



**GRADUATE STUDY: ITS and LOGISTIC**  
**SEMESTER (I)**

**Syllabus**

Academic year 2023/2024

Course:		<b>Game theory</b>			
Head of course: Full. Prof. <b>Jasmina Pašagić Škrinjar</b> , Ph.D.					
Co-lecturers: Assoc. Prof. <b>Borna Abramović</b> , Ph.D. <b>Lucija Bukvić</b> , MSc Traff. Eng.					
Semester: <b>W/S</b>	Course code: <b>118259</b>	Lectures: <b>30</b>	Auditory exercises: <b>30</b>	Seminars: <b>0</b>	ECTS credits: <b>5</b>
Group for lectures: <b>20 students</b>			Group for auditory exercises and seminars: <b>20 students</b>		

**Objective of the course:**

- Provide basic knowledge of game theory and apply it to address specific conflict situations that arise from the same multi-stakeholder goal.
- Adopting approaches, methods and procedures for the application of game theory in the decision-making system.

**Learning outcomes:**

After the completion of the course the students will be able to:

1. Define basic terms in game theory.
2. Classify basic terms and types of game theory.
3. Evaluate optimal strategy through cost matrix.
4. Applying the game theory in determining Nash Equilibrium.
5. Identify needed elements for cooperativeness and coalition inside the game.
6. Create a bargaining process using game theory.



## LECTURES, EXERCISES, and SEMINARS

Week	Syllabus	Form of classes	Performed by	Lessons	Remark
1.	<ul style="list-style-type: none"> <li>Game theory - a tool for decision making in traffic and logistics</li> <li>Troubleshooting process</li> </ul>	L	Jasmina Pašagić Škrinjar	2	
	<ul style="list-style-type: none"> <li>Game elements</li> <li>Game results</li> </ul>	AE	Lucija Bukvić	2	
2.	<ul style="list-style-type: none"> <li>Game structure terminology</li> <li>Basic terms</li> </ul>	L	Jasmina Pašagić Škrinjar	2	
	<ul style="list-style-type: none"> <li>Application of game theory in transportation and logistics</li> </ul>	AE	Lucija Bukvić	2	
3.	<ul style="list-style-type: none"> <li>Zero sum game</li> <li>Non-zero sum game</li> </ul>	L	Jasmina Pašagić Škrinjar	2	
	<ul style="list-style-type: none"> <li>Solve example tasks</li> </ul>	AE	Lucija Bukvić	2	
4.	<ul style="list-style-type: none"> <li>Two player games in extensive form</li> <li>Translating a game</li> <li>Perfect information games</li> <li>Imperfect information games</li> </ul>	L	Jasmina Pašagić Škrinjar	2	
	<ul style="list-style-type: none"> <li>Solve example tasks</li> </ul>	AE	Lucija Bukvić	2	



5.	<ul style="list-style-type: none"> <li>Resolve tasks by dominant strategy</li> </ul>	L	Jasmina Pašagić Škrinjar	2	
	<ul style="list-style-type: none"> <li>Application limitations of the elimination and dominant strategy</li> </ul>	AE	Lucija Bukvić	2	
6.	<ul style="list-style-type: none"> <li>Optimal strategy - von Neumann criterion</li> <li>Determining solutions in pure strategies</li> </ul>	L	Jasmina Pašagić Škrinjar	2	
	<ul style="list-style-type: none"> <li>No saddle point games - mixed strategy</li> </ul>	AE	Lucija Bukvić	2	
7.	<ul style="list-style-type: none"> <li>Matrix game solving using linear programming</li> </ul>	L	Jasmina Pašagić Škrinjar	2	
	<ul style="list-style-type: none"> <li>Solving problems using linear programming</li> </ul>	AE	Lucija Bukvić	2	
8.	<ul style="list-style-type: none"> <li>Cooperativeness and coalition</li> </ul>	L	Jasmina Pašagić Škrinjar	2	
	<ul style="list-style-type: none"> <li>Multiple Nash Equilibrium Games - Coordination Games</li> <li>Prisoner's dilemma</li> </ul>	AE	Lucija Bukvić	2	
9.	<ul style="list-style-type: none"> <li>Nash equilibrium - solution concepts in simultaneous games</li> <li>Nash equilibrium for games in extensive form</li> </ul>	L	Borna Abramović	2	



	<ul style="list-style-type: none"> <li>Solving example tasks</li> </ul>	AE	Borna Abramović	2	
10.	<ul style="list-style-type: none"> <li>Bargaining games</li> </ul>	L	Borna Abramović	2	
	<ul style="list-style-type: none"> <li>Practical applications of bargaining games</li> </ul>	AE	Borna Abramović	2	
11.	<ul style="list-style-type: none"> <li>Rational behaviour - preferences</li> </ul>	L	Borna Abramović	2	
	<ul style="list-style-type: none"> <li>Solve practical tasks using the WinQSB software package</li> </ul>	AE	Borna Abramović	2	
12.	<ul style="list-style-type: none"> <li>Specific applications of game theory - purchase of a loading and unloading crane</li> <li>An example of a bimatrix game with complete information</li> </ul>	L	Borna Abramović	2	
	<ul style="list-style-type: none"> <li>Choosing a new city transport line using game theory approach</li> </ul>	AE	Borna Abramović	2	
13.	<ul style="list-style-type: none"> <li>Applying game theory in traffic - a game of market entry</li> <li>Price competition</li> </ul>	L	Borna Abramović	2	
	<ul style="list-style-type: none"> <li>Bimatrix games with incomplete information</li> </ul>	AE	Borna Abramović	2	



14.	<ul style="list-style-type: none"><li>Graphical solution of matrix games</li></ul>	L	Jasmina Pašagić Škrinjar	2	
	<ul style="list-style-type: none"><li>Solving the game of order <math>2 \times 2</math></li></ul>	AE	Lucija Bukvić	2	
15.	<ul style="list-style-type: none"><li>Solving the game of orders <math>2 \times n</math> and <math>m \times 2</math></li></ul>	L	Jasmina Pašagić Škrinjar	2	
	<ul style="list-style-type: none"><li>Problem solving tasks</li></ul>	AE	Lucija Bukvić	2	

L = Lectures; AE = Auditory Exercises; LE = Laboratory Exercises; S = Seminars



## STUDENT OBLIGATIONS AND EXAMS

### Conditions for obtaining signatures:

Attendance is mandatory and students are required to attend at least 70% of the classes. After the lectures and successfully defended the case study, the necessary conditions for obtaining signatures.

**Written exam:** During the semester, conducted two tests, first short exam is numerically and the other is the theory. In case he does not pass both tests the student goes to the written part of the exam.

**Oral exam:** In order to attend oral exam student must pass written exam.

## LITERATURE

### a) Obligatory literature:

1. Pašagić Škrinjar, J.; Abramović, Borna; **Primjena teorije igara u prometu i logistici**; Zagreb: Sveučilište u Zagrebu, Fakultet prometnih znanosti, 2017
2. Kopal, R., Korkut, D.; **Teorija igara - praktična primjena u poslovanju**; Zagreb, 2011.

### b) Recommended literature:

1. Samuelson, L. (2002) **Evolution and game theory**. *JEP*. 16.
2. Pavličić, D.; **Teorija odlučivanja**; Beograd 2010
3. Martić, Lj.; **Primjena matematičkih metoda u ekonomskoj analizi**; Zagreb, 1971.
4. Von Neumann, J. i Morgenstern, O. (1944) **Theory of Games and Economic Behavior**, Princeton: Princeton University Press
5. Stojanović, B; **Teorija igara - elementi i primena**; Beograd 2005.





## METHODOLOGY OF THE IMPLEMENTATION OF THE COURSE PLAN

### 1. LECTURES

In the course of the lectures the theoretical framework of the curriculum is presented and followed by practical examples. To this end Power Point presentations are used.

### 2. AUDITORIAL EXERCISES

In the course of exercises students are required to practice diverse calculations solving challenges in order to define all necessary parameters for a game theory.

### 3. DOCUMENTATION

Attendance list is signed by students prior to every lecture.

### 4. ECTS CREDITS

Activity	ECTS credits
Class attendance	1
Oral exam	2
Written exam	2
In total:	5

## METHODS OF MONITORING QUALITY THAT ENSURE ACQUISITION OF EXIT COMPETENCES

The student's attendance record is kept during the semester. At the end of the semester an evaluation of the quality and efficiency of the course and the lecturers will be carried out. Information on the achievement of learning outcomes and student progress will be used by teachers for self-evaluation and improvement of teaching methods.

