SYLLABUS OF A MODULE

Polish name of a module	**Teoria gier i decyzji**
English name of a module	**Theory of games and decisions**
Kod przedmiotu	**CIDM2_06**
Rodzaj przedmiotu	**Mandatory in the elective field**
ISCED classification	0541
Field of study	*Sztuczna Inteligencja i Data Science*
Languages of instruction	*English*
Level of qualification	*Second degree*
Form of study	*Full-time*
Number of ECTS credit points	*5*
Semester	*2*

Number of hours per semester:

Lecture	Tutorial	Laboratory	Seminar	Project	Others
15 E	30	0	0	0	0

MODULE DESCRIPTION

Module objectives

O1. To provide students with a foundation to normative decision theory, especially the theory of games, and equip them with basic mathematical concepts and tools that are used to analyze and solve decision problems.
O2. To present various and sometime unexpected real-world applications of this abstract mathematical theory.
O3. To equip students with knowledge which is sufficient to recognize and assess archetypal decision-making situations in complicated real-world settings.

PRELIMINARY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic probability theory, basic linear algebra, general mathematical maturity.

LEARNING OUTCOMES

LO 1 - The student is aware of the theoretical and practical importance of the axioms, definitions and theorems occurring in the normative decision theory. He/she explains different key concepts of solutions to the game problems and the practical consequences of using particular concepts.
LO 2 - Student lists the most important classes of models appearing in the theory, and makes appropriate and varied interpretations. He/she recognizes archetypal decision-making situations in exemplary real-world decision problem settings.
LO 3 - Student has competences in the area of independent and team work on problems related to the matter of games theory and decision making. He/she has the ability to critically evaluate the knowledge he/she possesses and recognizes the importance of this knowledge in solving cognitive and practical problems

MODULE CONTENT

Type of classes – Lectures		**Number of hours**
Lect. 1	Overview of decision theory - introduction. Behavioral vs. normative theory. Classification of decision problems.	**1**
Lect. 2-3	Linear programming tasks as problems of decision making under certainty. Decision making under risk: stochastic programming and chance-constrained programming.	**2**
Lect. 4-5	Fundamentals of the utility theory. Axioms of the preference relation. Utility function: basic concept and theorems	**2**
Lect. 6-7	Extensive-form games. The notion of a strategy.	**2**
Lect. 8-9	Normal-form games. Matrix games. Various concepts of solutions.	**2**
Lect. 10-11	Zero-sum two-person games. Von Neumann minimax theorem.	**2**
Lect. 12-13	Cooperative vs. non-cooperative games. "Prisoner dilemma" problem and its various interpretations. Two-person cooperative games. Nash bargaining axioms and bargaining–problem solution.	**2**
Lect. 14-15	Selected problems in contemporary decision-making theory.	**2**
Type of classes – Tutorial		**Number of hours**
T. 1	Introduction. Matrices and vectors. Discrete probability distributions.	**2**
T. 2-3	Decision making with the help of mathematical programming models	**4**
T. 4-5	Preferences and utility function.	**4**
T. 6-7	Games in the extensive-form. Strategies. Matrix games - various concepts of solutions.	**4**
T. 8-10	Zero-sum matrix games. Examples. Saddle points. Mixed strategies - the concept and the payoff.	**6**
T. 11-12	Cooperative games - exemplary analysis. Computing arbitration pairs.	**4**
T. 13-14	Contemporary decision-making problems	**4**
T. 15	**Analysis of students achievments**	**2**

TEACHING TOOLS

1.	multimedia presentations
2.	lecture notes (including electronic)
3.	problem sets for students
4.	traditional face-to-face, blackboard supported tutorials

WAYS OF ASSESSMENT (F – FORMATIVE, S – SUMMATIVE

F1. – assessment of student's activity (during all types of classes)
F2. – assessment of the correctness of solutions to given problems (during tutorials)
F3. – assessment of the quality of acquired knowledge and skills (during tutorials)
S1. – assessment of problem-solving skills - a **report** containing solutions to problems given during classes plus **achievement test**
S2. – assessment of the degree to which the teaching material is known and understood by student – **open-book exam**

*) the condition for obtaining a credit is to obtain positive grades from all laboratory exercises and the completion of the test task

STUDENT'S WORKLOAD

L.p.	**Forms of activity**	**Average number of hours required for realization of activity**
1.	**Contact hours with teacher**	
1.1	Lectures	15
1.2	Tutorials	30
1.3	Laboratory	0
1.4	Seminar	0
1.5	Project	0
Total number of contact hours with teacher:		45
2.	**Student's individual work**	
2.1	Preparation for tutorials and tests	25
2.2	Prreparation for laboratory exercises, writing reports on laboratories	0
2.3	Preparation of project	0
2.4	Preparation for final lecture assessment	0
2.5	Preparation for examination	20
2.6	Individual study of literature	10
Total numer of hours of student's individual work:		55
Overall student's workload:		100
Overall number of ECTS credits for the module		4
Number of ECTS points that student receives in classes requiring teacher's supervision:		1,8
Number of **ECTS** credits acquired during practical classes including laboratory exercises and projects :		1,2

BASIC AND SUPPLEMENTARY RESOURCE MATERIALS

RECOMMENDED readings (all available at various internet book-shops and libraries):
Morris P., Introduction to game theory, Spriger-Verlag 1994
Webb J. N., Game Theory: Decisions, Interaction and Evolution, Springer Verlag, London, 2007
Osborne M.J., Rubinstein A., A Course in Game Theory, MIT Press, 1994.
J. Watson, Strategy: an introduction to game theory; New York & London, W.W. Norton 2002

Owen G., Game Theory, Emerald Group Pub 2013
Aliprantis C.D., Chakrabarti S.K., Games and Decision Making, Oxford University Press, 2000
Lindgren B.W., Elements of decision theory, Macmillan, London, 1971
Luce D. R., Raiffa H. , Games and decisions; introduction and critical survey, Wiley, New York, 1957.
ADDITIONAL readings:
P.D. Straffin, Game Theory and Strategy, Mathematical Association of America, Washington 1993
K.H. Erickson, Game Theory: A Simple Introduction, Createspace Independent Publishing Platform, 2013
Rasmusen E., Games And Information, An Introduction To Game Theory, Blackwell Publishers Inc., Oxford,UK,, 2007
Geçkil Il. K. Anderson, P.L , Applied game theory and strategic behavior, Taylor and Francis Group, 2010
Hargreaves-Heap S.P., Varoufakis Y., Game Theory - A Critical Introduction, Taylor & Francis e-Library, London, New York 2003
D. Fudenberg, J. Tirole, Game Theory, MIT Press, 1991
M. Maschler, E. Solan, S. Zamir, Game Theory, Cambridge University Press 2013

MODULE COORDINATOR (NAME, SURNAME, INSTITUTE, E-MAIL ADDRESS)

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MATRIX OF LEARNING OUTCOMES

Learning outcome	Relating specific outcome to outcomes defined for entire programme (PEK)	Module Objectives	Module content	Teaching tools	Ways of assessment
LO1	KSI2_W01, KSI2_W02,	O1, O2	Lect.1-15 Lab.1-15	1-4	F1, F2, F3 S1, S2
LO2	KSI2_U02, KSI2_U04,	O1, O2, O3	Lect.1-15 Lab.1-15	1-4	F1, F2, F3 S1, S2
LO3	K_K01, K_K05	O1, O2, O3	Lect.1-15 Lab.1-15	1-4	F1, F2, F3 S1, S2

ASSESSMENT- DETAILS

Learning outcomes	Grade 2	Grade 3	Grade 4	Grade 5
LO1	Student does not master knowledge addressed during lectures at acceptable level (scored less than 50% of points)	Student knows main theoretical results addressed during lectures (scored no less than 50% of points)	Student knows most theoretical results addressed during lectures and can interpret importance of the main ones (scored more than 75% of points)	Student knows all theoretical results addressed during lectures and can interpret their practical importance (scored more than 90% of points)
LO2	Student does not masters skills addressed during tutorials and lectures at acceptable level (scored less than 50% of points)	Student knows most of the important classes of models found in the theory of games and decisions. Student can illustrate the significance of the most popular models with the help of some real-world decision-making situations (scored no less than 50% of points).	Student lists the most important classes of models found in the theory of games and decisions. Student can also present a number of real-world decision-making situations using a proper mathematical model. For most important cases, student also recognizes the importance of the assumptions adopted during the modeling (scored more than 75% of points).	Student lists all important classes of models found in the theory of games and decisions, gives them appropriate and various practical interpretations. If a given problem can be described with the help of different models, the student indicates differences in their applicability and quality of results. Student is able to analyze the impact of various assumptions on the obtained solution (scored more than 75% of points).

LO3	The student has insufficient competences in the area of independent and team work on problems related to the subject matter (scored less than 50% of points).	The student has satisfactory competences in working independently and in a team on problems related to the subject matter. (scored no less than 50% of points).	The student has considerable competence in working independently and in a team on problems related to the subject matter. He/she has the ability to critically evaluate the knowledge he/she possesses (scored more than 75% of points).	The student has full competence in working independently and in a team on problems related to the subject matter. He/she has the ability to critically evaluate the knowledge he/she possesses and recognizes the importance of this knowledge in solving cognitive and practical problems (scored more than 90% of points).

*The grade 3.5 is issued when the learning outcomes are fully passed with a grade of 3.0, but the student has not fully assimilated the learning outcomes with a grade of 4.0. The grade 4.5 is issued when the learning outcomes are passed with a grade of 4.0, but the student has not fully assimilated the learning outcomes with a grade of 5.0.

ADDITIONAL USEFUL INFORMATION ABOUT MODULE

1. All the information for the students of this degree course are available on the website of the Faculty: **www.wimii.pcz.pl** as well as on the webpages given to students during the first class of a given module.
2. The information on the teachers' duty hours is provided to students during the first class of a given module.
3. Lectures may be conducted in the e-learning mode