COURSE DESCRIPTION CARD - SYLLABUS

Course name
Intelligent Decision Support Systems

Course

Field of study
Computing

Year/Semester
1/1

Area of study (specialization)
Artificial Intelligence

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	30	
Tutorials	Projects/seminars	

Number of credit points

5

Lecturers

Responsible for the course/lecturer:
Professor Roman Słowiński

e-mail: roman.slowinski@cs.put.poznan.pl

tel. 61 665 2902

Institute of Computing Science, Faculty of Computing and Telecommunications

Street Piotrowo 2, 60-965 Poznań

Responsible for the course/lecturer:
Milosz Kadziński, PhD, DSc

e-mail: milosz.kadzinski@cs.put.poznan.pl

tel. 61 665 3022

Institute of Computing Science, Faculty of Computing and Telecommunications

Street Piotrowo 2, 60-965 Poznań

Prerequisites

Knowledge: Learning outcomes of the first cycle defined in the Resolution of the Senate of the PUT, in particular the effects K1st_W1, K1st_W4, K1st_W6, K1st_W7, K1st_W9 verified in the recruitment process for the second cycle - these effects are presented on the website of the Faculty of Computing and Telecommunications: www.fc.put.poznan.pl.

Skills: Learning outcomes of the first cycle defined in the Resolution of the Senate of the PUT, in particular the effects K1st_U1, K1st_U2, K1st_U3, K1st_U4, K1st_U5, K1st_U8, K1st_U11, K1st_U15, K1st_U16, K1st_U17, K1st_U18.

Social competence: outcomes of the first cycle defined in the Resolution of the Senate of the PUT, in particular the effects K1st_K1, K1st_K2, K1st_K3, K1st_K4.

Course objective

1. Providing basic knowledge on intelligent decision support systems, their theoretical foundations and computer implementations, with an emphasis on constructive learning of preferences as an approach characteristic for artificial intelligence.

2. Acquiring knowledge about selected methods and tools of the widely understood decision theory using elements of computer science, mathematics, artificial intelligence, management and cognitive sciences.

3. Developing the skills of an analyst of the decision-making process consisting in the ability to select the most appropriate method of intelligent decision support for a given decision problem, depending on the type of available data, the form of expected results and the type of the assumed preference model.

4. Acquiring skills in using software implementing selected intelligent decision support methods.

5. Developing the skills of mathematical modeling of the decision-making process in deterministic conditions, as well as under risk and uncertainty, including: definition of a set of decision variants (actions), construction of a coherent family of criteria (dimensions) for their assessment, aggregation of criteria and constructive learning of preferences in an interactive way.

6. Learning some exemplary practical applications of intelligent decision support methods, as well as methods and tools of widely understood decision theory.

7. Building students' teamwork skills.

Course-related learning outcomes

Knowledge

1. Has advanced and in-depth knowledge of widely understood information systems, theoretical foundations of their construction, and methods, tools and programming environments used to implement them [K2st_W1]

2. Has knowledge about development trends and the most important cutting edge achievements in computer science and other selected and related scientific disciplines [K2st_W4]

3. Has advanced and detailed knowledge of the processes occurring in the life cycle of hardware or software information systems [K2st_W5]

4. Knows advanced methods, techniques and tools used to solve complex engineering tasks and conduct research in a selected area of computer science [K2st_W6]

5. Has detailed knowledge of selected areas of mathematics, artificial intelligence, management and cognitive sciences, in relation with intelligent decision support and widely understood decision theory [-]

6. Knows examples of practical applications of intelligent decision support methods [-]

Skills

1. Is able to obtain information from literature, databases and other sources (both in Polish and English), integrate them, interpret and critically evaluate them, draw conclusions and formulate and fully justify opinions [K2st_U1]

2. Can use analytical, simulation and experimental methods to formulate and solve engineering problems and simple research problems [K2st_U4]

3. When formulating and solving engineering tasks, is able to integrate knowledge from different areas of computer science (and if necessary also knowledge from other scientific disciplines) and apply a systemic approach, also taking into account non-technical aspects [K2st_U5]

4. Is able to assess the suitability and the possibility of using new achievements (methods and tools) and new IT products [K2st_U6]

5. Is able to use conceptually new methods to solve complex IT tasks, including atypical tasks and tasks containing a research component [K2st_U10]

6. Can determine the directions of further learning and implement the process of self-education, including other people [K2st_U16]

7. Is able to formulate decision problems, model the preferences of participants of the decision-making process, and design methods of multi-criteria decision analysis under deterministic conditions and under risk and uncertainty [-]

Social competences

1. Understands that in the field of IT the knowledge and skills quickly become obsolete [K2st_K1]

2. Understands the importance of using the latest knowledge in the field of computer science in solving research and practical problems [K2st_K2]

3. Understands the importance of popularization activities concerning the latest achievements in the field of computer science [K2st_K3]

4. Is able to interact and work in a group, assuming various roles in it: analyst, decision maker or designer of an intelligent decision support system [-]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Forming assessment:

a) in terms of lectures:

- on the basis of answers to questions about the material presented during the lectures.

b) in terms of laboratories/exercises:

- on the basis of an assessment of the progress in the implementation of assigned tasks.

Summary assessment:

a) in terms of lectures, verification of the expected learning outcomes is carried out by:

- assessment of knowledge and skills demonstrated in a written exam with different characteristics of problems to be solved: 40% of questions concern basic knowledge and are presented in the form of a test (multiple-choice test questions, content to be completed), 40% of questions are simple computational (or algorithmic) tasks, while the remaining 20% of questions are more complex problems; the number of questions in the exam is approximately 15; all questions are scored similarly; the exam is passed if more than half of the points were obtained.

- analysis and presentation of the exam results,

b) in terms of laboratories/exercises, verification of the expected learning outcomes is carried out by:

- assessment of knowledge and skills in solving laboratory tasks through 2 tests in the semester with closed tasks (tasks with questions for which truth or falsity of statements should be determined) and open computational tasks, referring to the methods of modeling preferences and analyzing decisions learned during the course,

- evaluation of reports prepared partly during the classes and partly after their completion; this assessment also includes the ability to work in a team of 3-4 people,

- assessment of skills in solving laboratory exercises with the use of software implementing methods of intelligent decision support.

Obtaining additional points for activity during classes, especially for:

- analysis of additional aspects of a given problem,

- efficiency in applying the acquired knowledge while solving a given problem,

- ability to cooperate in a team solving a given problem in the laboratory,

- development of software useful in laboratory classes.

The laboratory final assessment grade is awarded taking into account the total number of points according to the scale: at least 50% of points – grade 3.0; 60% - grade 3.5; 70% - grade 4.0; 80% - grade 4.5; 90% - grade 5.0.

Programme content

The program of lectures covers the following topics:

1. Intelligent Decision Support Systems (IDSS) - definitions. Decision problems: choice (optimization), classification (ordinal), ranking. The aspect of multidimensionality and methods of resolving conflicts between dimensions: multiple decision-makers (negotiations and group decision-making), multiple criteria (multi-criteria decision aiding), multiple states of nature (decision-making under risk and

uncertainty). Decision support process: elicitation of preferential information, building a preference model, developing recommendations. Application of the artificial intelligence paradigm to constructive preference learning.

2. Preference models for multidimensional decision problems: (i) utility function, (ii) relational system, (iii) set of decision rules.

3. IDSS based on a function preference model: robust ordinal regression methods (UTA^GMS, GRIP, RUTA), hierarchical problem analysis (AHP, MCHP). Handling interactions - Choquet and Sugeno integrals. Links with stochastic multiobjective acceptability analysis (SMAA).

4. IDSS based on a relational preference model: methods with the outranking relation (ELECTRE III/IV, ELECTRE TRI-ASSISTANT), robust ordinal regression methods (ELECTRE^GKMS, PROMETHEE^GKS). Links with hierarchical problem analysis (ELECTRE-MCHP, PROMETHEE-MCHP).

5. IDSS based on a rule-based preference model: methods using dominance-based rough set theory (DRSA) for multi-attribute ordinal classification and ranking.

6. IDSS supporting negotiations and group decisions. The methods: UTA^GMS-GROUP, UTADIS^GMS-GROUP, PROMETHEE-GDSS, DRSA-GROUP.

7. IDSS supporting decisions under risk and uncertainty. Decision trees and multi-attribute utility theory. The portfolio selection problem and the newsboy problem. Robust ordinal regression and rule-based approach.

Laboratory classes are organized in the form of fifteen 2-hour exercises, taking part in the laboratory. Individual issues discussed during the lecture are illustrated with tasks during laboratory classes. Additional practical issues discussed in these classes concern some behavioral aspects of decision support, auction mechanisms and equitable resource allocation. In addition, students analyze real-world decision problems (case studies), which allow the application of knowledge about the learned methods in practice. Decision support systems such as diviz or jMAF are used to this end.

Teaching methods

Lecture: multimedia presentation supplemented with illustrative examples. Demonstration of selected systems in the field of algorithmic decision theory.

Laboratory exercises: solving problems, practical and programming exercises, discussion, team work, case studies, demonstration of selected systems, modeling of real decision problems and solving them with methods available in the laboratory, multimedia show.

Bibliography

Basic

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Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	60	2,5
Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam, project preparation) [1]	65	2,5

[1] delete or add other activities as appropriate