

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 basic concepts of game theory and related quantitative methods, which can be applied to analyze social issues and political situations, make reasonable social choice, evaluate optimal strategies to achieve equilibrium, and divide assets or costs fairly. Students will acquire quantitative skills required to analyze political, economic and social issues rationally, though a strong Mathematics background is not necessary.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Understand voting systems in making social choice. (b) Evaluate political power of a body within a council by using simple models based on number of members and votes needed to pass a law. (c) Describe competitive situation between two bodies and analyze strategies. (d) Solve disputes among bodies by making a fair division or apportionment using quantitative methods. (e) Develop logical thinking and ability to explain issues or conflicts in society.
Subject Synopsis/ Indicative Syllabus	<p><u>Social Choice and Voting Systems</u> Introduction to social choice procedures and the properties they satisfy. These procedures include: Condorcet's method, plurality voting, Borda count, Hare system, approval voting. Examples will be given of voting systems in Hong Kong and all over the world.</p> <p><u>Political Power</u> Evaluation of ways of forming a coalition among bodies in a council, evaluation of their political power by Shapley-Shubik index of power, Banzhaf index of power. Introduction of the chair's paradox.</p> <p><u>Game Theory</u> Using two persons zero sum game and general sum game to understand concepts of dominant strategy, threat, Nash equilibrium, maxi-min strategy, mixed strategy, prisoner's dilemma.</p> <p><u>Division and Auction</u> Problem of apportionment and Hamilton's method. Fair division using divide-and-choice method, adjusted winner procedure. Division of</p>

	contested sum in debt collection problem, taxi fare problem. Game tree analysis and the dollar auction problem. Examples of auction methods.																																																				
Teaching/Learning Methodology	<p><u>Lectures:</u> 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.</p> <p><u>Tutorials:</u> Tutorial problems will be given and explained in tutorial classes. Students will solve problems by applying what they have learnt in 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.</p>																																																				
Assessment Methods in Alignment with Intended Learning Outcomes	<table border="1" data-bbox="533 801 1482 1193"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> <th></th> </tr> </thead> <tbody> <tr> <td>1. Project</td> <td>40</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>2. Test</td> <td>20</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>3. Exam</td> <td>40</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>Total</td> <td>100 %</td> <td colspan="6"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p><u>Project:</u> Students will choose and explore a social topic and demonstrate their quantitative skills which they have learnt in lectures. Instructors will provide a list of topics which students can choose from. If students want to choose a topic not on the list, they have to get prior approval from the instructor. Students should choose topics by week 7 of the semester. A possible list of topics include: voting system of different countries; power index of different councils or organizations around the world (e.g., UN, European Union); and game theory and competition between two supermarket chains. The project will be a maximum of 5 pages long. Students will have to demonstrate the following four things 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. Turnitin will be used to assess plagiarism.</p> <p><u>Test and exam</u> Written exam with multiple choice questions, short questions, long questions will be given to students in order to test both their quantitative</p>							Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						a	b	c	d	e		1. Project	40	✓	✓	✓	✓	✓		2. Test	20	✓	✓	✓	✓	✓		3. Exam	40	✓	✓	✓	✓	✓		Total	100 %						
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	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	109 Hrs.
Reading List and References	<p>Alan D. Taylor and Allison M. Pacelli, Mathematics and politics strategy, voting, power and proof, Springer 2008</p> <p>Christoph Börgers, Mathematics of social choice : voting, compensation, and division, Society for Industrial and Applied Mathematics 2010</p> <p>Jonathan K. Hodge, The mathematics of voting and elections : a hands-on approach, American Mathematical Society 2005</p> <p>Wojciech Cwalina, Andrzej Falkowski and Bruce I. Newman, A cross-cultural theory of voter behavior, The Haworth Press, 2008</p> <p>Jason Brennan, The ethics of voting, Princeton, 2011</p> <p>Staffan I. Lindberg, Democratization by Elections, The Johns Hopkins University Press, 2009</p>	