementation of design/laboratory tasks through 2 colloquia during the semester;
- assessment of knowledge and skills demonstrated in a written exam covering several tasks i multiple choice test questions; after the written exam, a detailed discussion of the results i any oral question ends with a grade.

Programme content

The subject program covers the following topics: classes of decision-making problems: classification, selection, ranking. Principles of computer decision support: the concept of decision variant (acceptable solution), attribute and criterion for evaluating variants. Problem modeling decision-making analytically, as optimization problems, and symbolically, as problems artificial intelligence. Distinction between the roles of the analyst, the decision-maker and other participants in the problem
decision-making. Formulating decision problems as mathematical programming problems: modeling of soft constraints, quotient programming, intentional, max-min, issue transport and the problem of allocation. Basic multi-criteria decision-making problems. Construction i properties of the family of criteria for a given decision problem. Definition of criteria scales: ordinal, interval, quotient. Definition of the dominance relationship (in the Pareto sense) and the set of decision variants
(solutions) non-dominated. The concept of a compromise decision variant (solution). depending on the value system, i.e. the preferences of a given decision-maker. Preference model categories:
functional, relational and rule-based. Properties of an additive weighted-sum preference model. Elements of utility theory. Methods supporting multi-criteria selection and ranking: method ASSESS construction of a multi-attribute utility function using the deterministic determination method lottery equivalents; UTA+ method based on a preference model in the form of an additive function utility constructed in ordinal regression mode. Elements of relational models of preferences. ELECTRE Is multi-criteria selection support method and multi-criteria support method ELECTRE TRI classification based on the preference model in the form of a superiority relationship constructed in
compliance and non-compliance test mode. Elements of multi-criteria optimization. Modeling imprecision, uncertainty and inconsistency in decision-making problems based on elements of theory fuzzy sets and rough set theory. Intelligent decision support system with
symbolic representation of knowledge based on rough set theory; rule representation knowledge in classification problems. Problems of group decision making. Elements of theory social choice. Condorcet and Borda methods of vote aggregation. Arrow's theorem. Examples real decision-making problems and selecting appropriate methods to solve them.

Course topics

none

Teaching methods

Lecture: multimedia presentation, illustrated with examples given on the board.
Laboratory exercises: multimedia presentation illustrated with examples given on the blackboard and completing the tasks given by the teacher - practical exercises.

Bibliography

Basic
1. Programowanie matematyczne, W. Grabowski, PWE, Warszawa, 1984
2. Wielokryterialne wspomaganie decyzji, B. Roy, WNT, Warszawa, 1990
3. Multiobjective Optimization: Interactive and Evolutionary Approaches, J.Branke, K.Deb, K.Miettinen, R.Słowiński (eds.), State-of-the-Art Survey series of the Lecture Notes in Computer Science, vol.5252, Springer, Berlin, 2008
4. Search Methodologies: Introductory Tutorials in Optimization and Decision Support Techniques, E.K. Burke and G. Kendall (eds.), 2nd edition, Springer, New York, 2014 [udostępniane przez prowadzącego]
5. Fuzzy Sets in Decision Analysis, Operations Research and Statistics, R. Słowiński (ed.), Kluwer Academic Publishers, Boston, 1998
6. Multiple Criteria Decision Analysis: State of the Art Surveys, J.Figueira, S.Greco and M.Ehrgott (eds.), 2nd edition, Operations Research & Management Science 233, Springer, New York, 2016 [shared by the presenter]

Additional
1. Copies of slides provided by the lecturer
2. Encyclopedia of Complexity and Systems Science, R.A.Meyers (ed.), Springer, New York, 2009
3. Techniki informacyjne w badaniach systemowych, P.Kulczycki, O.Hryniewicz, J.Kacprzyk (red.), WNT, Warszawa, 2007
4. Rough Sets, R.Słowiński, Y.Yao (eds.), Part C of the Handbook of Computational Intelligence, edited by J.Kacprzyk and W.Pedrycz, Springer, Berlin, 2015, pp. 329-451

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	62	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	63	2,50