Social Choice and the Mathematics of Manipulation

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Alan D. Taylor

Social Choice And The Mathematics Of Manipulation

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Social Choice And The Mathematics Of Manipulation:

Social Choice and the Mathematics of Manipulation Alan D. Taylor,2005-05-09 Honesty in voting it turns out is not always the best policy Indeed in the early 1970s Allan Gibbard and Mark Satterthwaite building on the seminal work of Nobel laureate Kenneth Arrow proved that with three or more alternatives there is no reasonable voting system that is non manipulable voters will always have an opportunity to benefit by submitting a disingenuous ballot The ensuing decades produced a number of theorems of striking mathematical naturality that dealt with the manipulability of voting systems This 2005 book presents many of these results from the last quarter of the twentieth century especially the contributions of economists and philosophers from a mathematical point of view with many new proofs The presentation is almost completely self contained and requires no prerequisites except a willingness to follow rigorous mathematical arguments Mathematics students as well as mathematicians political scientists economists and philosophers will learn why it is impossible to devise a completely unmanipulable voting system **Social Choice and the Mathematics of Manipulation** Alan D. Taylor,2005

Handbook of Computational Social Choice Felix Brandt,Vincent Conitzer,Ulle Endriss,Jérôme Lang,Ariel D. Procaccia,2016-04-25 A comprehensive survey of computational aspects of collective decisions for graduate students researchers and professionals in computer science and economics **Algorithmic Decision Theory** Dimitris Fotakis,David Ríos Insua,2021-10-27 This book constitutes the conference proceedings of the 7th International Conference on Algorithmic Decision Theory ADT 2021 held in Toulouse France in November 2021 The 27 full papers presented were carefully selected from 58 submissions The papers focus on algorithmic decision theory broadly defined seeking to bring together researchers and practitioners coming from diverse areas of computer science economics and operations research in order to improve the theory and practice of modern decision support *Cycles and Social Choice* Thomas Schwartz,2018-03-22 The centuries old paradox of voting is that majorities sometimes prefer x to y y to z and z to x a cycle The discovery of the sources and consequences of such cycles under majority rule and countless other regimes constitutes much of the mathematical theory of voting and social choice This book explores the big questions posed by the paradox of voting positive questions about how to predict outcomes and explain observed stability and normative questions about how to hold elections how to take account of preference intensities the relevance of social welfare to social choice and challenges to formal rationality individual and social The overall lesson is that cycles are facts ubiquitous and consequential in non obvious ways not puzzles to be solved much less maladies or misfortunes to be avoided or regretted **Transactions on Computational Collective Intelligence XXIII** Ngoc Thanh Nguyen,Ryszard Kowalczyk,Jacek Mercik,2016-06-21 These transactions publish research in computer based methods of computational collective intelligence CCI and their applications in a wide range of fields such as the semantic Web social networks and multi agent systems TCCI strives to cover new methodological theoretical and practical aspects of CCI understood as the form of intelligence that emerges from the collaboration and competition of many

individuals artificial and or natural The application of multiple computational intelligence technologies such as fuzzy systems evolutionary computation neural systems consensus theory etc aims to support human and other collective intelligence and to create new forms of CCI in natural and or artificial systems This twenty third issue contains 14 carefully selected and revised contributions   *Algorithmic Aspects of Manipulation and Anonymization in Social Choice and Social Networks* Talmon, Nimrod,2016-05-20 This thesis presents a study of several combinatorial problems related to social choice and social networks The main concern is their computational complexity with an emphasis on their parameterized complexity The goal is to devise efficient algorithms for each of the problems studied here or to prove that under widely accepted assumptions such algorithms cannot exist The problems discussed in Chapter 3 and in Chapter 4 are about manipulating a given election where some relationships between the entities of the election are assumed This can be seen as if the election occurs on top of an underlying social network connecting the voters participating in the election or the candidates which the voters vote on The problem discussed in Chapter 3 Combinatorial Candidate Control is about manipulating an election by changing the set of candidates which the voters vote on That is there is an external agent who can add new candidates or delete existing candidates A combinatorial structure over the candidates is assumed such that whenever the external agent adds or removes a candidate a predefined set of candidates related to the chosen candidate are added or removed from the election The problem discussed in Chapter 4 Combinatorial Shift Bribery is also about manipulating an election Here however the external agent can change the way some voters vote Specifically a combinatorial structure over the voters is assumed such that the external agent can change the position of its preferred candidate in sets of voters following some predefined patterns The problem discussed in Chapter 5 Election Anonymization is also about elections The main concern here however is preserving the privacy of the voters when the votes are published along with some additional private information The task is to transform a given election such that each vote would appear at least k times By doing so even an adversary which knows how some voters vote cannot identify individual voters The problems discussed in Chapter 6 and in Chapter 7 are also about privacy Specifically a social network modeled as a graph is to become publicly available The task is to anonymize the graph that is to transform the graph such that for every vertex there will be at least k 1 other vertices with the same degree By doing so even an adversary which knows the degrees of some vertices cannot identify individual vertices In the problem discussed in Chapter 6 Degree Anonymization by Vertex Addition the way to achieve anonymity is by introducing new vertices In the problem discussed in Chapter 7 Degree Anonymization By Graph Contractions the way to achieve anonymity is by contracting as few edges as possible The main aim of this thesis considering the problems mentioned above is to explore some boundaries between tractability and intractability Specifically as most of these problems are computationally intractable that is NP hard or even hard to approximate some restricted cases and parameterizations for these problems are considered The goal is to devise efficient algorithms for them running in polynomial time when some parameters are

assumed to be constant or even better to show that the problems are fixed parameter tractable for the parameters considered If such algorithms cannot be devised then the goal is to prove that these problems are indeed not fixed parameter tractable with respect to some parameters or even better to show that the problems are NP hard even when some parameters are assumed to be constant Diese Dissertation stellt eine Untersuchung von verschiedenen kombinatorischen Problemen im Umfeld von Wahlen und sozialen Netzwerken dar Das Hauptziel ist die Analyse der Berechnungskomplexit t mit dem Schwerpunkt auf der parametrisierten Komplexit t Dabei werden f r jedes der untersuchten Probleme effiziente Algorithmen entworfen oder aber gezeigt dass unter weit akzeptierten Annahmen solche Algorithmen nicht existieren k nnen Die Probleme welche im Kapitel 3 und im Kapitel 4 diskutiert werden modellieren das Manipulieren einer gegebenen Wahl bei welcher gewisse Beziehungen zwischen den Beteiligten angenommen werden Dies kann so interpretiert werden dass die Wahl innerhalb eines Sozialen Netzwerks stattfindet in dem die W hler oder die Kandidaten miteinander in Verbindung stehen Das Problem Combinatorial Candidate Control ONTROL welches in Kapitel 3 untersucht wird handelt von der Manipulation einer Wahl durch die nderung der Kandidatenmenge ber welche die W hler abstimmen Genauer gesagt gibt es einen externen Agenten welcher neue Kandidaten hinzuf gen oder existierende Kandidaten entfernen kann Es wird eine kombinatorische Struktur ber der Kandidatenmenge angenommen so dass immer wenn der externe Agent einen Kandidaten hinzuf gt oder entfernt eine vordefinierte Kandidatenmenge welche mit den ausgew hlten Kandidaten in Beziehung steht ebenfalls hinzugef gt bzw entfernt wird Das Problem Combinatorial Shift Bribery welches in Kapitel 4 untersucht wird thematisiert ebenfalls die Manipulation einer Wahl Hier allerdings kann der externe Agent nderungen des Abstimmungsverhaltens einiger W hler herbeif hren Dabei wird eine kombinatorische Struktur ber den W hlern angenommen so dass der externe Agent die Position des von ihm pr ferierten Kandidaten bei mehreren W hlern entsprechend vordefinierter Muster gleichzeitig ndern kann Das Problem Election Anonymization welches in Kapitel 5 untersucht wird befasst sich ebenso mit Wahlen Das Hauptanliegen hier ist es jedoch die Privatsph re der W hler bei der Ver ffentlichung der Stimmenabgaben zusammen mit einigen zus tzlichen privaten Informationen aufrecht zu erhalten Die Aufgabe ist es eine gegebene Wahl so zu ver ndern dass jede Stimmenabgabe mindestens k fach vorkommt Dadurch kann noch nicht einmal ein Gegenspieler einzelne W hler identifizieren wenn er die Stimmenabgaben einiger W hler bereits kennt Die in Kapitel 6 und 7 untersuchten Probleme behandeln gleicherma en Privatsph renaspekte Pr ziser gesagt geht es darum dass ein soziales Netzwerk modelliert als Graph ver ffentlicht werden soll Die Aufgabe ist es den Graphen zu anonymisieren dies bedeutet man ver ndert den Graphen so dass es f r jeden Knoten mindestens k 1 weitere Knoten mit dem selben Grad gibt Dadurch wird erreicht dass selbst ein Gegenspieler welcher die Knotengrade einiger Knoten kennt nicht in der Lage ist einzelne Knoten zu identifizieren Bei dem Problem Degree Anonymization by Vertex Addition welches in Kapitel 6 untersucht wird wird Anonymit t durch Einf hrung neuer Knoten erreicht Bei dem Problem Degree Anonymization by Graph Contractions

welches in Kapitel 7 untersucht wird wird Anonymit t durch die Kontraktion von m glichst wenigen Kanten erreicht Das Hauptanliegen dieser Dissertation in Bezug auf die obig genannten Probleme ist es die Grenzen der effizienten L sbarkeit auszuloten Insbesondere da die meisten dieser Probleme berechnungsschwer genauer NP schwer bzw sogar schwer zu approximieren sind werden einige eingeschr nkte F lle und Parametrisierungen der Probleme betrachtet Das Ziel ist es effiziente Algorithmen f r sie zu entwickeln welche in Polynomzeit laufen wenn einige Parameter konstante Werte aufweisen oder besser noch zu zeigen dass die Probleme fixed parameter tractable f r die betrachteten Parameter sind Wenn solche Algorithmen nicht gefunden werden k nnen dann ist es das Ziel zu beweisen dass diese Probleme tats chlich nicht fixed parameter tractable bez glich der entsprechenden Parameter sind oder noch besser zu zeigen dass die Probleme NP schwer sind sogar wenn die entsprechenden Parameter konstante Werte aufweisen **Operations Research and Enterprise Systems** Greg H. Parlier,Federico Liberatore,Marc Demange,2018-06-28 This book constitutes revised selected papers from the 6th International Conference on Operations Research and Enterprise Systems ICORES 2017 held in Porto Portugal in February 2017 The 15 papers presented in this volume were carefully reviewed and selected from a total of 90 submissions They are organized in topical sections named methodologies and technologies and applications **Algorithmic Decision Theory** Patrice Perny,Marc Pirlot,Alexis Tsoukiàs,2013-10-28 This book constitutes the thoroughly refereed conference proceedings of the Third International Conference on Algorithmic Decision Theory ADT 2013 held in November 2013 in Bruxelles Belgium The 33 revised full papers presented were carefully selected from more than 70 submissions covering preferences in reasoning and decision making uncertainty and robustness in decision making multi criteria decision analysis and optimization collective decision making learning and knowledge extraction for decision support Outlooks and Insights on Group Decision and Negotiation Bogumił Kamiński,Gregory E. Kersten,Tomasz Szapiro,2015-06-11 This book constitutes the proceedings of the 15th International Conference on Group Decision and Negotiation GDN 2015 held in Warsaw Poland in June 2015 The GDN meetings aim to bring together researchers and practitioners from a wide spectrum of fields including economics management computer science engineering and decision science From a total of 119 submissions 32 papers were accepted for publication in this volume The papers are organized into topical sections on group problem structuring and negotiation negotiation and group processes preference analysis and decision support formal models voting and collective decision making conflict resolution in energy and environmental management negotiation support systems and studies online collaboration and competition and market mechanisms and their users *Multiagent Systems, second edition* Gerhard Weiss,2016-10-28 The new edition of an introduction to multiagent systems that captures the state of the art in both theory and practice suitable as textbook or reference Multiagent systems are made up of multiple interacting intelligent agents computational entities to some degree autonomous and able to cooperate compete communicate act flexibly and exercise control over their behavior within the frame of their objectives They are the enabling technology for a wide range of

advanced applications relying on distributed and parallel processing of data information and knowledge relevant in domains ranging from industrial manufacturing to e commerce to health care This book offers a state of the art introduction to multiagent systems covering the field in both breadth and depth and treating both theory and practice It is suitable for classroom use or independent study This second edition has been completely revised capturing the tremendous developments in multiagent systems since the first edition appeared in 1999 Sixteen of the book s seventeen chapters were written for this edition all chapters are by leaders in the field with each author contributing to the broad base of knowledge and experience on which the book rests The book covers basic concepts of computational agency from the perspective of both individual agents and agent organizations communication among agents coordination among agents distributed cognition development and engineering of multiagent systems and background knowledge in logics and game theory Each chapter includes references many illustrations and examples and exercises of varying degrees of difficulty The chapters and the overall book are designed to be self contained and understandable without additional material Supplemental resources are available on the book s Web site Contributors Rafael Bordini Felix Brandt Amit Chopra Vincent Conitzer Virginia Dignum J rgen Dix Ed Durfee Edith Elkind Ulle Endriss Alessandro Farinelli Shaheen Fatima Michael Fisher Nicholas R Jennings Kevin Leyton Brown Evangelos Markakis Lin Padgham Julian Padget Iyad Rahwan Talal Rahwan Alex Rogers Jordi Sabater Mir Yoav Shoham Munindar P Singh Kagan Tumer Karl Tuyls Wiebe van der Hoek Laurent Vercouter Meritxell Vinyals Michael Winikoff Michael Wooldridge Shlomo Zilberstein   *Judgment Aggregation* Davide Grossi,Gabriella Pigozzi,2014-03-01 Judgment aggregation is a mathematical theory of collective decision making It concerns the methods whereby individual opinions about logically interconnected issues of interest can or cannot be aggregated into one collective stance Aggregation problems have traditionally been of interest for disciplines like economics and the political sciences as well as philosophy where judgment aggregation itself originates from but have recently captured the attention of disciplines like computer science artificial intelligence and multi agent systems Judgment aggregation has emerged in the last decade as a unifying paradigm for the formalization and understanding of aggregation problems Still no comprehensive presentation of the theory is available to date This Synthesis Lecture aims at filling this gap presenting the key motivations results abstractions and techniques underpinning it   **Designing an All-Inclusive Democracy** Peter Emerson,2007-05-05 This book describes the voting procedures by which majority rule may be replaced by a more consensual system of governance In a word such an inclusive polity can be achieved by asking the voters or more usually their representatives in councils and parliaments to state their preferences so to facilitate the identification of that option which gains the highest average preference score   *Clusters, Orders, and Trees: Methods and Applications* Fuad Aleskerov,Boris Goldengorin,Panos M. Pardalos,2014-06-11 The volume is dedicated to Boris Mirkin on the occasion of his 70th birthday In addition to his startling PhD results in abstract automata theory Mirkin s ground breaking contributions in various fields of decision making and data

analysis have marked the fourth quarter of the 20th century and beyond Mirkin has done pioneering work in group choice clustering data mining and knowledge discovery aimed at finding and describing non trivial or hidden structures first of all clusters orderings and hierarchies in multivariate and or network data This volume contains a collection of papers reflecting recent developments rooted in Mirkin s fundamental contribution to the state of the art in group choice ordering clustering data mining and knowledge discovery Researchers students and software engineers will benefit from new knowledge discovery techniques and application directions **Multiagent System Technologies** Jörg P. Müller,Michael Weyrich,Ana L.C. Bazzan,2014-09-15 This book constitutes the proceedings of the 12th German Conference on Multiagent System Technologies MATES 2014 held in Stuttgart Germany in September 2014 The 9 full papers and 7 short papers included in this volume were carefully reviewed and selected from 31 submissions The book also contains 2 invited talks The papers are organized in topical sections named mechanisms negotiation and game theory multiagent planning learning and control and multiagent systems engineering modeling and simulation Fuzzy Social Choice Theory Michael B. Gibilisco,Annie M. Gowen,Karen E. Albert,John N. Mordeson,Mark J. Wierman,Terry D. Clark,2014-02-24 This book offers a comprehensive analysis of the social choice literature and shows by applying fuzzy sets how the use of fuzzy preferences rather than that of strict ones may affect the social choice theorems To do this the book explores the presupposition of rationality within the fuzzy framework and shows that the two conditions for rationality completeness and transitivity do exist with fuzzy preferences Specifically this book examines the conditions under which a maximal set exists the Arrow s theorem the Gibbard Satterthwaite theorem and the median voter theorem After showing that a non empty maximal set does exists for fuzzy preference relations this book goes on to demonstrating the existence of a fuzzy aggregation rule satisfying all five Arrowian conditions including non dictatorship While the Gibbard Satterthwaite theorem only considers individual fuzzy preferences this work shows that both individuals and groups can choose alternatives to various degrees resulting in a social choice that can be both strategy proof and non dictatorial Moreover the median voter theorem is shown to hold under strict fuzzy preferences but not under weak fuzzy preferences By providing a standard model of fuzzy social choice and by drawing the necessary connections between the major theorems this book fills an important gap in the current literature and encourages future empirical research in the field **Artificial Intelligence Safety and Security** Roman V. Yampolskiy,2018-07-27 The history of robotics and artificial intelligence in many ways is also the history of humanity s attempts to control such technologies From the Golem of Prague to the military robots of modernity the debate continues as to what degree of independence such entities should have and how to make sure that they do not turn on us its inventors Numerous recent advancements in all aspects of research development and deployment of intelligent systems are well publicized but safety and security issues related to AI are rarely addressed This book is proposed to mitigate this fundamental problem It is comprised of chapters from leading AI Safety researchers addressing different aspects of the AI

control problem as it relates to the development of safe and secure artificial intelligence The book is the first edited volume dedicated to addressing challenges of constructing safe and secure advanced machine intelligence The chapters vary in length and technical content from broad interest opinion essays to highly formalized algorithmic approaches to specific problems All chapters are self contained and could be read in any order or skipped without a loss of comprehension

   Systems, Procedures and Voting Rules in Context Adiel Teixeira de Almeida,Danielle Costa Morais,Hannu Nurmi,2019-10-16 This book deals with the choice of methods to be applied in the decision processes within organizations It discusses the use of voting procedures for group decision in business organizations focusing on decision making contexts Within this book the reader explores the relevant part of the decision making process consisting of choosing the voting procedures and recognizing the drawbacks of that procedure This book includes a unique feature of providing a framework for choosing the voting procedure that is the most appropriate for a particular business decision process The book is useful for a broad researcher audience dealing with the group decision making processes within business organizations and for practitioners and students working in the group decision and negotiation field   *Handbook of Social Choice and Welfare* Kenneth J. Arrow,A. Sen,Kotaro Suzumura,2010-10-13 This second part of a two volume set continues to describe economists efforts to quantify the social decisions people necessarily make and the philosophies that those choices define Contributors draw on lessons from philosophy history and other disciplines but they ultimately use editor Kenneth Arrow s seminal work on social choice as a jumping off point for discussing ways to incentivize punish and distribute goods Develops many subjects from Volume 1 2002 while introducing new themes in welfare economics and social choice theory Features four sections Foundations Developments of the Basic Arrovian Schemes Fairness and Rights and Voting and Manipulation Appeals to readers who seek introductions to writings on human well being and collective decision making Presents a spectrum of material from initial insights and basic functions to important variations on basic schemes   **Manipulative Voting Dynamics** Neelam Gohar,2017-05-11 One of the most actively growing subareas in multi agent systems is computational social choice theory which provides a theoretical foundation for preference aggregation and collective decision making in multi agent domains It is concerned with the application of techniques developed in computer science including complexity analysis and algorithm design in the study of social choice mechanisms such as voting It seeks to import concepts from social choice theory into Artificial Intelligence and computing People often have to reach a joint decision despite conflicting preferences over the alternatives This joint decision can be reached by an informal negotiating process or by a carefully specified protocol Over the course of the past decade or so computer scientists have also become deeply involved in this study Within computer science there is a number of settings where a decision must be made based on the conflicting preferences of multiple parties The paradigms of computer science give a different and useful perspective on some of the classic problems in economics and related disciplines A natural and very general approach for deciding among multiple

alternatives is to vote on them Voting is one of the most popular ways of reaching common decisions As such the study of elections is an area where fields such as computer science economics business operations research and political science can be brought together Social choice theory deals with voting scenarios in which a set of individuals must select an outcome from a set of alternatives This book focuses on convergence to pure strategy Nash equilibria in plurality voting games and a number of other positional and non positional scoring rules In such games the voters strategically choose a candidate to vote for and the winner is determined by the plurality or other voting rules Voters take turns modifying their votes these manipulations are classified according to the way in which they affect the outcome of the election The focus is on achieving a stable outcome taking strategic behaviour into account A voting profile is in equilibrium when no voter can change his vote so that his more preferable candidate gets elected The book investigates restrictions on the number of iterations that can be made for different voting rules considering both weighted and equi weighted voting settings

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Table of Contents Social Choice And The Mathematics Of Manipulation

1. Understanding the eBook Social Choice And The Mathematics Of Manipulation
   - The Rise of Digital Reading Social Choice And The Mathematics Of Manipulation
   - Advantages of eBooks Over Traditional Books
2. Identifying Social Choice And The Mathematics Of Manipulation
   - Exploring Different Genres
   - Considering Fiction vs. Non-Fiction
   - Determining Your Reading Goals
3. Choosing the Right eBook Platform
   - Popular eBook Platforms
   - Features to Look for in an Social Choice And The Mathematics Of Manipulation
   - User-Friendly Interface
4. Exploring eBook Recommendations from Social Choice And The Mathematics Of Manipulation
   - Personalized Recommendations

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