GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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|---|---|---|---|
| Subject name and code | Game theory, PG_00069466 | | |
| Field of study | Mathematics | | |
| Date of commencement of studies | October 2025 | Academic year of realisation of subject | 2025/2026 |
| Education level | second-cycle studies | Subject group | Specialty subject group<br>Subject group related to scientific research in the field of study |
| Mode of study | Full-time studies | Mode of delivery | at the university |
| Year of study | 1 | Language of instruction | Polish |
| Semester of study | 1 | ECTS credits | 4.0 |
| Learning profile | general academic profile | Assessment form | assessment |
| Conducting unit | Department of Nonlinear Analysis and Statistics -> Faculty of Applied Physics and Mathematics -> Wydziały Politechniki Gdańskiej | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr hab. Zdzisław Dzedzej | |
| | Teachers | dr hab. Zdzisław Dzedzej | |

**Lesson types and methods of instruction**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 30.0 | 0.0 | 0.0 | 0.0 | 30.0 | 60 |

E-learning hours included: 0.0

eNauczanie source addresses:

Moodle ID: 1066 Teoria gier 25-26
https://enauczanie.pg.edu.pl/2025/course/view.php?id=1066

**Learning activity and number of study hours**

| Learning activity | Participation in didactic classes included in study plan | Participation in consultation hours | Self-study | SUM |
|---|---|---|---|---|
| Number of study hours | 60 | 5.0 | 35.0 | 100 |

**Subject objectives**

The aim of the subject is to familiarize students with different aspects of game theory and their applications to different fields of science, for example, to economics (insurance, bargaining, negotiations) or biology (population dynamics). Among others students should master such notions like equilibrium, optimal strategy and different techniques of game solving.

During seminars additional applications aspects like combinatorial games will be touched.and basic effects as game solving will be trained

## Learning outcomes

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [K7_U09] constructs mathematical models used in specific advanced applications of mathematics, can use stochastic processes as a tool for modeling phenomena and analyzing their evolution,constructs mathematical models used in specific advanced applications of mathematics, uses stochastic processes as a tool for modeling phenomena and analyzing their evolution, recognizes mathematical structures in physical theories | Presentation of some application of game theory | [SU3] Assessment of ability to use knowledge gained from the subject<br>[SU5] Assessment of ability to present the results of task |
| [K7_W02] has enhanced knowledge of a selected branch of mathematics,theoretical or applied, knows classical definitions and theorems and their proofs and connections with other fields,understands problems being examined | Solving of small games, linear programming | [SW1] Assessment of factual knowledge<br>[SW2] Assessment of knowledge contained in presentation |

## Subject contents

1. Uncertainty and chance, decision making under uncertainty, two-person matrix games.
2. Strategic form games, applications, Nash equilibrium, zero sum matrix game, saddle points.
3. Solving matrix games with mixed strategies.
4. Graphs and trees, single-person decisions.
5. Sequential games, the structure of sequential games.
6. Sequential games with perfect information.
7. Sequential games with imperfect information.
8. Coalitional games- Shapley value.
9. Games with more than two strategies, equilibria and stability.
10. Combinatorial games
11. Linear programming

## Prerequisites and co-requisites

Calculus I and II, linear algebra, elements of probability theory and statistics

## Assessment methods and criteria

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| general activity | 0.0% | 10.0% |
| seminar presentation | 0.0% | 30.0% |
| Test | 50.0% | 60.0% |

## Recommended reading

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|---|---|
| Basic literature | 1. M. DeVoss, D. Kent, Game Theory, AMS 2016<br>2. Philip Straffin, Teoria gier, Scholar 2001.<br>3. James N. Webb, Game Theory. Decisions, Interaction and Evolution, Springer 2007<br>4. Tadeusz Płatkowski, Wstęp do teorii gier, Uniwersytet Warszawski, 2012.<br>5. G. Owen, Teoria gier, PWN 1975. |
| Supplementary literature | 1. J. Hofbauer, K. Sigmund, Evolutionary Games and Population Dynamics, Cambridge UP 2002.<br>2. J. Watson, Strategia. Wprowadzenie do teorii gier, WNT 2005.<br>3. S. Stahl, A gentle introduction to game theory, AMS 1998.<br>4. M. J. Osborne, A. Rubinstein , A course in game theory, MIT Press 1998.<br>5. A. Karlin, Y. Peres, Game Theory, Alive, AMS 2017 |
| eResources addresses | |

## Example issues/ example questions/ tasks being completed

1. Write the following game as a bi-matrix game and solve it:
   Two firms (A and B) decide whether to design the devise they sell to use K1 or K2 extensions. Both players
   will sell more devises if their their products are compatible. If they both choose for K1 extension the payoffs will be 2 for each. If they both choose for K2 extension the payoffs will be 1 for each. If they choose different extensions the payoffs will be 1 for each.
2. Finding Nash equilibria:
   A man has two sons. When he dies, the value of his estate (after tax) is 100000 zł. In his will it states that the two sons must each specify a sum of money $s_i$ that they are willing to accept. If $s_1 + s_2$ 100000, then each
   gets the sum he asked for and the remainder (if there is any) goes to the local home for spoilt cats. If $s_1 + s_2 > 100000$, then neither son receives any money and the entire sum of 100000 zł goes to the cats home. Assume
   that (i) the two men care only about the amount of money they will inherit, and (ii) they can only ask for whole złotys. Find all the pure strategy Nash equilibria of this game..

## Work placement

Not applicable