Subject Description Form

Subject Code	AMA1D04
Subject Title	Understanding Social Conflicts by Game Theory
Credit Value	3
Level	1
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	This subject aims to introduce the basic concepts of game theory, social choice theory and related mathematical methods, which can be applied to analyze the quantitative principles behind social and political issues, make reasonable social choice, evaluate optimal strategies to achieve equilibrium, and divide assets or costs fairly. Students will acquire knowledge and skills useful for analyzing political, economic and social issues in a quantitative approach. A strong mathematics background is not necessary.
Intended Learning Outcomes *(Note 1)*	Upon completion of the subject, students will be able to: (a) understand the concept of social choice theory to identify different social choice procedures and voting systems. (b) understand the concept of game theory and evaluate optimal strategies. (c) demonstrate analytical skills and critical thinking through problem solving. (d) develop communication skills useful for competitive or cooperative situations. (e) identify conflicts in political and business situations and analyze them with logical thinking and quantitative methods. (f) improve literacy through comprehension of related information from various sources and expressing own idea in writing.
Subject Synopsis/ Indicative Syllabus *(Note 2)*	<u>Social Choice and Voting Systems</u> Introduction to the concept of social choice theory including the common social choice procedures and the desirable properties they satisfy. These procedures include: Condorcet's method, plurality voting, Borda count, Hare system, etc. The concept will be extended to electoral systems for one or multiple seats, with real-life examples. <u>Political Power</u> Introduction to the concept of game in coalition form using various yes-no voting systems, with the evaluation of political power of bodies by Shapley-Shubik index of power and Banzhaf index of power.

	Game Theory Using two-persons zero-sum game and general-sum game to understand concepts of dominant strategy, Nash equilibrium, maximin and minimax strategy, mixed strategy, threat strategy, cooperative strategy, Nash bargaining model, game in extensive form, game tree analysis, prisoner's dilemma and other famous problems in game theory. Division and Fairness Problem of apportionment and Hamilton's method. Fair division using divide-and-choice method, adjusted winner procedure. Division of contested sum in debt collection problem, taxi fare problem..
Teaching/Learning Methodology *(Note 3)*	Lectures: Explanation of basic concepts and methods illustrated by examples will be given in lectures. Lecture notes and readings will be given to students in advance. Tutorials: Tutorial problems will be given and explained on tutorial classes. Students will solve problems by applying what they have learnt on lectures. Students will understand social topics and mathematical strategies through interactive activities including free discussion, mock election, mock auction, games, etc. They can also seek advices from their tutor on their individual projects.

Assessment Methods in Alignment with Intended Learning Outcomes

(Note 4)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	f
1. Project	40	✓	✓			✓	✓
2. Tutorial	10			✓	✓	✓	
3. Test	20	✓	✓	✓			
4. Exam	30	✓	✓	✓			
Total	100 %						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Project:

Students will choose and explore a case related to social issues and demonstrate their quantitative skills which they have learnt in lectures. Students should propose a topic and submit an abstract in the middle of the semester. The instructor will advise on the feasibility of the proposed topic. Students will have to demonstrate the following in their project: (a) a clear explanation of social issue/conflict they have chosen; (b) use of their quantitative skills learned in lectures to solve the social issue/conflict; (c) justification of their methodology; (d) a coherent conclusion and the limitations of the methodology used. A

rubrics based on parts (a) to (d) will be employed to assign a grade to the project. Students can opt for using generative AI to assist writing of project, subject to the project instructions and submission of an AI report.

Tutorial performance

Case study problems, competitive games and topics for discussion, graded exercise questions will be given on tutorial. The performance of participation of students will be assessed.

Test and exam

Written exam with multiple choice questions, short questions, long questions will be given to students in order to test both their quantitative skills and ability to explain concepts. Multiple choice questions test students' understanding in basic concepts and terminologies. Short questions cover application of quantitative methods introduced in social decision making, voting, fair division or strategy making with simple calculations. Long questions involve case studies in which students will use both qualitative and quantitative skills to analyze a given situation of a social issue and evaluate a fair, optimal solution.

Student Study Effort Expected	Class contact:	
	▪ Lecture	26 Hrs.
	▪ Tutorial	13 Hrs.
	Other student study effort:	
	▪ Reading reference materials	30 Hrs.
	▪ Research and preparation for project	40 Hrs.
	Total student study effort	112 Hrs.
Reading List and References	Alan D. Taylor and Allison M. Pacelli, Mathematics and politics: strategy, voting, power and proof, Springer, 2008	
	Christoph Börgers, Mathematics of social choice : voting, compensation, and division, Society for Industrial and Applied Mathematics, 2010	
	W. D. Wallis, The Mathematics of Elections and Voting, Springer, 2014 Jonathan K. Hodge, The mathematics of voting and elections : a hands-on approach, 2nd edition, Ringgold, 2018	
	E. N Barron, Game theory an introduction, 2nd edition, Wiley, 2013	
	Aviad Heifetz, Game theory interactive strategies in economics and management, Cambridge, 2012	

Note 1: Intended Learning Outcomes
Intended learning outcomes should state what students should be able to do or attain upon completion of the subject. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

Note 2: Subject Synopsis/ Indicative Syllabus
The syllabus should adequately address the intended learning outcomes. At the same time over-crowding of the syllabus should be avoided.

Note 3: Teaching/Learning Methodology
This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

Note 4: Assessment Method
This section should include the assessment method(s) to be used and its relative weighting, and indicate which of the subject intended learning outcomes that each method purports to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.