

# The Hong Kong Polytechnic University

## Subject Description Form

<b>Subject Code</b>	AMA
<b>Subject Title</b>	Understanding Social Conflicts by Game Theory
<b>Credit Value</b>	3
<b>Level</b>	1
<b>Pre-requisite / Co-requisite/ Exclusion</b>	Nil
<b>Objectives</b>	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.
<b>Intended Learning Outcomes</b>	<p>Upon completion of the subject, students will be able to:</p> <p>(a) understand the concept of social choice theory to identify different social choice procedures and voting systems.</p> <p>(b) understand the concept of game theory and evaluate optimal strategies.</p> <p>(c) demonstrate analytical skills and critical thinking through problem solving.</p> <p>(d) develop communication skills useful for competitive or cooperative situations.</p> <p>(e) identify conflicts in political and business situations and analyze them with logical thinking and quantitative methods.</p> <p>(f) improve literacy through comprehension of related information from various sources and expressing own idea in writing.</p>
<b>Subject Synopsis/ Indicative Syllabus</b>	<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 contested sum in debt collection problem, taxi fare problem. Game tree analysis and the dollar auction problem. Examples of auction methods.</p>																																																						
<p><b>Teaching/Learning Methodology</b></p>	<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 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.</p>																																																						
<p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p>	<table border="1" data-bbox="518 853 1469 1400"> <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>f</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. Tutorial</td> <td>10</td> <td></td> <td></td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>3. Test</td> <td>20</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4. Exam</td> <td>30</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></p> <p>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. Turnitin will be used to assess originality.</p> <p><u>Tutorial participation</u></p> <p>Case study problems, competitive games and topics for discussion will be given on tutorial. The performance of participation of students will be assessed.</p>	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 %						
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	<p><u>Test and exam</u></p> <p>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.</p>	
<p><b>Student Study Effort Expected</b></p>	<p>Class contact:</p>	
	<ul style="list-style-type: none"> <li>▪ Lecture</li> </ul>	<p>26 Hrs.</p>
	<ul style="list-style-type: none"> <li>▪ Tutorial</li> </ul>	<p>13 Hrs.</p>
	<p>Other student study effort:</p>	
	<ul style="list-style-type: none"> <li>▪ Reading reference materials</li> </ul>	<p>30 Hrs.</p>
	<ul style="list-style-type: none"> <li>▪ Research and preparation for project</li> </ul>	<p>40 Hrs.</p>
	<p>Total student study effort</p>	<p>112 Hrs.</p>
<p><b>Reading List and References</b></p>	<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>	