Sveučilište u Zagrebu Agronomski fakultet
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Linear Programming and Game Theory (296654)

Nositelj kolegija

doc. dr. sc. Biserka Kolarec

Opis kolegija

The course deals with mathematical methods for optimization and strategic decision-making. It introduces linear programming, including mathematical modelling, graphical and simplex methods, duality, sensitivity analysis, and selected applications such as production, investment, transportation and assignment problems. The course also introduces fundamental concepts of game theory, including two-person zero-sum games, pure and mixed strategies, optimal strategies and Markov chains. It gives the connection between game theory and linear programming. Emphasis is placed on modelling, solving, interpreting, and evaluating optimization and decision-making problems.

ECTS: **6.00**

Engleski jezik: **R1**

Sati nastave: 60
Predavanja: 40
Auditorne vježbe: 14
Seminar: 6

Izvođač predavanja

- dr. sc. Marina Ninčević

Ocjenjivanje

Dovoljan (2): 60-70 %
Dobar (3): 71-80 %
Vrlo dobar (4): 81-90 %
Izvrstan (5): 91-100 %

Vrsta kolegija

- Undergraduate studies / BS Courses taught in English (Izborni kolegij, 2. semestar, 1. godina)

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Opće kompetencije

1. Formulate real-world problems mathematically: identify decision variables, constraints, and objective functions; translate practical problems into linear programming or game-theoretic models.
2. Apply mathematical methods for optimization: solve linear programming problems using appropriate methods; understand the geometric and algebraic interpretation of solutions; recognize feasible, optimal, and unbounded/infeasible problems.
3. Analyse and interpret solutions: interpret an optimal solution in the context of the original problem; assess the influence of changes in parameters and constraints; use sensitivity analysis to support managerial or economic decisions.
4. Understand strategic decision-making: model situations involving competing decision-makers;distinguish between cooperative and non-cooperative situations; identify and analyse dominant strategies, equilibrium strategies, and mixed strategies.
5. Use game theory to solve decision problems: construct and analyse payoff matrices; determine optimal strategies in appropriate classes of games; understand the relationship between linear programming and zero-sum games.
6. Develop analytical and critical thinking: decompose a complex problem into mathematically manageable components;
7. Use computational tools: use appropriate software to solve and analyse optimization and game-theoretic problems; interpret computational results
8. Communicate mathematical results: present a mathematical model clearly; explain the meaning and limitations of a solution; justify conclusions using appropriate mathematical arguments.

Oblici nastave

- Lectures
- Construction exercises
- Seminars
- Exercises

Ishodi učenja i način provjere

Ishod učenja	Način provjere
identifying the mathematical theories underlying linear programming optimisation and game theory procedures	
determine the graphical solution to a linear programming problem involving two variables	
use Excel's Solver to set up and solve problems, as well as interpret the Sensitivity Report	
conduct research to model a linear programming problem	
solve games with equilibrium, apply matrix game theory to concrete game situations including games against nature	
choose the optimal path through a decision tree or Markov chain	

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Način rada

Obveze nastavnika

preparing and delivering lectures, seminars, and practical classes;
preparing teaching materials and learning activities;
supervising students' work;
holding office/consultation hours;
assessing and grading students fairly;
conducting or participating in examinations

Obveze studenta

Attending lectures regularly and solve practical personal assignement problems

Tjedni plan nastave

1. Types of linear programming problems: transport, optimal production and investments, dietary problems
2. Graphical solution of problems with two variables, concept of a feasible region, and optimal feasible solution
3. Setting the objective function and decision variables
4. Solver tool for solving LP problems, managing input
5. Simplex method in Solver
6. Finding solutions for specific problems
7. Interpretation of shadow prices, reduced costs, and allowable increase and decrease of variables
8. The meaning and solution of the dual problem
9. Formulation of special LP problems: investment, production
10. Formulation of special LP problems: transportation and assignment, dynamic programming
11. Definition of a game, types of games, payoff matrix, pure and mixed strategies
12. Nash equilibrium in games with pure strategies
13. Games with mixed strategies, formulating an LP problem
14. Methods for choosing optimal strategies in games against nature
15. Stochastic processes and Markov chains

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