

MGIMO University
School of Government and International Affairs

Syllabus approved
Dean, The MGIMO School of Government and International Affairs
Mikhail Troitskiy
« » 2022

Game-Theoretical Analysis of International Processes

Undergraduate Course Syllabus

Instructor
Dr. Igor Istomin

© Dr. Igor Istomin, 2021

© MGIMO University, 2021

This syllabus is designed in accordance with the MGIMO Educational Standard for undergraduate programs in International Affairs.

Author _____ Dr. Igor Istomin

Director MGIMO Library _____ Marina Reshetnikova

PART 1: INSTRUCTOR INFORMATION, COURSE DESCRIPTION AND TEACHING METHODS

1.1 General information

Template

- Full course title: Game-Theoretical Analysis of International Processes
- Type of course: optional
- Level of course B.A.
- Year of study: 3rd
- Number of ECTS credits allocated: 2
- Name of lecturer(s) and office hours:
Dr Igor Istomin, PhD
Associate Professor, Department of Applied International Political Analysis
Office hours: Thursday 12.00 – 14.15 PM, office 3036
E-mail: iaistomin@gmail.com

1.2 Course aims and learning outcomes

The aim of the course is to provide students with foundational knowledge and sound understanding of game theory, to introduce students to its application to the analysis of international politics, to orient students to the diversity of game-theoretical models and multiple tasks they could be used for, to provide students with skills for advancing their knowledge in the field.

Learning outcomes:

By the end of this course students should be able to:

- understand the nature of strategic interactions and corresponding challenges for analysis and decision-making;
- embrace various concepts of utility in their application to politics;
- appreciate the relational nature of power in political interactions;
- distinguish different types of game-models in social environment;
- solve simple (2x2) games in extensive and normal forms in both pure and mixed strategies.

1.3 Course requirements and grading plan

Course requirements

Students will be required to attend not less than 90% of classes and be prepared for class discussions. Conscientious reading of the assigned materials is compulsory. Students will also be required to conduct home assignments and write two in-class tests.

Grading plan

- Class participation - 10%
Students are expected to attend all the lectures seminars and participate in class discussions; since the course is highly interactive, it is essential that students attend the seminars having read the materials for that day's class.
- Written home assignments – 90%
The students are expected to submit written home assignments at least one day before the seminar class. Such papers should include answers to the tasks given at previous lecture.
- Written exam – 100% (in class, 80 minutes, for those who failed to achieve satisfactory grade throughout the semester).

PART 2. COURSE CONTENT

2.1 Types of work

Types of work	Academic hours
Total	72
Total for lectures, seminars and written exam	34
Lectures	16
Seminars	18
Homework	38
Written and oral home assignments	16
Preparation for lectures, seminars and written exam	16

2.2. Course content and readings by topic [template]

Topic 1. Introduction to the course. Strategic interactions in political relations (1 class)

The goal and structure of the course. The attributes of strategic interaction. Examples from social interactions and politics. Private, public and club goods. The logic of collective action and tragedy of commons. The role of supreme authority in domestic politics and international relations. Quantitative and qualitative information and the problem of quantification. Major types of scaling (nominal, ordinal and interval).

Readings:

1. *Hardin G.* The tragedy of the commons // *Science*. 1968. No. 162. 1243-1248. <http://cescos.fau.edu/gawliklab/papers/HardinG1968.pdf>
2. *De Mesquita B.B.* The Predictioneer's Game: Using the logic of brazen self-interest to see and shape the future. N.Y.: Random House Incorporated, 2010. P. 10-29.
3. *Powell R.* The modeling enterprise and security studies // *International Security*. 1999. Vol. 24. No. 2. P. 97-106.

Topic 2. Rational choice, expected utility and probability (2 classes)

The concept of rational choice. Limitations of rationalism in politics. Assessing utility in multidimensional comparison. Linear convolution and threshold aggregation. Probability theory and expected utility. Assessing conditional probability.

Readings:

1. *De Mesquita B. B.* An expected utility theory of international conflict // *American Political Science Review*. 1980. Vol. 74. No. 04. P. 917-931.
2. *Kydd A.H.* *International Relations Theory: the Game-Theoretic Approach*. Cambridge: Cambridge University Press, 2015. P. 11-34.
3. *Kahler M.* Rationality in International Relations // *International Organization*. 1998. Vol. 52. No. 4. P. 919-941.

Topic 3. Antagonistic relations in international politics and zero-sum games (2 classes)

Antagonistic and non-antagonistic games. Payoff matrix. Iteration dominance. Minimax solution. Saddle point. Zero-sum game model: matching pennies. Solving 2xm games through graphic representation.

Readings:

1. *Brams S.J.* *Game theory and politics*. Mineola: Dover Publications, 2011. P. 2-17. URL: <https://books.google.ru/books?hl=ru&lr=&id=ft0oAwAAQBAJ&oi=fnd&pg=PP1&dq=Ga>

Topic 4. Political coordination and bargaining in non-antagonistic games (2 classes)

Dominating and dominated strategies. Major game models: Prisoners' Dilemma, Stag Hunt, Battle of Sexes, Chicken game. Nash Equilibrium in pure strategies. No equilibrium and multiple equilibrium in pure strategies. Thomas Shelling findings on identification of focal points.

Readings:

1. *Kydd A.H.* International Relations Theory: the Game-Theoretic Approach. Cambridge: Cambridge University Press, 2015. P. 36-49.
2. *Avenhaus R., Huber R.* A Game-Theoretical Analysis of the Conflict about Iran's Nuclear Program // PIN Points / Processes of International Negotiation Program at the International Institute for Applied Systems Analysis (IIASA) Network Newsletter. 2007. № 28. P.13-15.
3. *Nash J.* Non-cooperative games // Annals of mathematics. 1951. Vol. 54. Issue 2. P. 286-295.

Topic 5. Political decisions under the shadow of the future and repeated games (2 classes)

Nash Equilibrium in mixed strategies. The paradox in the Battle of sexes. Solving prisoner's dilemma in repeated games: 'eye to eye' strategy and the role of kindness and forgiveness in optimizing results. Differentiation between Liberal and Realist perspectives on the conditions of Prisoner's Dilemma.

Readings:

1. *Axelrod R.* Effective Choice in the Prisoner's Dilemma // The Journal of Conflict Resolution. 1980. Vol. 24. No. 1. P. 3-25.
2. *Kydd A.H.* International Relations Theory: the Game-Theoretic Approach. Cambridge: Cambridge University Press, 2015. P. 49-53.
3. *Powell R.* Absolute and Relative Gains in International Relations Theory // American Political Science Review. 1991. Vol. 85. No. 04. P. 1303-1320.

Topic 6. International bargaining and its reflection in games in extensive form (2 classes)

Sequential games and construction of game trees. Solving through backward induction. Finding subgame perfect equilibrium. Role of bargaining in preventing conflicts.

Readings:

1. *Kydd A.H.* International Relations Theory: the Game-Theoretic Approach. Cambridge: Cambridge University Press, 2015. P. 55-73.
2. *Fearon J.D.* Rationalist explanations for war //International organization. 1995. Vol. 49. No. 3. P. 379-414.
3. *Powell R.* Bargaining theory and international conflict // Annual Review of Political Science. 2002. Vol. 5. No. 1. P. 1-30.

Topic 7. Uncertainty in politics and games with imperfect and incomplete information (2 classes)

Modelling uncertainty. Information sets. The problem of information asymmetry in international politics. Calculation of probabilities in games with nature. Ultimatum game. Bayesian equilibrium.

Readings:

1. *Kydd A.H.* International Relations Theory: the Game-Theoretic Approach. Cambridge: Cambridge University Press, 2015. P. 92-111.

2. *Morrow J.D.* Capabilities, uncertainty, and resolve: A limited information model of crisis bargaining //American Journal of Political Science. – 1989. – Vol. 33. -No. 4. P. 941-972.
3. *Powell R.* Allocating defensive resources with private information about vulnerability // American Political Science Review. – 2007. – Vol. 101. – No. 4. P. 799-809.

Topic 8. Coalitional games and division of payoffs (2 classes)

Negotiated meaning of justice in negotiations and policy learning. Mathematical criteria of just outcome. Methods to solve the problem of division: “divide and choose” procedure. The challenge of unequal utility and ‘adjusting winner” procedure. Playing a game: the case of Moldova and Transnistria. Manipulation of preferences in the context of information dominance. Search for just division in situations with more than two players.

Topic 9. Wrap up and feedback session (1 class)

Discussion of main learning outcomes. Reflections on the course. Directions for future studies. Provision of zachyets. Exam for those who failed to accumulate no less than 70 points during semester.

2.3. Examples of exam tasks

Task 1. Assessing the strategies

Syrian government and rebels are pressed by Russia and the United States to negotiate on the future of their country. Both could negotiate in good faith, imitate interest in negotiations or reject them upfront. Construct a game, assess the values and try to solve it in pure strategies.

Task 2. Finding the Nash equilibrium

Assume that forthcoming negotiations between the UK and the EU could be represented with the following matrix:

	Common market	Restrictions on migration
Soft	$m+n-f, x-p-r$	$m-n-f, x$
Tough	$m+n, x-p$	$-n, -x-r$

Brussels has two strategies for these negotiations – soft and tough. London has two preferences: to keep the common market with the EU and to restrict migration from the continent. The UK could prioritize either of the preferences. If it chooses the latter option, while the EU pursues soft strategy, then both parties will manage to keep the common market, but if the Brussels employs the tough policy, than parties will not be able to agree on the continuation of British access to it.

Then for the EU:

m – gain, which it has from access of Britain to the common market;

n – gain, which it has from freedom of movement between the EU and Britain;

f – cost of the negative example of softness towards the UL for other reluctant member-states.

For the UK:

x – gain, which it has from the common market with the EU;

p – cost, which the British government will pay for ignoring public opinion opposition towards migration from the EU;

r – cost, which the British government will pay in the public opinion for not being assertive enough or for being too tough if it could get a better deal from Brussels.

In accordance with the recent expert assessment, m is 3 times more than, n , while f is 1/2 of m . Meanwhile, p is 2/5 of x , and r is 1/2 of p . *Find Nash Equilibrium in this game and payoffs for each of the players.*

List of questions for an exam:

1. What are the objectives of game theory? How does it contribute to the analysis of international relations?

2. What are the main attributes of rational player? What are the limitations on rationality in politics?
3. Explain the main attributes of the tragedy of commons? How is it related to the issues of rationality?
4. What are the main dimensions of state preferences in international relations? How could be overall utility for a state in a certain situation be assessed given its multiple preferences?
5. What is the role of risk in international relations? How expected utility of a state could be assessed?
6. What are the various categories to classify games? In which forms games could be presented?
7. How a game zero-sum game could be in normal form and solved?
8. What is Nash equilibrium and how could it be found?
9. Explain the main attributes of the security dilemma as a game-theoretical model?
10. What are the differences between coordination game and prisoner's dilemma?
11. What are the differences between chicken game and 'battle of the sexes'?
12. How could players seek optimization through mixed strategies?
13. What is the role of focal points in findings solutions to games? What kind of focal point could exist in international relations?
14. What are the main differences between single-shot prisoner's dilemma and repeated prisoner's dilemma? What does it tell us about the shadow of the future?
15. How games could be presented in extended form? What is the role of backward induction in solving them?
16. How could concerns regarding future affect states' desire to engage in preventive actions? How could it be modelled?
17. How differences in speed and depth of power transition could affect calculations of states regarding possibility of launching preventive war?
18. What is the role of bargaining in international interactions? How could it be modeled?
19. What are the specific features of bargaining over future bargaining power?
20. How uncertainty regarding prospects affect politics? What are the common sources of uncertainty in international relations?
21. How the notion of information sets could be introduced in a game? How probabilities of various states of affairs affect calculations of players?
22. How could states manage risks of confrontation through bluff? What could be the long-term consequences of bluffing?
23. What are the main criteria reflecting justice in international deals? How could a just division be achieved?

2.4. Exam timing

Autumn semester tests – last week of study in December.

2.5. Consolidated reading list (in alphabetic order)

Main literature:

1. *Brams S.J.* Game theory and politics. Mineola: Dover Publications, 2011.
2. *Kydd A.H.* International Relations Theory: the Game-Theoretic Approach. Cambridge: Cambridge University Press, 2015.

Additional literature:

3. *Avenhaus R., Huber R.* A Game-Theoretical Analysis of the Conflict about Iran's Nuclear Program // PIN Points / Processes of International Negotiation Program at the International Institute for Applied

- Systems Analysis (IIASA) Network Newsletter. – 2007. – № 28. – P.13-15. URL: <http://www.pin-negotiation.org/userfiles/images/pinpoints/PP28.pdf#page=13>
4. *Axelrod R.* Effective Choice in the Prisoner's Dilemma // *The Journal of Conflict Resolution.* – 1980. – Vol. 24. – No. 1. – P. 3-25. URL: <http://journals.sagepub.com/doi/pdf/10.1177/002200278002400101>
 5. *De Mesquita B. B.* An expected utility theory of international conflict // *American Political Science Review.* – 1980. – Vol. 74. – No. 04. – P. 917-931. URL: <http://www.jstor.org/stable/1954313>
 6. *De Mesquita B.B.* *The Predictioneer's Game: Using the logic of brazen self-interest to see and shape the future.* N.Y.: Random House Incorporated, 2010.
 7. *Fearon J.D.* Rationalist explanations for war // *International organization.* – 1995. – Vol. 49. – No. 3. P. 379-414. URL: <http://www.jstor.org/stable/2706903>
 8. *Hardin G.* The tragedy of the commons // *Science.* – 1968. – No. 162. 1243-1248. URL: <http://cescos.fau.edu/gawliklab/papers/HardinG1968.pdf>
 9. *Kahler M.* Rationality in International Relations // *International Organization.* – 1998. – Vol. 52. No. 4. – P. 919-941. URL: <http://www.jstor.org/stable/2601362>
 10. *Morrow J.D.* Capabilities, uncertainty, and resolve: A limited information model of crisis bargaining // *American Journal of Political Science.* – 1989. – Vol. 33. -No. 4. P. 941-972. URL: <http://www.jstor.org/stable/2111116>
 11. *Nash J.* Non-cooperative games // *Annals of mathematics.* – 1951. – Vol. 54. – Issue 2. – P. 286-295. URL: <http://www.cs.uu.nl/docs/vakken/msagi/Nash51.pdf>
 12. *Powell R.* Absolute and Relative Gains in International Relations Theory // *American Political Science Review.* – 1991. – Vol. 85. – No. 04. – P. 1303-1320. URL: <http://www.jstor.org/stable/1963947>
 13. *Powell R.* Allocating defensive resources with private information about vulnerability // *American Political Science Review.* – 2007. – Vol. 101. – No. 4. P. 799-809. URL: <http://www.jstor.org/stable/27644485>
 14. *Powell R.* Bargaining theory and international conflict // *Annual Review of Political Science.* – 2002. – Vol. 5. – No. 1. P. 1-30. **Available from: Business Source Premier (EBSCO)**
 15. *Powell R.* The modeling enterprise and security studies // *International Security.* – 1999. – Vol. 24. – No. 2. – P. 97-106. URL: <http://slantchev.ucsd.edu/courses/pdf/powell-is1999v24n2.pdf>

PART 3. FINAL REMARKS

Template

- Plagiarism is considered as a severe violation and as an indication of incompetence in the course. Plagiarism is understood as making of one's text using compilation method for other people's publications, even connected with own phrases and sentences. Collective performance of individual tasks is also unacceptable. Proved plagiarism: an F-mark is given regardless of the fulfillment of all other requirements.
- Assignments are to be handed in on the due date. Late submissions will translate into the lowering of the grade by 5 points (out of 100) for each day of delay.
- Students are asked to keep a copy of all work submitted for evaluation.