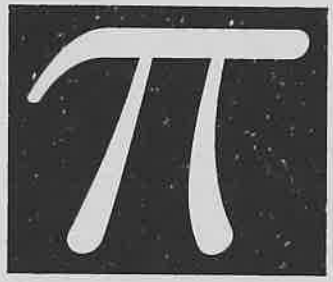

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THEMATIC SUMMER IN MATHEMATICAL ECONOMICS AND FINANCE

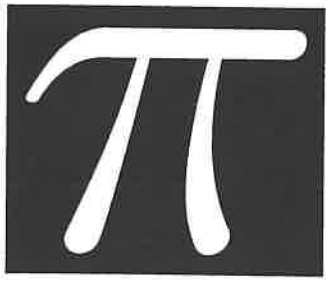
University of British Columbia

Vancouver, Canada

July–August, 1998

Co-sponsored by the Natural Sciences and
Engineering Research Council of Canada

Conference Guide



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Foreword

Welcome to the 1998 PIMS Thematic Program. This summer we have a group of activities dealing with mathematical problems arising in the social sciences, economics and finance. Our goals are to expose graduate students, the scientific community at large and the private sector to some of the modern mathematical methods and models for Decision making and industrial organization, Social choice and distributive justice, Voting rules, Design of markets under incomplete information, Consumer theory, Bureaucracy theory, Corruption in organizations, Competition in Nonlinear prices, to name a few. In mathematical finance, the emphasis will be on the far-reaching mathematical methods of stochastic programming and their applications in Risk management, dynamic sampling and financial strategies.

In doing so, we hope to introduce Canadian mathematicians to the interesting and important mathematical problems arising in these fields. Furthermore, we hope to develop this new and dynamic area of mathematical research in Western Canada and to connect the mathematicians with the business, management and commerce sectors.

PIMS is particularly proud of the highly interdisciplinary aspects of this year's program. The primary audience for this thematic program are economists, mathematicians, philosophers, political scientists, financial analysts and financial engineers, but many of the lectures will be of interest for a general audience. Particular emphasis has been placed on the preparation of graduate students for the more advanced workshops. This important multidisciplinary initiative would not have been possible without the support of the Natural Sciences and Engineering Research Council of Canada.

We hope that you will find your stay in Vancouver beneficial and enjoyable. We encourage you to consider further collaboration with the Pacific Institute for the Mathematical Sciences in the future.

Nassif Ghoussoub
Director of PIMS

PIMS Contact Information

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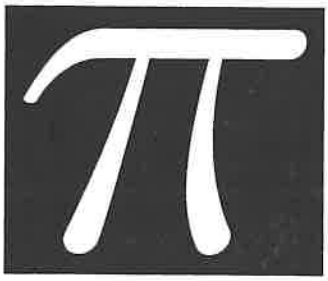
Contents

PIMS Computer Lab and Library

Located in Room 306 of the Old Computer Science Building is the PIMS Computer Lab and Library. It contains a small mathematics library, discussion areas, and a number of computer terminals which may be used for accessing your home account. The Lab is accessible at any time by an access code number, which you will be given at registration time. If you have any questions regarding the Lab, then please at ask at the PIMS offices in the Old Auditorium Annex.



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Workshop on Mathematical Methods and Models for Social Choice and Distributive Justice

University of British Columbia
Vancouver, British Columbia, Canada

Thursday, July 2 and Tuesday, July 7 to Thursday, July 9, 1998

Organizers

Hervé Moulin (Duke University)
John Weymark (University of British Columbia)

Introduction

Social choice theory is concerned with analyzing the properties of actual procedures for making collective decisions and with the design of collective decision procedures that satisfy various normative criteria and feasibility constraints. The subject includes such topics as voting rules, committee decision-making, and bargaining. Social choice theory also provides an analytic framework for studying distributive justice in problems of resource allocation (such as how to equitably share the costs of a facility among its users and how to measure income inequality).

The aim of this workshop is to provide a mini-course in social choice theory and related issues of distributive justice, with special emphasis on topics that illustrate the diverse branches of mathematics that the subject draws upon (such as algebra, analysis, topology, functional equations, game theory, graph theory, measurement theory, and majorization theory). Each lecture is self-contained and is designed to provide an introduction to the topic for nonspecialists and a fresh perspective on the subject for the specialist.

Each of the lectures is two hours long. The three lectures on July 2nd will provide enough of an introduction to social choice theory for interested parties to benefit from the papers presented to the Society for Social Choice and Welfare conference, July 3-6.

Registration

Registration is held in the Geography Building, Room 101 on Thursday, July 2 at 8:15–8:45 and 10:45–11:00. Outside of these times, participants may register at the PIMS office.

Schedule of Events

All lectures are held in the Geography Building, Room 101.

Thursday, July 2

8:45–10:45	**Donald Campbell** (College of William and Mary): Arrovian Social Choice
10:45–11:00	Coffee
11:00–1:00	**Yves Sprumont** (Université de Montréal): Strategy-Proof Mechanisms
1:00–2:15	Lunch
2:15–4:15	**Bhaskar Dutta** (Indian Statistical Institute, Delhi Centre): Implementation Theory

Tuesday, July 7

8:45–10:45	**Luc Lauwers** (Katholieke Universiteit Leuven): Topological Social Choice
10:45–11:00	Coffee
11:00–1:00	**Michel Le Breton** (GREQAM and Université de la Méditerranée): Choice from Tournaments

Wednesday, July 8

8:45–10:45 **William Thomson** (University of Rochester): Axiomatic Theory of Bargaining

10:45–11:00 Coffee

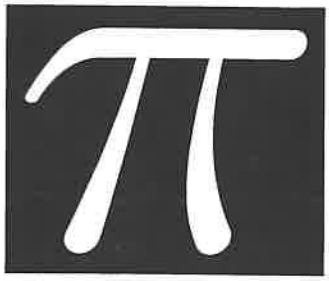
11:00–1:00 **Walter Bossert** (University of Nottingham): Utility Theory, Social Choice, and Inequality Measurement

Thursday, July 9

8:45–10:45 **Hervé Moulin** (Duke University): Rationing Methods

10:45–11:00 Coffee

11:00–1:00 **Eric Friedman** (Rutgers University): Cost Sharing Methods



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Fourth International Meeting of the Society for Social Choice and Welfare

University of British Columbia
Vancouver, British Columbia, Canada

Friday, July 3 to Monday, July 6, 1998

Other Sponsors

Centre for Applied Ethics, UBC
Faculty of Arts, UBC
Department of Economics, UBC
Office of the Vice-President of Research, UBC

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David Donaldson (University of British Columbia)
Hugh Neary (University of British Columbia)
Diana Weymark (Western Washington University)
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Arunava Sen (Indian Statistical Institute, Delhi Centre)
Yves Sprumont (Université de Montréal)
John Weymark (Chair, University of British Columbia)
Elena Yanovskaya (St. Petersburg Institute for Economics and Mathematics)

Introduction

Approximately two hundred contributed papers will be presented in parallel sessions. The keynote speakers have all made fundamental contributions to the study of social institutions when individuals use private information strategically. The conference will be used to help celebrate Professor Mirrlees' recent Nobel Prize and the twenty-fifth anniversary of the Gibbard-Satterthwaite Theorem.

Registration

The registration desk will be open from 5:00 to 6:30 pm on Thursday, July 2nd in Room 910 of the Buchanan Tower. It will reopen at 8:10 am the next day in the lobby of the Curtis Building (LAW), where the lectures are held.

Schedule of Events

For papers with multiple authors, the speaker is indicated by *.

Friday, July 3

9:00–10:40

1A. Strategy-Proofness with Indivisibilities

Location : Curtis Building (LAW), Room 102
Chair: Jordi Massó (Universitat Autònoma de Barcelona)

Bettina Klaus (Universiteit Maastricht and University of Nebraska at Lincoln): Fair Allocation of an Indivisible Commodity when Monetary Compensations are Not Possible.

Szilvia Papai (Koç University): Strategyproof Assignment by Hierarchical Exchange.

Atila Abdulkadiroğlu (University of Rochester) and **Tayfun Sönmez*** (University of Michigan): Recapturing Efficiency in House Allocation with Existing Tenants.

Eiichi Miyagawa (University of Rochester and Columbia University): Strategy-Proofness and Implementation for the Provision of Multiple Public Goods as Options.

1B. Local Public Goods and Clubs

Location: Curtis Building (LAW) Rm 157
Chair: Robert P. Gilles (Virginia Polytechnic Institute and State University)

John P. Conley (University of Illinois at Urbana-Champaign) and **Myrna Holtz Wooders*** (University of Toronto): Tiebout Economies with a Continuum of Traders.

John P. Conley* (University of Illinois at Urbana-Champaign) and **Hideo Konishi** (Southern Methodist University and Boston University): The Tiebout Theorem: On the Existence of Asymptotically Efficient Migration-Proof Equilibria.

Vicky Barham (University of Ottawa) and **Laura Razzolini*** (University of Mississippi): From Each According to Their Capacity to Pay: Differentiated Pricing in Clubs.

Marcus Berliant* (Washington University) and **John H. Y. Edwards** (Tulane University): Local Public Goods and Clubs: A Unified Theory of First Best,

1C. Path-Dependent and Path-Independent Choice

Location: Curtis Building (LAW), Room 169
Chair: Nick Baigent (Graz University)

Wulf Gaertner (Universität Osnabrück) and **Yongsheng Xu*** (University of Nottingham): On the Structure of Choice under Different External References.

Mark R. Johnson (Tulane University) and **Richard A. Dean*** (California Institute of Technology): Path Independent Choice Functions over Infinite Domains.

Mark R. Johnson (Tulane University): The Complexity of Economic Choice.

Gleb A. Koshevoy (Central Institute of Economics and Mathematics, Moscow): Choice Functions and Abstract Convex Geometries.

1D. Egalitarianism and Utilitarianism

Location: Curtis Building (LAW), Room 177
Chair: Marc Fleurbaey (THEMA and Université de Cergy-Pontoise)

Peter Vallentyne (Virginia Commonwealth University): Why and How Egalitarians Should Appeal to a Utilitarian-Like Principle (and Not to Leximin or Other Prioritarian Principles).

Yew-Kwang Ng (Monash University and National Taiwan University): Rational Individualistic Egalitarianism Implies Utilitarianism.

Serge-Christophe Kolm (École des Hautes Études en Sciences Sociales): Macrojustice.

Marc Fleurbaey (THEMA and Université de Cergy-Pontoise) and **François Maniquet*** (FNRS, CORE, and Facultés Universitaires Notre-Dame de la Paix, Namur): Fair Social Orderings with Unequal Production Skills.

10:40–11:00

Break

11:00–12:15

2A. Topics in Strategy-Proofness I

Location: Curtis Building (LAW), Room 102
Chair: Arunava Sen (Indian Statistical Institute, Delhi Centre)

Sang-Chul Suh (University of Windsor): Strategy-Proof Solutions in a Permit Sharing Problem: Equivalence Between Strategy-Proofness and Monotonicity.

Hans van der Stel (Universiteit Maastricht): Strategy-Proof Decision Schemes for Linear Utility Maximizers with a Finite Number of Outcomes.

Antonio Nicolò (Universitat Autònoma de Barcelona): Nash Implementation in Truthful Strategies, Strategy-Proofness and Efficiency on the Restricted Domain of Leontief Preferences.

2B. Stable Coalitions, Syndicates and Networks

Location: Curtis Building (LAW), Room 157
Chair: Hideo Konishi (Southern Methodist University and Boston University)

Hélène Ferrer (CORE, Université Catholique de Louvain and GEMMA, Université de Caen): Stable Syndicates of Factors Owners and Distribution of Social Output.

Ana Mauleon (Universidad del Pais Vasco–Euskal Herriko Unibertsitatea) and **Vincent Vannetelbosch*** (Universidad del Pais Vasco–Euskal Herriko Unibertsitatea and CORE, Université Catholique de Louvain): Coalitional Negotiation.

Alison Watts (Vanderbilt University): A Dynamic Model of Network Formation.

2C. Voting Rules I

Location: Curtis Building (LAW), Room 169
Chair: Gilbert Laffond (Conservatoire National des Arts et Métiers)

Michel Truchon (Université Laval): Rating Skating and the Theory of Social Choice.

William V. Gehrlein* (University of Delaware) and **Dominique Lepelley** (Université de Caen): Condorcet Efficiencies under the Maximal Culture Condition.

Ad van Deemen (Katholieke Universiteit Nijmegen) and **Ton Storcken*** (Universiteit Maastricht): Single Mode Distributions.

2D. Egalitarianism in TU Games

Location: Curtis Building (LAW), Room 177
Chair: Bhaskar Dutta (Indian Statistical Institute, Delhi Centre)

Javier Arin* (Universidad del Pais Vasco–Euskal Herriko Unibertsitatea) and **Elena Inarra** (Universidad del Pais Vasco–Euskal Herriko Unibertsitatea): Consistency and Egalitarianism: The Egalitarian Set.

Javier Arin (Universidad del Pais Vasco–Euskal Herriko Unibertsitatea), **Jeroen Kuipers*** (Universidad del Pais Vasco–Euskal Herriko Unibertsitatea), and **Dries Vermeulen** (Tilburg University): An Axiomatic Approach to Egalitarianism in TU-Games.

Jean-Yves Jaffray (LAFORIA, Université de Paris VI) and **Philippe Mongin*** (THEMA, CNRS, and Université de Cergy-Pontoise): Constrained Egalitarianism.

12:15–1:30

Lunch Break

1:30–2:15

3A. Markets

Location: Curtis Building (LAW), Room 102
Chair: Hans Haller (Virginia Polytechnic Institute and State University)

Robert P. Gilles* (Virginia Polytechnic Institute and State University) and **Dimitrios Diamantaras** (Temple University): Pricing in Economies with Variable Number of Commodities.

Frank Page* (University of Alabama) and **Myrna Holtz Wooders** (University of Toronto): Inconsequential Arbitrage

3B. Optimal Income Taxation

Location: Curtis Building (LAW), Room 157
Chair: Steven Slutsky (University of Florida)

Johann K. Brunner (University of Linz): Optimal Taxation of Income and Bequests.

Sinikka Hämäläinen (University of Tampere): Asymmetric Attitude Towards Emigration and Immigration: National Interest in Income Tax Policy.

Marc Fleurbaey* (THEMA and Université de Cergy-Pontoise) and **François Maniquet** (FNRS, CORE, and Facultés Universitaires Notre-Dame de la Paix, Namur): Optimal Income Taxation: An Ordinal Approach.

3C. Interdependent Preferences

Location: Curtis Building (LAW), Room 169
Chair: Richard C. Cornes (Keele University)

Steven R. Beckman (University of Colorado at Denver), **John P. Formby*** (University of Alabama), **W. James Smith** (University of Colorado at Denver), and **Buhong Zheng** (University of Colorado at Denver): Envy, Malice and Pareto Efficiency: An Experimental Examination.

Levent Koçkesen (New York University), **Efe A. Ok** (New York University) and **Rajiv Sethi*** (Barnard College, Columbia University): The Strategic Advantage of Negatively Interdependent Preferences.

3D. Stability in Games and Economies

Location: Curtis Building (LAW), Room 177
Chair: Theo S. H. Driessen (University of Twente)

Oscar Volij (Brown University): Communication, Credible Improvements and the Core of an Economy with Asymmetric Information.

Robert Delver* (Royal Netherlands Naval Academy) and **Herman Monsuur** (Royal Netherlands Naval Academy): Socially Stable Sets.

Joachim Rosenmüller (Universität Bielefeld): Solution to Large Totally Balanced Games.

2:45–3:05

Break

3:05–3:55

4A. Strategy-Proofness and the Division Problem

Location: Curtis Building (LAW), Room 102
Chair: Yves Sprumont (Université de Montréal)

Jordi Massó* (Universitat Autònoma de Barcelona) and **Alejandro Neme** (Universidad Nacional de San Luis and CONICET): Maximal Domain of Preferences in the Division Problem.

Hervé Moulin (Duke University): Rationing a Commodity Along Fixed Paths.

4B. Policy Dispersion in Elections

Location: Curtis Building (LAW), Room 157
Chair: Jeffrey S. Banks (Center for Advanced Study in the Behavioral Sciences and California Institute of Technology)

César Martinelli (Instituto Technológico Autónomo de Mexico): Information Revelation in Electoral Competition.

James Adams (University of California at Santa Barbara) and **Samuel Merrill, III*** (Wilkes University): Dispersed Policy Equilibria in a Multivariate Spatial Model: The 1988 French Presidential Election.

4C. Voting and Spending Decisions

Location: Curtis Building (LAW), Room 169
Chair: Murat Sertel (Turkish Academy of Sciences and Boğaziçi University)

Jacob Paroush* (Bar-Ilan University) and **Ruth Ben-Yashar** (Bar-Ilan University): The Optimal Policy of Investment in Human Capital: The Example of Collective Decision Making.

Karl Widerquist (Jerome Levy Economics Institute of Bard College): A Voting Paradox and the Budget Deficit.

4D. Utility Representation

Location: Curtis Building (LAW), Room 177
Chair: Vicki Knoblauch (Royal Holloway, University of London)

Marc-Arthur Diaye (LAMIA, Université de Paris 1 Panthéon-Sorbonne): Variable Intervals Model.

Carlos Rodríguez-Palmero (Universidad de Valladolid): A Complete and Continuous Numerical Representation for Partial Orders.

3:55–4:05

Break

4:05–5:05

Keynote Address

Location: Curtis Building (LAW), Room 101/102/201
Chair: Kotaro Suzumura (Hitotsubashi University)

Allan F. Gibbard (University of Michigan): Social Choice: What are the Questions?

5:15

Welcoming Reception

UBC Museum of Anthropology

Saturday, July 4

9:00–10:40

5A. Rationalizability in Games and Welfare Economics

Location: Curtis Building (LAW), Room 102
Chair: Hans Peters (Universiteit Maastricht)

Charles Blackorby (University of British Columbia and GREQAM), **Walter Bossert*** (University of Nottingham), and **David Donaldson** (University of British Columbia): Rationalizable Solutions to Pure Population Problems.

Lin Zhou* (Duke University) and **Indrajit Ray** (University of York): Game Theory via Revealed Preferences.

Yves Sprumont (Université de Montréal): Cooperative or Noncooperative Behavior? A Note on the Testable Implications of Collective Choice Theories.

5B. Topics in Strategy-Proofness II

Location: Curtis Building (LAW), Room 157
Chair: Ton Storcken (Universiteit Maastricht)

Tatsuyoshi Saijo* (Osaka University), **Tomas Sjöström** (Harvard University), and **Takehiko Yamato** (Tokyo Metropolitan University): Ultimate Implementation: Strategy-Proofness Reconsidered.

Shigehiro Serizawa (Shiga University): Pairwise Strategy-Proof Rules.

James Schummer (Northwestern University): Manipulation Through Bribes.

Fuad Aleskerov* (Boğaziçi University and Institute of Control Sciences, Moscow) and **Eldeniz Kurbanov** (Boğaziçi University): A Degree and an Efficiency of Manipulation of Known Social Choice Rules.

5C. Equality of Opportunity/Freedom of Choice

Location: Curtis Building (LAW), Room 169
Chair: Klaus Nehring (University of California at Davis)

Prasanta K. Pattanaik* (University of California at Riverside) and **Yongsheng Xu** (University of Nottingham): On Ranking Opportunity Sets in Economic Environments.

Ricardo Arlegi (Universidad Pública de Navarra) and **Jorge Nieto*** (Universidad Pública de Navarra): Equality of Opportunities: Cardinality-Based Criteria.

Vitorocco Peragine (University of York): Measuring and Implementing Equality of Opportunity for Income.

5D. Taxation and Inequality

Location: Curtis Building (LAW), Room 177
Chair: Marcus Berliant (Washington University)

Pierre Pestieau (Université de Liège), **Uri Possen** (Cornell University), and **Steven Slutsky*** (University of Florida): Randomization, Revelation, and Redistribution in a Lerner World.

James Davies (University of Western Ontario) and **Michael Hoy*** (University of Guelph): Flat Taxes and Inequality.

Udo Ebert (Carl von Ossietzky Universität Oldenburg) and **Patrick Moyes*** (CNRS, IDEP, LARE, and Université Montesquieu Bordeaux IV): Consistent Income Taxation when Households are Heterogeneous.

Dominique Thon* (Bodø Graduate School of Business) and **Stein W. Wallace** (Norwegian University of Science and Technology): The Redistribution of Income Between Heterogeneous Income Units.

10:40–11:00

Break

11:00–12:15

6A. Voting on Distributional Issues

Location: Curtis Building (LAW), Room 102
Chair: Michel Le Breton (GREQAM-LEQAM, Université de la Méditerranée, and Institut Universitaire de France)

David Austen-Smith (Northwestern University): Redistributing Income under Proportional Representation.

Jean-François Laslier* (CNRS, THEMA, and Université de Cergy-Pontoise) and **Nathalie Picard** (THEMA and Université de Cergy-Pontoise): Dividing a Dollar, Democratically.

6B. Manipulation, Strategy-Proofness, and Multivalued Choice

Location: Curtis Building (LAW), Room 157
Chair: Tayfun Sönmez (University of Michigan)

Nick Baigent* (Graz University) and **Benjamin Lane** (Graz University): Strategy Proofness of Social Choice Correspondences with Restricted Domains.

Stephen Ching* (City University of Hong Kong) and **Lin Zhou** (Duke University): Multi-Valued Strategy-Proof Social Choice Rules.

Donald E. Campbell (College of William and Mary) and **Jerry S. Kelly*** (Syracuse University): Trade-Offs for the Gibbard-Satterthwaite Theorem.

6C. Decision Theory

Location: Curtis Building (LAW), Room 169
Chair: Philippe Mongin (THEMA, CNRS, and Université de Cergy-Pontoise)

Chew Soo-Hong (Hong Kong University of Science and Technology and University of California at Irvine) and **Guofu Tan*** (Hong Kong University of Science and Technology and University of British Columbia): The Demand for Sweepstakes.

Peter J. Coughlin (University of Maryland, College Park): An Analysis of Strategies Which are Based on the Principle of Insufficient Reason.

6D. Consistency and Converse Constency

Location: Curtis Building (LAW), Room 177
Chair: Bettina Klaus (Universiteit Maastricht and University of Nebraska at Lincoln)

Koji Takamiya (Hokkaido University): The Consistency Principle and an Axiomatization of the α-Core.

Ryo-ichi Nagahisa (Kansai University) and **Tomoichi Shinotsuka*** (Otaru University of Commerce and California Institute of Technology): The Consistency Principle and the Core of Simple Games with Ordinal Preferences.

Anne van den Nouweland* (University of Oregon), **Stef Tijs** (Tilburg University), and **Myrna Holtz Wooders** (University of Toronto): Axiomatization of Lindahl and Ratio Equilibria in Public Good Economies.

12:15–1:45

Lunch

1:45–3:00

7A. Voting and Redistributive Taxation

Location: Curtis Building (LAW), Room 102
Chair: **Johann K. Brunner** (University of Linz)

Stephen M. Calabrese (Koç University): Local Redistribution Financed by Income Tax.

Carmen Beviá* (Universitat Autònoma de Barcelona) and **Iñigo Iturbe-Ormaetxe** (Universidad de Alicante): Taxation, Altruism and Subsidies for Higher Education.

7B. Implementation with Simple and Natural Mechanisms

Location: Curtis Building (LAW), Room 157
Chair: Tatsuyoshi Saijo (Osaka University)

Frédéric Gaspart (Facultés Universitaires Notre-Dame de la Paix, Namur): Stable Implementation: Axioms and Mechanisms.

Pablo Amorós* (Universidad de Alicante and Universidad de Granada) and **Bernardo Moreno** (Universidad de Alicante and Universidad de Málaga): Implementation of Optimal Contracts under Adverse Selection.

Jörg Naeve (Universität Bielefeld and Université de Caen): The Nash Bargaining Solution is Nash Implementable.

7C. Voting Rules II

Location: Curtis Building (LAW), Room 169
Chair: William Zwicker (Union College)

Semih Koray (Bilkent University): Consistency in Electoral System Design.

Satya Paul (University of Western Sydney at Macarthur): A New Social Ranking Rule.

Peter J. Emerson (The de Borda Institute, Belfast): The Matrix Vote for a Power-Sharing Executive.

7D. Solution Concepts for Cooperative Games

Location: Curtis Building (LAW), Room 177
Chair: Carmen Herrero (IVIE and Universidad de Alicante)

María del Carmen Marco Gil* (Universidad Pública de Navarra) and **Begoña Subiza** (Universidad de Alicante): Equal-Loss Solution for Monotonic Coalitional Games.

Juan Manuel Dubra (New York University): An Asymmetric Kalai-Smorodinsky Solution.

Emilio Calvo (Universitat de València) and **Hans Peters*** (Universiteit Maastricht): Dynamics and Axiomatics of the Equal Area Bargaining Solution.

3:00–3:20

Break

3:20–4:35

8A. Bargaining and Equality

Location: Curtis Building (LAW), Room 102
Chair: Walter Bossert (University of Nottingham)

Efe A. Ok (New York University) and **Lin Zhou*** (Duke University): The Choquet Bargaining Solutions.

Marco Mariotti (Royal Holloway, University of London): Fair Bargains: Distributive Justice and Nash Bargaining Theory.

John P. Conley (University of Illinois at Urbana-Champaign) and **Simon Wilkie*** (California Institute of Technology): The Ordinal Egalitarian Bargaining Solution.

8B. Strategy-Proofness and Generalized Medians

Location: Curtis Building (LAW), Room 157
Chair: James Schummer (Northwestern University)

Dolors Berga* (Universitat de Girona) and **Shigehiro Serizawa** (Shiga University): Maximal Domain for Strategy-Proof Rules with One Public Good.

Anna Bogomolnaia (Universitat Pompeu Fabra): A Characterization of Median Voter Schemes.

Lars Ehlers* (Universiteit Maastricht), **Hans Peters** (Universiteit Maastricht), and **Ton Storcken** (Universiteit Maastricht): Strategy-Proof Probabilistic Decision Schemes.

8C. Competition in Models of Taxation and Rent-Seeking

Location: Curtis Building (LAW), Room 169
Chair: Gareth D. Myles (University of Exeter)

Amrita Dhillon* (University of Warwick) **Carlo Perroni** (University of Warwick), and **Kimberley A. Scharf** (University of Warwick and Institute for Fiscal Studies): Implementing Tax Coordination.

Marcel Gérard* (ARPEGE, Facultés Universitaires Catholiques de Mons): Interjurisdictional Competition, Multinationals and Labour Market Conditions.

Ani Dasgupta* (Pennsylvania State University) and **Kofi O. Nti** (Pennsylvania State University): Designing an Optimal Contest.

8D. Aggregation of Fuzzy Preferences

Location: Curtis Building (LAW), Room 177
Chair: Prasanta K. Pattanaik (University of California at Riverside)

José Luis García-Lapresta* (Universidad de Valladolid) and **Bonifacio Llamazares** (Universidad de Valladolid): Aggregation of Fuzzy Preferences: Some Rules of the Mean.

Maurice Salles (GEMMA-CREME and Institut SCW, Université de Caen): Fuzzy Aggregation in an Economic Environment: The Quantitative Case.

4:35–4:45

Break

4:45–5:45

Keynote Address

Location: Curtis Building (LAW), Room 101/102/201
Chair: Salvador Barberà (Universitat Autonòma de Barcelona)

Mark A. Satterthwaite (Northwestern University): Competitive Markets and Strategy-Proofness

7:30

Conference Banquet

Location: Law Courts Inn

Sunday, July 5

9:00–10:40

9A. Endogeneity in Elections I

Location: Curtis Building (LAW), Room 102
Chair: David Austen-Smith (Northwestern University)

Maria E. Gallego (Wilfrid Laurier University): Endogenous Elections and Strategic Voting.

Sandro Brusco (Universidad Carlos III de Madrid): Electoral Systems and the Number of Parties: A Dynamic Model.

Matthew O. Jackson* (California Institute of Technology) and **Boaz Moselle** (Northwestern University): Coalition Formation in Legislative Voting.

Akram Temimi (University of Alabama) and **John P. Conley*** (University of Illinois at Urbana-Champaign): Endogenous Enfranchisement when Groups' Preferences are Conflicting.

9B. Values and Semivalues of TU Games

Location: Curtis Building (LAW), Room 157
Chair: Joachim Rosenmüller (Universität Bielefeld)

Irinel Dragan (University of Texas at Arlington): Potential and Consistency for Semivalues of Finite Cooperative TU Games.

Theo S. H. Driessen (University of Twente): Weighted Potential and Consistency: A Uniform Approach to Values for TU-Games.

Emilio Calvo* (Universitat de València) and **J. Carlos Santos** (Universidad del Pais Vasko–Euskal Herriko Unibertsitatea): The Multilevel Value.

Anna B. Khmelnitskaya (St. Petersburg Institute for Economics and Mathematics): On Some Marginalist Values for TU Games.

9C. Poverty, Inequality and Horizontal Inequity

Location: Curtis Building (LAW), Room 169
Chair: James F. Foster (Vanderbilt University)

Jean-Yves Duclos* (Université Laval) and **Peter Lambert** (University of York): A Normative Approach to Measuring Classical Horizontal Inequity.

Buhong Zheng (University of Colorado at Denver): On the Power of Poverty Orderings.

Yoram Amiel* (Ruppin Institute), **Frank Cowell** (London School of Economics), and **Avraham Polovin** (Ruppin Institute): Inequality and Risk Perceptions.

Marc Fleurbaey (THEMA and Université de Cergy-Pontoise) and **Alain Trannoy*** (THEMA and Université de Cergy-Pontoise): Welfare Comparisons and Bounded Equivalence Scales.

9D. Evolution of Preferences and Social Customs

Location: Curtis Building (LAW), Room 177
Chair: Rajiv Sethi (Barnard College, Columbia University)

Theodore C. Bergstrom* (University of California at Santa Barbara) and **Giovanni Ponti** (University of California at Santa Barbara): Long-Term Partnership and Desertion.

Alberto Bisin* (New York University) and **Thierry Verdier** (CERAS, DELTA, and CEPR): The Economics of Cultural Transmission and the Dynamic of Preferences.

Jeffrey C. Ely* (Northwestern University) and **Okan Yilankaya** (Northwestern University): Nash Equilibrium and the Evolution of Preferences.

Arthur J. Robson (University of Western Ontario): Why Would Nature Give Individuals Utility Functions?

10:40–11:00

Break

11:00–12:15

10A. Tournaments

Location: Curtis Building (LAW), Room 102
Chair: Jean-François Laslier (CNRS, THEMA, and Université de Cergy-Pontoise)

Jeffrey S. Banks (Center for Advanced Study in the Behavioral Sciences and California Institute of Technology), **John Duggan*** (University of Rochester), and **Michel Le Breton** (GREQAM-LEQAM, Université de la Méditerranée, and Institut Universitaire de France): The Uncovered Set with Arbitrary Distributions of Voters.

Laurent Vidu (GEMMA-CREME, Université de Caen): Individual Preference Aggregation in a Cartesian Product and Single-Peakedness.

Gilbert Laffond (Conservatoire National des Arts et Métiers) and **Jean Lainé*** (Ecole Nationale de la Statistique et de l'Administration Economique and Laboratoire d'Economie Industrielle): Majority Voting on Orders.

10B. Screening in Taxation and Related Models

Location: Curtis Building (LAW), Room 157
Chair: Udo Ebert (Carl von Ossietzky Universität Oldenburg)

Marc Fleurbaey (THEMA and Université de Cergy-Pontoise), **Denis Maguain** (THEMA and Université de Cergy-Pontoise), and **Robert Gary-Bobo*** (THEMA and Université de Cergy-Pontoise): Education, Distributive Justice and Adverse Selection.

Charles Blackorby* (University of British Columbia and GREQAM) and **Paul Beaudry** (University of British Columbia): Taxes and Employment Subsidies in Optimal Redistribution Programs.

10C. Equity and Efficiency

Location: Curtis Building (LAW), Room 169
Chair: Alain Trannoy (THEMA and Université de Cergy-Pontoise)

Peter Wakker* (Leiden University Medical Center and CentER, Tilburg University) and **Anja De Waegenaere** (CentER, Tilburg University): When Equity Dominates Efficiency: Nonmonotonic Choquet Integrals.

Kotaro Suzumura (Hitotsubashi University): Paretian Welfare Judgements and Bergsonian Social Choice.

Koichi Tadenuma (Hitotsubashi University): Efficiency First or Equity First?—Two Principles and Rationality of Social Choice.

10D. Topics in Game Theory

Location: Curtis Building (LAW), Room 177
Chair: John P. Conley (University of Illinois at Urbana-Champaign)

Alfonso Barriuso (Universidad del Pais Vasco–Euskal Herriko Unibertsitatea) and **José Ramón Uriarte*** (Universidad del Pais Vasko–Euskal Herriko Unibertsitatea): Modelling Noisy Players.

Toru Hokari (University of Rochester): Weighted Dutta-Ray Solutions.

12:15–1:45

Lunch

1:45–3:00

11A. Decisiveness Structures

Location: Curtis Building (LAW), Room 102
Chair: Fuad Aleskerov (Boğaziçi University and Institute of Control Sciences, Moscow)

Jeffrey S. Banks* (Center for Advanced Study in the Behavioral Sciences and California Institute of Technology) and **John Duggan** (University of Rochester): Stationary Equilibria in a Bargaining Model of Social Choice.

Norman Schofield (Washington University): The Heart and the Uncovered Set.

Shasikanta Nandeibam (University of Birmingham): The Structure of Probabilistic Social Choice Correspondences.

11B. Welfare Properties of Strategy-Proof Mechanisms for Public Decisions

Location: Curtis Building (LAW), Room 157
Chair: John O. Ledyard (California Institute of Technology)

Rajat Deb (Southern Methodist University), **Indranil K. Ghosh*** (Southern Methodist University), and **Tae Kun Seo** (Southern Methodist University): The Pivotal Mechanism for Excludable Public Goods: Characterization and Welfare Asymptotics.

Rajat Deb* (Southern Methodist University), **Laura Razzolini** (University of Mississippi), and **Tae Kun Seo** (Southern Methodist University): The Conservative Equal Costs Rule, the Serial Cost Sharing Rule and the Pivotal Mechanism: Asymptotic Welfare Loss Comparisons for the Case of an Excludable Public Project.

Manipushpak Mitra (Indian Statistical Institute, Delhi Centre) and **Arunava Sen*** (Indian Statistical Institute, Delhi Centre): Dominant-Strategy Implementation of First-Best Public Decisions.

11C. Bargaining as Compromises

Location: Curtis Building (LAW), Room 169
Chair: Lin Zhou (Duke University)

Steven J. Brams* (New York University) and **D. Marc Kilgour** (Wilfrid Laurier University): Fallback Bargaining.

Andreas Pfingsten (Universität Münster) and **Andreas Wagener*** (Universität-GH Siegen): Bargaining Solutions as Social Compromises.

Elizabeth Naeve-Steinweg (Universität Bielefeld and Université de Caen): The Averaging Mechanism.

11D. Preferences and Demand

Location: Curtis Building (LAW), Room 177
Chair: Marc-Arthur Diaye (LAMIA, Université de Paris 1 Panthéon-Sorbonne)

Vicki Knoblauch (Royal Holloway, University of London): Preference Representation and Computable Preferences.

Ursicino Carrascal (Universidad de Valladolid): Obtaining Equivalent Incomes with Consumption Equivalence Scales.

3:00–3:20

Break

3:20–4:35

12A. Axiomatic Models of Resource Allocation

Location: Curtis Building (LAW), Room 102
Chair: Anne van den Nouweland (University of Oregon)

Jingang Zhao (Ohio State University): Duality, Homogeneity, and d-Monotonicity in Linear Bargaining.

Yan Yu (Duke University): Information and Mechanism Design: On the Cost Sharing of Multiple Public Goods.

William Thomson (University of Rochester): On the Axiomatic Method.

12B. Noncooperative Bargaining

Location: Curtis Building (LAW), Room 157
Chair: Carmen Herrero (IVIE and Universidad de Alicante)

Paola Manzini* (Queen Mary and Westfield College) and **Marco Mariotti** (Royal Holloway, University of London): A Model of Bargaining with the Possibility of Arbitration.

Clara Ponsatí* (Universitat Autònoma de Barcelona) and **József Sákovics** (Institut d'Analisi Econòmica (CSIC), Universitat Autònoma de Barcelona): Randomly Available Outside Options in Bargaining.

Mika Widgrén (Yrjö Jahnsson Foundation, CEPR, and Massachusetts Institute of Technology): Non-Cooperative Bargaining of National and Supranational Interests under Asymmetric Information.

12C. Voting Games

Location: Curtis Building (LAW), Room 169
Chair: Maurice Salles (GEMMA-CREME and Institut SCW, Université de Caen)

Mathieu Martin (GEMMA-CREME, Université de Caen): Nonemptiness of the Stability Set.

Gilbert Laffond* (Conservatoire National des Arts et Métiers) and **Jean Lainé** (Ecole Nationale de la Statistique et de l'Administration Economique and Laboratoire d'Economie Industrielle): Cores of Majority Voting Games in a Representative Democracy.

Murat Sertel* (Turkish Academy of Sciences and Boğaziçi University) and **M. Remzi Sanver** (Boğaziçi University): Strong Equilibria of Voting Games are the Generalized Condorcet Winners.

12D. Formal Models of Justice and Ethics

Location: Curtis Building (LAW), Room 177
Chair: Rajat Deb (Southern Methodist University)

Nicolas Gravel* (THEMA and Université de Cergy-Pontoise), **Jean-François Laslier** (THEMA and Université de Cergy-Pontoise), and **Alain Trannoy** (THEMA and Université de Cergy-Pontoise): Individual Moral Consistency and Aggregative Collective Choices.

Geiko Gotoh (National Institute of Population and Social Security Research) and **Naoki Yoshihara*** (Hokkaido University): A Formulation of the Rawlsian Difference Principle—An Extended Social Welfare Function Approach.

Reiko Gotoh (National Institute of Population and Social Security Research) and **Naoki Yoshihara*** (Hokkaido University): A Game Form Approach to Theories of Distributive Justice—Formalizing Needs Principle.

4:35–4:45

Break

4:45–5:45

Keynote Address

Location: Curtis Building (LAW), Room 101/102/201
Chair: Peter J. Hammond (Stanford University)

James A. Mirrlees (Cambridge University): Economic Policy and Economic Politics.

5:45–6:10

Biennial Meeting of the Members of the Society for Social Choice and Welfare

Location: Curtis Building (LAW), Room 102

6:10–6:30

Meeting of the Editorial Board of Social Choice and Welfare

Location: Curtis Building (LAW), Room 102

Monday, July 6

9:00–10:40

13A. Implementation Theory

Location: Curtis Building (LAW), Room 102
Chair: John Duggan (University of Rochester)

Matthew O. Jackson (California Institute of Technology) and **Thomas R. Palfrey*** (California Institute of Technology): Voluntary Implementation.

Pablo Amorós (Universidad de Alicante and Universidad de Granada), **Luis C. Corchón** (Universitat Pompeu Fabra), and **Bernardo Moreno*** (Universidad de Alicante and Universidad de Málaga): The Truth, the Whole Truth, and Nothing But the Truth.

Eric J. Friedman* (Rutgers University) and **Scott Shenker** (Xerox PARC): Learning and Implementation on the Internet.

Ehud Kalai (Northwestern University) and **John O. Ledyard*** (California Institute of Technology): Repeated Implementation.

13B. Opportunities/Freedom of Choice

Location: Curtis Building (LAW), Room 157
Chair: Yongsheng Xu (University of Nottingham)

Ruvin Gekker (University of Wales, Aberystwyth): On the Axiomatic Approach to Freedom of Choice: An Algebraic Characterization Result.

Klaus Nehring (University of California at Davis): Preference for Flexibility and Freedom of Choice in a Savage Framework.

Klaus Nehring* (University of California at Davis) and **Clemens Puppe** (University of Bonn): Diversity and Similarity of Options: A Metric of Opportunity.

Sebastiano Bavetta (Università di Palermo and London School of Economics): Opportunity and the Extent of Choice: Another View of Effective Freedom.

13C. Power Indices

Location: Curtis Building (LAW), Room 169
Chair: Steven J. Brams (New York University)

Madeleine O. Hosli (University of Michigan): Bringing Cooperative Game Theory Back In: Institutions and Intergovernmentalism in the European Union.

René van den Brink* (Tilburg University), **Peter Borm** (Tilburg University), and **Marco Slikker** (Tilburg University): A Class of Relational Power Measures for Digraph Competitions.

13D. Growth and Welfare

Location: Curtis Building (LAW), Room 177
Chair: Robert Gary-Bobo (THEMA and Université de Cergy-Pontoise)

Seppo Honkapohja (University of Helsinki) and **Arja Turunen-Red*** (University of New Orleans): Complementarity, Growth and Welfare in Open Economies.

Günther Rehme (Technische Universität Darmstadt and European University Institute): Public Policies and Education, Economic Growth and Income Distribution.

Werner Hediger (ETH—Swiss Federal Institute of Technology): Sustainable Development and Social Welfare.

10:40–11:00

Break

11:00–12:15

14A. Rights and Freedoms

Location: Curtis Building (LAW), Room 102
Chair: Laura Razzolini (University of Mississippi)

Marc Fleurbaey (THEMA and Université de Cergy-Pontoise) and **Martin van Hees*** (University of Twente): On Rights in Game Forms.

Antonio Romero-Medina (Universidad Carlos III de Madrid): More on Preferences and Freedom.

14B. Division and Rationing Problems

Location: Curtis Building (LAW), Room 157
Chair: François Maniquet (FNRS, CORE, and Facultés Universitaires Notre-Dame de la Paix, Namur)

Youngsub Chun (Seoul National University): The Separability Principle in Economies with Single-Peaked Preferences.

Carmen Herrero* (IVIE and Universidad de Alicante) and **Antonio Villar** (IVIE and Universidad de Alicante): A Characterization of the Constrained Equal-Loss Solution in Bankruptcy.

Julius Barbanel (Union College): Partition Ratios, Pareto Optimal Cake Division, and Related Notions.

14C. Voting Rules III

Location: Curtis Building (LAW), Room 169
Chair: Michel Truchon (Université Laval)

Donald G. Saari (Northwestern University) and **Fabrice Valognes*** (GEMMA-CREME, Université de Caen): Elementary Geometry of Voting.

William Zwicker (Union College): Breaking Cycles Consistently.

Dominique Lepelley (Université de Caen) and **Vincent Merlin*** (Université de Caen): Scoring Run-off Paradoxes for Variable Electorate.

14D. Externalities

Location: Curtis Building (LAW), Room 177
Chair: Alison Watts (Vanderbilt University)

Hans Gersbach (University of Heidelberg) and **Hans Haller*** (Virginia Polytechnic Institute and State University): Collective Decisions and Competitive Markets.

Yukihiko Funaki* (Waseda University) and **Takehiko Yamato** (Tokyo Metropolitan University): The Core of an Economy with a Common Pool Resource: A Partition Function Form Approach.

Ken-Ichi Shimomura (Osaka University and California Institute of Technology): The R&D Free-Rider Problem in Oligopoly with Spillovers.

12:15–1:45

Lunch

12:20–1:30

Meeting of the Council of the Society for Social Choice and Welfare

Location: Curtis Building (LAW), Room 177

1:45–3:00

15A. Inequality Decomposition

Location: Curtis Building (LAW), Room 102
Chair: Michael Hoy (University of Guelph)

Udo Ebert (Carl von Ossietzky Universität Oldenburg): Linear Inequality Concepts and Social Welfare.

James F. Foster* (Vanderbilt University) and **Artyom Shneyerov** (Northwestern University): A General Class of Additively Decomposable Inequality Measures.

Frédéric Chantreuil* (INRA-Grignon) and **Alain Trannoy** (THEMA and Université de Cergy-Pontoise): Inequality Decomposition Values.

15B. Prospect Theory

Location: Curtis Building (LAW), Room 157
Chair: Guofu Tan (Hong Kong University of Science and Technology and University of British Columbia)

Peter Wakker (Leiden University Medical Center and CentER, Tilburg University) and **Horst Zank*** (Universiteit Maastricht): A Simple Axiomatization of Rank-Dependent Utility and Cumulative Prospect Theory with Constant Proportional Risk Aversion.

Stefan Traub (Christian-Albrechts-Universität zu Kiel): Framing, and Judgments of Fairness in Taxation.

Christian Seidl (Christian-Albrechts-Universität zu Kiel): Testing Editing Phases.

15C. Social Aggregation

Location: Curtis Building (LAW), Room 169
Chair: Jerry S. Kelly (Syracuse University)

Richard Cramer-Benjamin (University of Massachusetts at Amherst), **Gary D. Crown** (Wichita State University), and **Melvin F. Janowitz*** (University of Massachusetts at Amherst): Permutation Invariant Consensus Methods.

Henri Patrice Nzitat (GEMMA-CREME, Université de Caen): Notes on Weak Pareto Variants of Harsanyi's Social Aggregation Theorem.

15D. Endogeneity in Elections II

Location: Curtis Building (LAW), Room 177
Chair: Matthew O. Jackson (California Institute of Technology)

George Bulkley (University of Exeter) and **Gareth D. Myles*** (University of Exeter): On the Membership of Decision-Making Committees.

Salvador Barberà* (Universitat Autonòma de Barcelona), **Michael Maschler** (The Hebrew University of Jerusalem), and **Jonathan Shalev** (CORE, Université Catholique de Louvain): Voting for Voters: A Model of Electoral Evolution.

Bhaskar Dutta* (Indian Statistical Institute, Delhi Centre), **Michel Le Breton** (GREQAM-LEQAM, Université de la Méditerranée, and Institut Universitaire de France) and **Matthew O. Jackson** (California Institute of Technology): Strategic Candidacy in Committee Voting.

3:00–3:20

Break

16A. Social Choice with Interpersonal Comparisons

Location: Curtis Building (LAW), Room 102
Chair: David Donaldson (University of British Columbia)

Georges Bordes (LARE and Université Montesquieu Bordeaux IV), **Peter J. Hammond*** (Stanford University), and **Michel Le Breton** (GREQAM-LEQAM, Université de la Méditerranée, and Institut Universitaire de France), Social Welfare Functionals on Restricted Domains and in Economic Environments.

Bertil Tungodden (Norwegian School of Economics and Business Administration): Social Choices with Independent Norm Levels.

Elena Yanovskaya (St. Petersburg Institute for Economics and Mathematics): Nash Social Choice Orderings.

16B. Coalition Formation

Location: Curtis Building (LAW), Room 157
Chair: Myrna Holtz Wooders (University of Toronto)

Anke Gerber (Universität Bielefeld): Coalition Formation in General NTU Games.

Fritz Grafe (Universidad del Pais Vasco–Euskal Herriko Unibertsitatea) and **Ana Mauleon*** (Universidad del Pais Vasco–Euskal Herriko Unibertsitatea): Externalities and Free Trade Agreements.

Suryapratim Banerjee (Boston University), **Hideo Konishi*** (Southern Methodist University and Boston University), and **Tayfun Sönmez** (University of Michigan): Core in a Simple Coalition Formation Game.

16C. Voluntary Contributions Games

Location: Curtis Building (LAW), Room 169
Chair: Theodore C. Bergstrom (University of California at Santa Barbara)

Yusen Sung (National Taiwan University): Discrete Contributions to Continuous Public Goods with Pareto-Improving Strategic Transfers.

Richard C. Cornes* (Keele University) and **Emilson C. D. Silva** (University of Oregon): Rotten Kids, Purity and Perfection.

H. Elizabeth Peters (Cornell University), **Ali Sinan Ünür*** (Cornell University), **Jeremy Clark** (University of British Columbia), and **William D. Schulze** (Cornell University): Free-Riding and the Provision of Public Goods in the Family: An Experimental Test of the Rotten Kid Theorem.

16D. Majority Rule

Location: Curtis Building (LAW), Room 177
Chair: Dominique Lepelley (CREME, Université de Caen)

József Mala (Budapest University of Economics): On Generalized q-Majority Rule.

Hervé Cres* (HEC School of Management) and **Mich Tvede** (University of Copenhagen): Ordering Pareto Optima Through Majority Rule.

4:35–4:45

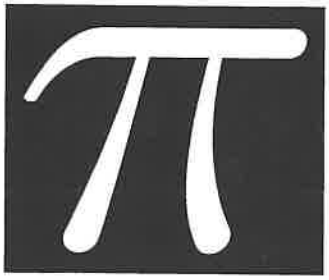
Break

4:45–5:45

Presidential Address

Location: Curtis Building (LAW), Room 101/102/201
Chair: William Thomson (University of Rochester)

Hervé Moulin (Duke University): Random Priority: A Probabilistic Resolution of the Tragedy of the Commons.



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Summer Conference on Industrial Organization

University of British Columbia
Vancouver, British Columbia, Canada

Friday, July 10 and Saturday, July 11, 1998

Organizer

Tom Ross (University of British Columbia)

Introduction

Each summer, the Policy Analysis Division of the Faculty of Commerce and Business Administration at the University of British Columbia organizes and hosts a small industrial organization conference on the U.B.C. campus. The summer conference began in 1987 at Carleton University and moved to U.B.C. in 1993.

The conference is open to anyone wishing to attend and there is no official registration procedure or fee for the workshops. However, those planning to attend are asked to inform the organizers to help them plan seating and catering. Anyone wishing to be included in the conference luncheon and/or dinner must inform the organizers at least two weeks before the conference and there will be a charge to cover the meal expenses.

Schedule of Events

All lectures are held in the MacPhee Conference Centre, Room 126.

Friday, July 10

9:00–12:00

Session I

Chair: Frank Mathewson (University of Toronto)

Joseph Harrington (Johns Hopkins University): Organizational Structure and Innovation in a Multi-Unit Firm.

Matthew Turner (University of Toronto): Optimal Quota Programs.

12:00

Luncheon

1:30–4:30

Session II

Chair: Gwill Allen (Competition Bureau)

Shane Greenstein (Northwestern University): America On and Off Line: The Geography of the US Internet Access Industry.

Thomas Hubbard (University of California, Los Angeles): Technological and Organizational Change in the Trucking Industry.

7:00

Dinner

Saturday, July 11

9:00–12:00

Session III

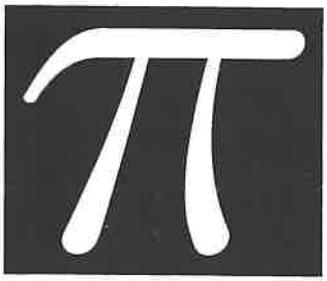
Chair: Aidan Vining (Simon Fraser University and CSGB)

Andrew Daughety and **Jennifer Reinganum** (Vanderbilt University): On the Economics of Trials: Adversarial Process, Evidence and Equilibrium Bias.

Randall Kroszner (University of Chicago): What Drives Deregulation? Economics and Politics of the Relaxation of Branch Banking Restrictions.

12:00

Light Lunch on Site



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Workshop on the Design of Markets and Organizations Under Incomplete Information

University of British Columbia
Vancouver, British Columbia, Canada

Monday, July 13 to Friday, July 17, 1998

Organizer

J. C. Rochet (Université des Sciences Sociales, Toulouse)

Introduction

Mechanism design theory is concerned with the design of social decision procedures when economic agents have private information and use it strategically. It is now possible to apply this theory to solve concrete problems, e.g., how to construct a revenue-maximizing auction, how to construct efficient trading mechanisms, how to design optimal tariff schedules for telephone or electricity, or how to design complex organizations in a way that prevents corruption. The practical implementation of the theory poses statistical and numerical problems that are just beginning to be solved by the use of powerful tools from functional analysis. These methods are likely to be of independent interest to applied mathematicians.

The main objectives of this workshop are (1) to survey mechanism design theory in a way that is accessible to non-economists, (2) to illustrate the power of the theory by studying four kinds of applications: auctions, trading mechanisms, nonlinear pricing, and the design of organizations, and (3) to consider the mathematical difficulties introduced by the practical implementation of mechanism design theory.

The primary audiences for this workshop are applied mathematicians (particularly specialists in statistics, numerical analysis, and functional analysis) and economists.

July 15th is devoted to the study of auctions in theory and practice. These lectures will include analyses of the recent spectrum auctions for telecommunications in the US and the electric power auction that is currently being implemented in California. Each of the other five topics will be covered in two lectures spread over two days. The special session on auctions can be followed independently of the rest of the workshop.

Registration

Registration is held in the Geography Building, Room 101 on Monday July 13 at 8:30–9:00 and 11:00–11:30. Outside of these times, participants may register at the PIMS office.

Schedule of Events

All lectures are held in the Geography Building, Room 101.

Monday, July 13

9:00–11:00	**Jean-Jacques Laffont** (Université des Sciences Sociales, Toulouse): Contract Theory with Adverse Selection I.
11:30–12:30	**Jean-Jacques Laffont** (Université des Sciences Sociales, Toulouse): Contract Theory with Adverse Selection II.
2:00–4:00	**Jean-Jacques Laffont** (Université des Sciences Sociales, Toulouse): Contract Theory with Adverse Selection III.

Tuesday, July 14

9:00–11:00 **David Martimort** (Université des Sciences Sociales, Toulouse): Theory of Bureaucracy I.

11:30–12:30 **David Martimort** (Université des Sciences Sociales, Toulouse): Theory of Bureaucracy II.

2:00–4:00 **David Martimort** (Université des Sciences Sociales, Toulouse): Theory of Bureaucracy III.

Wednesday, July 15

9:00–11:00 **Ken Hendricks** (University of British Columbia) and **Robert Porter** (Northwestern University): Empirical Methods in Auctions I.

11:30–12:30 **Ken Hendricks** (University of British Columbia) and **Robert Porter** (Northwestern University): Empirical Methods in Auctions II.

2:00–5:00 **Robert Wilson** (Stanford University): Design of Auction Markets.

Thursday, July 16

9:00–11:00 **Lars Stole** (University of Chicago): Competition in Nonlinear Prices I.

11:30–12:30 **Lars Stole** (University of Chicago): Competition in Nonlinear Prices II.

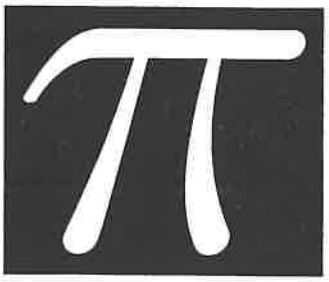
2:00–4:00 **Lars Stole** (University of Chicago): Competition in Nonlinear Prices III.

Friday, July 17

9:00–11:00 **Philippe Choné** (ENSAE) and **Jean-Charles Rochet** (Université des Sciences Sociales, Toulouse: Ironing, Sweeping, and Multidimensional Screening.

11:30–12:30 **Philippe Choné** (ENSAE) and **Jean-Charles Rochet** (Université des Sciences Sociales, Toulouse): Computation and Estimation of Optimal Nonlinear Prices I.

2:00–3:00 **Philippe Choné** (ENSAE) and **Jean-Charles Rochet** (Université des Sciences Sociales, Toulouse): Computation and Estimation of Optimal Nonlinear Prices II.



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Workshop on Recent Developments in Mathematical Economics

University of British Columbia

Vancouver, British Columbia, Cananda

Monday, July 20 to Thursday, July 23, 1998

Organizers

Ivar Ekeland (Université de Paris-Dauphine)
John Weymark (University of British Columbia)

Introduction

Recent developments in economic theory have required the use of advanced mathematical techniques and have raised many interesting mathematical problems. The aim of this workshop is to provide an introduction to several areas of economic research that have been the subject of much recent activity and in which progress has been made using mathematical techniques from areas such as game theory, optimization theory, calculus of variations, differential geometry, numerical analysis, and logic.

Each lecture is three hours long and does not presuppose that members of the audience have heard previous talks in the series. The primary audience for this workshop are scholars working in economics, mathematics, and operations research, but specific lectures will be of interest to others (such as mathematical biologists and logicians).

Registration

Registration is held in the Geography Building, Room 101 on Monday, July 20 at 8:30–9:00 and 1:00–1:30. Outside of these times, participants may register at the PIMS office.

Schedule of Events

All lectures are held in the Geography Building, Room 101. There will be a 15 minute break in the middle of each talk.

Monday, July 20

9:00–12:00 **Susan Athey** (Massachusetts Institute of Technology): Recent Advances in Comparative Statics: Theory and Applications to Games of Incomplete Information.

1:30–4:30 **Robert McCann** (Brown University and University of Toronto): Optimal Transportation, Hierarchical Structures, and Incentive Compatibility.

Tuesday, July 21

9:00–12:00 **Richard McKelvey** (California Institute of Technology) and **Andrew McLennan** (University of Minnesota): Computation of Equilibria in Finite Games.

1:00–4:30 **Ken Judd** (Stanford University): Numerical Methods in Economics.

Wednesday, July 22

9:00–12:00 **Philippe Mongin** (THEMA, Université de Cergy-Pontoise): Logic and the Foundations of the Theory of Games and Decisions.

1:00–4:30 **Jeroen Swinkels** (Washington University): Evolutionary Game Theory.

Thursday, July 23

9:00–12:00 **Ivar Ekeland** (Université de Paris-Dauphine): Disaggregation Problems in Consumer Theory: A Partial Differential Equations Approach.

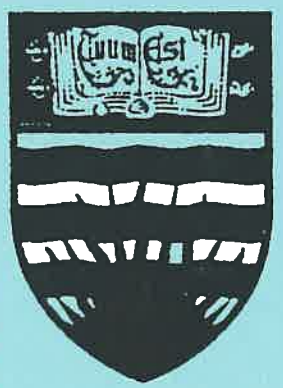
1:30–4:30 **Andreau Mas-Colell** (Universitat Pompeu Fabra): Adaptive Adjustments in Games.

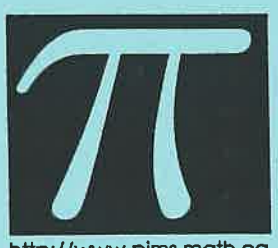
VII INTERNATIONAL CONFERENCE ON STOCHASTIC PROGRAMMING

THE UNIVERSITY OF BRITISH COLUMBIA

VANCOUVER, CANADA

AUGUST 8 - 16, 1998





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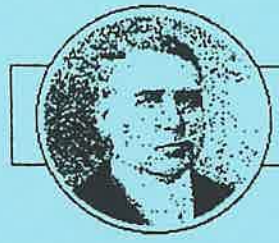

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PROGRAM IN FINANCIAL MODELING
Faculty of Commerce, UBC

VII International Conference on Stochastic Programming

The University of British Columbia

Tutorial Programme, Aug. 8–9

Main Programme, Aug. 10–14

Asset and Liability Management Seminar, Aug. 14–16

General Information

Organizing Committee

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Andrzej Ruszczynski (COSP Chair)
Jitka Dupacova (Eastern European Contact)
Alan King (COSP Meeting Chair)
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European Co-ordinator:

Enrico Moretto

Registration

Participants may pay registration fees and pick up the registration material at the following times.

Saturday, Aug. 8, 7:00–10:30am at McPhee Conference Centre registration desk.

Sunday, Aug. 9, 3:45–7:00pm in Walter Gage Residence Fireplace Lounge.

Monday, Aug. 10, 7:00am–5:00pm at McPhee Conference Centre registration desk.

Tuesday, Aug. 11, 8:00–10:30am at McPhee Conference Centre registration desk.

Wednesday, Aug. 12, 8:00–10:30am at McPhee Conference Centre registration desk.

Thursday, Aug. 13, 8:00–10:30am at McPhee Conference Centre registration desk.

Friday, Aug. 14, 8:00am–2:00pm at McPhee Conference Centre registration desk and 5:00–7:00pm in Walter Gage Residence Fireplace Lounge.

Saturday, Aug. 15, 7:00–10:30am at McPhee Conference Centre registration desk.

Sunday, Aug. 16, 7:30–10:30am at McPhee Conference Centre registration desk.

Outside of these times, participants may register at the PIMS office in the Old Auditorium Annex (telephone: 822–3922). The PIMS office is open Mon.–Fri., 8:30am–4:30pm.

Recreational Activities

Tennis Tournament

There will be a tennis tournament on Saturday, August 8, starting at 4:00pm. The fee to participate is Cdn$ 20. The tournament will be held on campus at the Coast Club (indoor and outdoor courts are available). Registration is limited to 16 people. This tournament is organized by R. Sanegre, S. Sen, and W. Ziemba. To register, please contact Rafael Sanegre at sanegre@aebc.com.

Golf Tournament

A golf tournament will be held at the University Golf Club on Sunday, August 9, starting at 3:45pm. The fee is Cdn$ 60 (not including rentals). This tournament is organized by R. Sanegre and W. Ziemba. To register, please contact Rafael Sanegre at sanegre@aebc.com.

Reception

On August 10, 7:30–9:00pm there will be a reception at Cecil Green Park, hosted by the *Frank Russell Company.*

Banquet

On August 13, there will be a banquet at the UBC Museum of Anthropology, hosted by *Falcon Asset Management.* The museum opens at 6:45pm, dinner follows at 7:30pm, and the museum closes at 11:00pm.

Reception

On August 15, 7:00–9:00pm, there will be a reception at the UBC Botanical Garden, hosted by IBM.

Publications

1. **Stochastic Programming: State of the Art 1998**

   Contents: The 15 main lectures plus banquet speech and a preface by the editors.

   Editors: Rogers Wets and William Ziemba

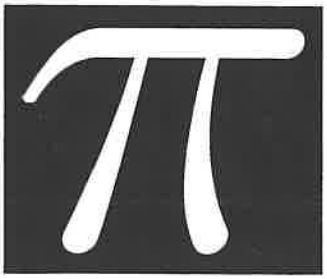
   Will be published by Baltzer Science Publishers as a special issue of the **Annals of Operations Research.**

2. **Research in Stochastic Programming (Selected refereed papers from the International Conference on Stochastic Programming)**

   Contents: Invited papers and contributed papers (all refereed). Deadline for submission of papers for consideration for this volume is September 30, 1998. Submitted papers should be sent (4 copies) to Chanaka Edirisinghe <chanaka@utk.edu>, College of Business, 610 Stokely Management Center, University of Tennessee, Knoxville, TN 37996, USA.

   Editors: John Birge, Chanaka Edirisinghe, and William Ziemba

   To be published by Baltzer Science Publishers as a special issue of the **Annals of Operations Research.**



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VII International Conference on Stochastic Programming: Tutorial Programme

University of British Columbia
Vancouver, British Columbia, Canada
Saturday, August 8 and Sunday, August 9, 1998

Other Sponsors

The Fields Institute for Research in Mathematical Sciences
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Math Consulting Group, A. G.
The Faculty of Commerce, UBC
The Program in Financial Modeling of the Faculty of Commerce, UBC
Algorithmics Inc.

Organizer

Julia Higle (University of Arizona)

Introduction

This two-day tutorial program is a prelude to the VII International Conference on Stochastic Programming that will follow and is intended primarily for students and newcomers to the field.

Computer Facilities

There will be two computer terminals in the lobby of the David Lam Management Centre, which participants may use for accessing their home accounts. In addition, tutorial participants have access to the PIMS computer lab, which is located in room 306 of the Old Computer Science Building. The access code for the door of the lab will be supplied at registration. The lab contains a small mathematics library and 9 terminals. At the terminals you should login using the username "ef-guest". The password for this account will be supplied at registration. If you have any questions regarding the Lab, then please ask at the PIMS office in the Old Auditorium Annex.

Schedule of Events

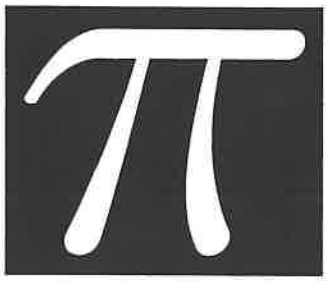
All tutorials are held in the McPhee Conference Centre, room 125.

Saturday, August 8

8:30–10:00	**Stein W. Wallace** (Norwegian University of Science and Technology): Introduction and overview of stochastic programming.
10:30–12:00	**Janos Mayer** (University of Zürich): Chance constrained programming.
1:30–3:00	**Maarten van der Vlerk** (University of Gröningen): Stochastic integer programs.
4:00	Tennis Tournament

Sunday, August 9

8:30–10:00	**Julia Higle** and **Suvrajeet Sen** (University of Arizona): Modeling in stochastic programming using a case study approach.
10:30–12:00	**Rüdiger Schultz** (Humbolt University): Stability in stochastic programming.
1:30–3:00	**Chanaka Edirishinghe** (University of Tennessee): Bounding techniques in stochastic programming.
3:45	Golf Tournament



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VII International Conference on Stochastic Programming: Main Programme

University of British Columbia

Vancouver, British Columbia, Canada

Monday, August 10 to Friday, August 14, 1998

Other Sponsors

The Fields Institute for Research in Mathematical Sciences
The Frank Russell Company
Falcon Asset Management
IBM
Math Consulting Group, A. G.
The Faculty of Commerce, UBC
The Program in Financial Modeling of the Faculty of Commerce, UBC
Algorithmics Inc.

Organizers

William Ziemba (University of British Columbia)
Roger Wets (University of California, Davis)

Introduction

Most practical decision problems involve uncertainty. Stochastic programming is the study of practical procedures for decision making under uncertainty over time. The uncertainty can be in the model's parameters or in the model itself. Parameters may be uncertain because of lack of reliable data, measurement errors, future and unobservable events, etc. The uncertainty of events, details of the problem structures and constraints and the risk/payoff of decisions are modeled in an optimization framework. High performance workstations and PCs are used to enable exact and approximate algorithms to determine robust first stage decisions that hedge against future uncertainty. Then as the uncertainty becomes known period by period resource decisions responding to the new information can be made. The VII International Conference on Stochastic Programming will discuss theory and computations in general settings and applications in many areas such as financial modeling, asset-liability management, risk control, bond portfolio management, currency modeling, transportation, energy planning, production planning, telecommunications, forest and fishery harvest management, energy-economic planning and other areas.

Computer Facilities

There will be two terminals in the lobby of the David Lam Management Centre which may be used for accessing your home account. The PIMS Computer Lab will not be available during Aug. 10–12.

Programme Summary

	Mon. Aug. 10	Tues. Aug. 11	Wed. Aug. 12	Thurs. Aug. 13	Fri. Aug. 14
0830–0930	Plenary I	Plenary I	Plenary I	Plenary I	Plenary I
0930–1030	Plenary II	Plenary II	Plenary II	Plenary II	Plenary II
1030–1100	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
1100–1200	Plenary III	Plenary III	Plenary III	Plenary III	Plenary III
1200–1400	Lunch Break	Lunch Break	Optional	Lunch Break	Lunch Break
1400–1600	4 parallel talks	4 parallel talks	Tours	4 parallel talks	4 parallel talks
1600–1830	4 parallel talks	Panel 1		4 parallel talks	Panel 2
Evening	Reception	Computer Presentations		Banquet	

Schedule of Events

Monday, August 10

Plenary Lectures

Chair: William T. Ziemba (University of British Columbia)
Location: Old Computer Science Building (CSCI), room 200

830–930 **Andras Prekopa** (Rutgers University): Probabilistic programming.

930–1030 **Roger J-B Wets** (UC Davis): Statistical estimation and stochastic programming.

1030–1100 Coffee Break

1100–1200 **Wim Klein Haneveld** and **Maarten vander Vlerk** (University of Groningen): Stochastic integer programming.

1200–1400 Lunch Break

1400–1600 **Parallel Sessions**

1A. Applications: Engineering I

Chair: Leon Lasdon (University of Texas, Austin)
Location: McPhee Conference Centre, room 125

Warren G. Powell (Princeton University) and **Zhi-Long Chen** (Dept. of Sytems Engineering): A convergent, sampling-based algorithm for multistage stochastic linear programs.

C. Lucas, **E. Messina**, **S. A. Mirhassani**, **G. Mitra**, and **A. Nagar** (Brunel University): Computational solution of capacity planning models under uncertainty.

John Birge and **Joyce Yen** (University of Michigan): Modeling disruptions in crew scheduling.

John A. Buzacott (York University) and **Douglas T. Gardner** (Algorithmics Inc.): STEELPLAN: a model for steel mill capacity planning under uncertainty.

1B. Modeling Languages and Computer Systems I

Chair: Horand I. Gassman (Dalhousie University)
Location: David Lam Management Research Centre, amphitheatre (room 142)

Horand I. Gassmann (Dalhousie University): A comprehensive input format for stochastic programs and a library of utilities for its use.

Robert Fourer (Northwestern University) and **David M. Gay** (Bell Laboratories): AMPL extensions for stochastic programming.

Claus Caroe (University of Copenhagen): Implementing the dual decomposition method for stochastic integer programs.

Robert Entriken and **John Stone** (Stanford University): SMPS.PL Users Guide.

1C. Theory

Chair: Suvrajeet Sen (University of Arizona)
Location: McPhee Conference Centre, room 126/128

Vlasta Kankova (Institute of Information Theory and Automation, Prague): A note on empirical estimates in multistage stochastic programming.

Urmila Diwekar (Carnegie Mellon University): An efficient approach to optimization under uncertainty.

Jano Mayer and **Peter Kall** (University of Zürich): On model management for recourse models.

Masami Kurano (Chiba University), **Masami Yasuda** (Chiba University), and **Yoshinobu Kadota** (Wakayama University): Stopped decision processes in conjunction with general utility.

1D. Financial Models I

Chair: John Mulvey (Princeton University)
Location: Old Computer Science Building (CSCI), room 200

Thomas Burkhardt (University of Freiberg): A mean-variance of first passage time approach to portfolio selection in a lognormal world.

Robert R. Grauer (Simon Fraser University) and **Nils H. Hakansson** (UC Berkeley): Applying the Grinbaltt-Titman and the conditional (Ferson-Schadt) performance measures: the case of industry rotation via the dynamic investment model.

David Edelman (University of Woologong): Quantifying the financial value of information.

Yuming Li (California State University of Fullerton), **Leonard C. Maclean** (Dalhousie University) and **William T. Ziemba** (University of British Columbia): Security and wealth aspects of optimal capital growth models with minimum expected time criteria.

1600–1630 Coffee Break

1630–1830 Parallel Sessions

2A. Applications: Engineering II

Chair: Warren G. Powell (Princeton University)
Location: McPhee Conference Centre, room 125

Roger J-B Wets (UC Davis), **Armen der Kiureghian** (UC Davis), and **Elijah Polak** (UC Berkeley): A convergent sampling-based algorithm for multistage stochastic linear programs.

Kurt Marti and **Gerald Stoeckl** (Federal Armed Forces University): Optimal design of trusses by stochastic linear programming with recourse.

Shanling Li, **Richard Loulou**, and **Atiqur Rahman** (McGill University): Technological progress and technological acquisition: a stochastic programming approach.

Shogo Shoide (Kobe-Gakuin University): A stochastic location problem of a break point on a linear barrier.

2B. Modeling Languages and Computer Systems II

Chair: Janos Mayer (University of Zürich)
Location: David Lam Management Research Centre, amphitheatre (room 142)
Note: This session ends at 1900.

Peter Kall (University of Zürich), **Jano Mayer** (University of Zürich) and **Suvrajeet Sen** (University of Arizona): A scenerio generation algorithm for multistage stochastic LPs.

Chanaka Edirishinghe and **G. M. You** (University of Tennessee): Implementation of bound-based solution methods for two-stage asset allocation.

Tamas Szantai (Technical University of Budapest): Improved bounds and simulation procedures on the value of some multivariate probability distribution functions.

Janos Mayer and **Peter Kall** (University of Zürich): SLP-IOR: a modeling system for SLP.

Martin H. van der Vlerk: Experiences with SLP-IOR.

2C. Algorithms

Chair: Andrzej Ruszczynski (Rutgers University)
Location: McPhee Conference Centre, room 126/128

Gongyun Zhao (National University of Singapore): A log-barrier decomposition method for solving stochastic programs.

K. A. Ariyawansa (Washington State University): Polynomial cutting plane algorithms for stochastic programming.

Leon Lasdon (University of Texas at Austin): Solving nonconvex financial methods.

Alan J. King and **Stephen E. Wright** (Miami U., Ohio): The flexible partition L-shaped method.

2D. Financial Models II

Chair: Nils H. Hakansson (UC Berkeley)
Location: Old Computer Science Building (CSCI), room 200
Note: This sessions ends at 1900.

Robert R. Grauer (Simon Fraser University) and **Frederick C. Shen** (Manulife Financial): On estimation risk and discrete-time dynamic portfolio theory: the evidence from asset allocation.

Karel Janacek (Charles University): Maximum growth strategies in gambling and investing.

Elena Medova (University of Cambridge): VAR methodology and the limitation of catastrophic or unquantifiable risk.

Nieves H. Pedron (University of Cambridge): Performance of alternative asset allocation models of recent US market history.

Petter E. de Lange (Norwegian University of Science and Technology): The impact of derivatives on the portfolio choices of insurance.

1930–2100 Reception at Cecil Green Park hosted by the Frank Russell Company.

Tuesday, August 11

Plenary Lectures

Chair: Roger Wets (University of California Davis)
Location: Old Computer Science Building (CSCI), room 200

830–930 **Zvi Artstein** (Weizmann Institute of Science): Gains of information in stochastic programming.

930–1030 **Georg Plug** (University of Vienna): Error estimates of sampling.

1030–1100 Coffee Break

1100–1200 **Julia Higle** and **Suvrajeet Sen**: (University of Arizona): Statistical approximation in linear programming.

1200–1400

3A. COSP Meeting/Lunch

Chair: Andrzej Ruszczynski (Rutgers University)
Location: Old Computer Science Building (CSCI), room 200

1400–1600 Parallel Sessions

4A. Applications: Engineering III

Chair: Stein W. Wallace (Norwegian University of Science & Technology)
Location: McPhee Conference Centre, room 125

Asgeir Tomasgard (Norwegian University of Science & Technology), **Stein W. Wallace** (Norwegian University of Science & Technology), **L. Stougie** (University of Groningen), **Martin H. van der Vlerk** (University of Groningen), **Shane Dye** (University of Canterbury): Hueristics for a stochastic service provision problem in telecommunications.

Asgeir Tomasgard (Norwegian University of Science & Technology), **Stein W. Wallace** (Norwegian University of Science & Technology), **Martin H. van der Vlerk** (University of Groningen), **L. Stougie** (University of Groningen), and **Shane Dye** (University of Canterbury): Solving a stochastic service provision problem in telecommunications using branch and bound relaxations.

Elena Medova and **James Scott** (University of Cambridge): Stochastic optimization models for oil consortium logistic planning.

V. S. Kirilyuk (Glushkov Institute of Cybernetics): On minimizing the demand for parallel-series systems with two failure modes.

4B. Sampling Algorithms I

Chair: David Morton (University of Texas at Austin)
Location: David Lam Management Research Centre, amphitheatre (room 142)

Greg Godfrey, **Warren G. Powell**, and **Joel Shapiro** (Princeton University): Approximation methods for multistage dynamic programs for discrete dynamic resource tranformation problems.

Yasunari Yoshitomi (Miyazaki University), **Toshifumi Takeba** (Miyazaki University), **Shigeyuki Tomita** (Miyazaki University),and **Hiroko Ikenoue** (National College of Technology): Genetic algorithm approach for solving stochastic programming problems.

Alexander Shapiro (Georgia Institute of Technology): Simulation based optimization — theory and algorithms.

G. Pritchard and **G. Zakeri** (Argonne National Labs): Sorting sampled right hand sides for stochastic programs.

4C. Bonds and Interest Rate Modeling

Chair: Marida Bertocchi (University of Bergamo)
Location: McPhee Conference Centre, room 126/128

Enrico Moretto (University of Verona): A stochastic programming approach to duration analysis: an application to the Italian market.

Karl Frauendorfer and **Michael Schuerle** (University of St. Gallen): Interest rate models in stochastic optimization.

K. Kortanek (University of Iowa) and **V. Medvedev** (Byelorussian State University): Models for estimating the structure of interest rates from observation of yield curves.

Hercules Vladimirou (University of Cyprus): Nested simulations for pricing floating-rate Brady bonds.

4D. Financial Models III

Chair: Michael A. H. Dempster (University of Cambridge)
Location: Old Computer Science Building (CSCI), room 200

Emmanuel Fragniere, **Jacek Gondzio**, and **Jean-Philippe Vial** (Université de Lausanne (HEC) BFSH1): A financial planning model with one million scenerios solved on an affordable virtual parallel machine.

Cees Dert (ABN-AMRO and Free University of Amsterdam), **Roy Kouwenberg** (Erasmus University), **Bart Oldenkamp** (Erasmus University), and **Shuzhong Zhang** (Erasmus University): A stochastic programming approach to guaranteed return portfolio modeling.

Alan J. King (IBM Research): Duality and Martingales in contingent claims analysis.

Yves Smeers (CORE/UCL): Strategic investments and stochastic multistage equilibirium problems.

16–1630 Coffee Break

1630–1830

5A. Panel I: Large Scale Stochastic Programming Computations

Chair: John Mulvey (Princeton University) and Roger J-B Wets (UC Davis)
Location: Old Computer Science Building (CSCI), room 200

1900–1945 Computer Demonstration

GAMS, Special Computer Presentation
Location: David Lam Management Research Centre, amphitheatre (room 142)

1945–2030 Computer Demonstration

IBM, Special Computer Presentation
Location: David Lam Management Research Centre, amphitheatre (room 142)

Wednesday, August 12

Plenary Lectures

Chair: John Birge (University of Michigan)
Location: Old Computer Science Building (CSCI), room 200

830–930 **R. Tyrell Rockafellar** (University of Washington): Duality in stochastic programming.

930–1030 **Andrzej Ruszczynski** (Rutgers University): Large scale stochastic programming algorithms and computational experiences.

1030–1100 Coffee Break

1100–1200 **Chanaka Edirisinghe** (University of Tennessee): Bounds and approximations for multiperiod stochastic programming.

There will be optional tours in the afternoon. For information on possible tours, there is a tour desk located in the lobby of the Walter Gage Residence.

In addition, John Mulvey is organizing a group to go to the *Semiahmoo Golf Course* in Blaine, Washington. This is a top golf course and relatively expensive. Note that this excursion involves crossing the Canada-USA border. Interested people should contact John Mulvey <mulvey@macbeth.Princeton.edu>.

Thursday, August 13

Plenary Lectures

Chair: John Mulvey (Princeton University)
Location: Old Computer Science Building (CSCI), room 200

830–930 **Stavros Zenios** (University of Cyprus): Solving large scale stochastic programs in mortgage backed security analysis.

930–1030 **Michael Dempster** (Cambridge University): Dynamic sampling algorithms.

1030–1100 Coffee Break.

1100–1200 **Leonard MacLean** (Dalhousie University) and **William T. Ziemba** (University of British Columbia): Growth versus security tradeoffs in dynamic investment analysis.

1200–1400 Lunch Break

1400–1600 Parallel Sessions

6A. Applications: Power and Water I

Chair: Werner Romisch (Humboldt University of Berlin)
Location: McPhee Conference Centre, room 125

Emmanuel Fragniere (Université de Lausanne (HEC) BFSH1): Uncertainty management of urban energy systems.

Benedikt Krasenbrink, **Samer Takriti**, and **L. S-Y Wu** (IBM Watson Research Center): Incorporating fuel constraints and electricity prices into the stochastic unit commitment problem.

Alejandro Jofre (Universidad de Chile) and **Francisco Ortega** (Université Catholique de Louvain): Power generation planning model with investments and parallel stochastic optimization.

Matthias Nowak (Humboldt University of Berlin): Stochastic Lagrangian relaxations for the optimization of a hydro-thermal power system.

6B. Sampling Algorithms II

Chair: Alexander Shapiro (School of Industrial and Systems Engineering)
Location: David Lam Management Research Centre, amphitheatre (room 142)

Davaadorjin Monhor (University of Sopron): Bounds for mulivariate probability distribution functions.

David Morton and **Kevin Wood** (University of Texas at Austin): Optimistic Monte Carlo bounds for stochastic programming.

Istvan Deak (Technical University of Budapest): Subroutines for computing normal probabilities of sets — computer experiences.

Christian Condeveaux-Lanloy, **Emmanuel Fragniere** and **Jacek Gondzio** (Université de Lausanne (HEC) BFSH1): Using SET to bridge the gap between AML's and S-MPS based codes.

6C. Economic and Financial Models

Chair: Eckhard Platen (University of Technology, Sydney)
Location: McPhee Conference Centre, room 126/128

Alexei A. Gaivoronski (Norwegian University of Science and Technology): Combining simulation and optimization for portfolio management.

Eckhard Platen (University of Technology, Sydney): Consistent financial market modelling.

G. Chow (Princeton University): Pricing contingent claims by the Lagrange method.

B. Curtis Eaves, **Donald J. Brown**, and **Peter M. DeMarzo** (Stanford University): The general equilibrium model of economics with incomplete assets.

1600–1630 Coffee Break

6D. Financial Models IV

Chair: Stewart Hodges (University of Warwick)
Location: Old Computer Science Building (CSCI), room 200

Adam J. Berger (Lattice Financial), **John Mulvey** (Princeton University), and **Robert Rush** (Rutgers University): A portfolio management system for catastrophe property liabilities.

Jerome Kreuser (World Bank): Asset and liability management models.

David Heath (Carnegie Mellon University): Some new term structure models.

Karl Frauendorfer (University of St. Gallen): Test problems in stochastic multistage programming.

1630–1830 Parallel Sessions

7A. Applications: Power and Water II

Chair: Alejandro Jofre (Universidad de Chile)
Location: McPhee Conference Centre, room 125

Javier Salmeron (Mathematical Sciences School), **Laureano F. Escudero** (Iberdrola Ingeniera y Consultoria), and **Margarita Sanchez** (Statistical School): A robust approach for long-term hydro-thermal electric coordination planning under uncertainty.

Patrizia Beraldi, **Chefi Triki**, and **Marino Sforna** (University of Calabria — DEIS): Economic dispatch and spot pricing in power production planning under uncertainty.

A. Philpott (University of Auckland): Optimal hydro-electric generation in an electricity market.

Stein-Erik Fleten (National Scientific and Technical University): Risk averse power scheduling with forward contracts.

7B. Scenerio Generation

Chair: Jitka Dupacova (Charles University)
Location: David Lam Management Research Centre, amphitheatre (room 142)

Stein W. Wallace (Norwegian University of Science & Technology): Constructing scenerio trees.

Werner Romisch (Humboldt University of Berlin): Quantitative stability in stochastic programming.

G. Consigli, **Michael A. H. Dempster**, **Nieves H. Pedron** and **Zhiping Chen** (University of Cambridge): Scenario generation for multistage stochastic programming portfolio models in sequential sampling algorithms.

Jitka Dupacova (Charles University): Scenerios for multistage stochastic programs.

7C. Chance Constrained Programming

Chair: Andras Prekopa (Rutgers University)
Location: McPhee Conference Centre, room 126/128

Riho Lepp (Institute of Cybernetics, Estonia): Approximation of decision rules in probabilistic programming.

Nicole Growe-Kuska (Humboldt University): Asymptotic expansions of optimal values in simple recourse models.

Stanislav Uryasev (University of Florida): Simultaneous calculation of sensitivities for probalistic performance functions: application in risk analysis.

Andrey Kibzun (Moscow Aviation Institute): On the worst distribution for stochastic programming problems.

7D. Financial Models V

Chair: Dan Rosen (Algorithmics Inc.)
Location: Old Computer Science Building (CSCI), room 200

Richard Grinold (Barclays Global Investors): A Markov approach to trading a single asset.

Bert Menkveld and **Ton Vorst** (Erasmus University): A pricing model for American options with stochastic interest rates.

Eric Reiner (Union Bank of Switzerland): Convolution methods for exotic options.

Anthony Neuberger (London Business School) and **Stewart Hodges** (University of Warwick): Rational bounds on the prices of exotic options.

1845–2300 Banquet at the UBC Anthropology Museum hosted by Falcon Asset Management. The Museum opens at 1845, dinner follows at 1930, museum closes at 2300.
Speaker: George Dantzig (Stanford University)

Friday, August 14

Plenary Lectures

Chair: Michael Dempster (University of Cambridge)
Location: Old Computer Science Building (CSCI), room 200

830–930 **Andy Turner** (The Frank Russell Company): Development and use of stochastic programming at the Frank Russell Company.

930–1030 **John Mulvey** (Princeton University): Solving many similar large scale stochastic programs in asset/liability management.

1030–1100 Coffee Break

1100–1200 **Ron Dembo** and **Dan Rosen** (Algorithmics Inc.): Experiences at Algorithmics using stochastic programming for risk management.

1200–1400 Lunch Break

1400–1600 Parallel Sessions

8A. Applications: Power and Water III

Chair: Chanaka Edirisinghe (University of Tennessee)
Location: McPhee Conference Centre, room 125

Lisa A. Korf (UC Davis): A stochastic programming perspective of stochastic control problems.

David H. Salinger (Columbia Basin Research, University of Washington): A splitting algorithm for multistage stochastic programming with application to hydropower scheduling.

Chanaka Edirishinghe, **Ike Patterson**, and **Nasreddine Saadouli** (University of Tennessee): Capacity planning model for a multipurpose water reservoir with target-priority operation.

S. Brignol and **A. Renaud** (Electricity de France): Optimizing short-term operation of power generation: a new stochastic model.

8B. Aggregation and Approximation

Chair: Zvi Arstein (The Weizmann Institute of Science)
Location: David Lam Management Research Centre, amphitheatre (room 142)

Andrzej Ruszczynski (Rutgers University) and **Arkadii V. Kryazhimskii** (Steklov Institute of Mathematics): Constraint aggregation in infinite-dimensional spaces with applications to optimal control, games and stochastic programming.

Stefan Mittnik, **Marc Paolella**, and **Svetlozar Rachev** (University of Kiel): Modeling conditional risk for fat-tailed return processes.

Silvia Vogel (Technical Univesity Ilmenau): On approximations of stochastic programming problems related to stochastic processes.

Darinka Dentcheva: Regular castaing representations of multifunctions with applications to stochastic programming.

8C. Integer Programming

Chair: W. Klein Haneveld (University of Groningen)
Location: McPhee Conference Centre, room 126/128

Shabbir Ahmed and **Nikolaos V. Sahinidis** (University of Illinois at Urbana-Champagn): An asymptotically optimal heuristic for a multi-stage stochastic integer program.

Tito Manlio Homem-de-Mello (Georgia Institute of Technology): Estimation of derivatives of nonsmooth performance measures in regenerative systems.

P. S. Knopov (Glushkov Institute of Cybernetics): On the one class of non-stationary stochastic optimization models.

Claus Caroe (University of Copenhagen), **Heidy Bachman** (Humboldt University Berlin), **Regina Urbaniak** (KKZ, Berlin), **Robert Weismantel** (KKZ, Berlin), and **Ruediger Schultz** (University of Leipzig): Recent progress in scenerio decomposition of stochastic integer programs.

8D. Financial Models IV

Chair: William T. Ziemba (University of British Columbia)
Location: Old Computer Science Building (CSCI), room 200
Note: This session is joint with the *Asset and Liability Management Seminar.*

Jitka Dupacova (Charles University) and **Marida Bertocchi**(University of Bergamo): Bond portfolio management in Italy.

Markus Rudolf (University of St. Gallen) and **William T. Ziemba** (University of British Columbia): Intertemporal surplus management.

Roy Kouwenberg and **Ton Vorst** (Erasmus University): Scenerio generation and stochastic programming in ALM.

Yuan-An Fan (Frank Russell Company): The Daido asset-liability management model.

1600–1630 Coffee Break

1630–1830 Parallel Sessions

9A. Panel II: Future of Stochastic Programming

Chair: John Birge (University of Michigan) and Stein W. Wallace (Norwegian University of Science & Technology)
Location: Old Computer Science Building (CSCI), room 200

John Birge (University of Michigan): Open Mathematical and algorithmic questions and challenges. Discussion on a specialized stochastic programming journal.

Stein W. Wallace (Norwegian University of Science & Technology): Challenges related to modeling, data collection, scenario tree generation and model verification. Open discussion.

9B. Risk Management

Chair: Enrico Moretto (University of Verona)
Location: McPhee Conference Centre, room 125
Note: This session ends at 1900. It is is joint with the *Asset and Liability Management Seminar.*

Cees Dert (ABN-AMRO and Fee University of Amsterdam): A multistage chance contrained programming approach to asset liability.

Elio Canestrelli (University of Venice): Analytical and numerical approaches in multidimensional stochastic processes applied to financial investments.

Arjan Berkelaar (Econometric Institute Erasmus: Downside-risk measures and the casino effect and its implications for financial risk-management.

Marc C. Steinbach (Zonrad-Zuse-Zentrum für Informationstechnik): Recursive direct optimization in financial multistage stochastic programs.

D. Kramkov and **W. Schachermayer** (University of Vienna): The asymptotic elasticity of utility functions and optimal investment in incomplete markets.

Abstracts

Session 1A. Applications: Engineering I

Warren G. Powell (Princeton University) and Zhi-Long Chen (Dept. of Systems Engineering): A convergent, sampling-based algorithm for multistage stochastic linear programs. We present a convergent algorithm for multistage stochastic linear programs that uses partial sampling and nested-Benders cuts. Prior work in this area has been restricted to two-stage problems, or multistage problems with very small sample spaces. We assume independence in the random variables between stages and randomness only on the right hand side of the constraints. This allows us to develop a convergent algorithm (in probability) that can handle large sample spaces in each stage (e.g. tens of thousands of outcomes) and large numbers of stages (e.g. 50 to 100). We outline the proof of convergence.

C. Lucas, E. Messina, S. A. Mirhassani, G. Mitra, and A. Nagar (Brunel University): Computational solution of capacity planning models under uncertainty. The traditional supply chain network problem is stated as a multi-period resource allocation problem involving 0–1 discrete strategic decision variables. The MIP structure of this problem makes it intractable for practical problems which involve multiple products, factories, warehouses, and distribution centres. The same problem formulated and studied under uncertainty makes it even more intractable. In this paper we consider two related modelling approaches and solution techniques addressing this issue. The first involves scenario analysis of solutions to "wait and see" models and the second involves a two stage integer stochastic programming representation and solution of the same problem. We show how the results from the former can be used in the solution of the latter model. We also give some computational results based on serial and parallel implementations of the algorithms

John Birge and Joyce Yen (University of Michigan): Modeling disruptions in crew scheduling. While the airline crew-scheduling problem has been readily solved, not much research has been done on crew scheduling under random delays. We examine the structure of this problem, find deterministic bounds, and integrate these deterministic bounds using stochastic programming techniques to find bounds on the optimal solution for the stochastic problem.

John A. Buzacott (York University) and Douglas T. Gardner (Algorithmics Inc.): STEELPLAN: a model for steel mill capacity planning under uncertainty. Steel mills face a variety of sources of uncertainty, including product demand and prices, cost and availability of process inputs, new technology development, and environmental regulations. In this paper, we describe STEELPLAN, a multistage stochastic programming model for capacity and sales planning under uncertainty at steel mills. The model contains a detailed technoeconomic description of the steel production process. Results from an application involving uncertainty in demand for different mill products are presented.

Session 1B. Modeling Languages and Computer System I

Horand I. Gassmann (Dalhousie University): A comprehensive input format for stochastic programs and a library of utilities for its use. This talk constitutes the final report on extensions to the SMPS format commissioned at the last Stochastic Programming Symposium in Nahariyya. The proposed extensions can handle both recourse and chance-constrained problems, allowing for a multitude of distributions. An easy interface to user-defined distributions makes the new format self-extending. A set of utility routines that read the input, extract and simulate scenarios, and effect a number of model transformations will also be described.

Robert Fourer (Northwestern University) and David M. Gay (Bell Laboratories): AMPL extensions for stochastic programming. We discuss several recent, active, or foreseen extensions to the algebraic modeling language AMPL that are designed to facilitate stating, solving, and manipulating some classes of stochastic programming problems. The extensions include user-defined suffixes (which can express time structure), random parameters (which can convey stochastic dependencies or be independent), and facilities for handling scenarios.

Claus Caroe (University of Copenhagen). Implementing the dual decomposition method for stochastic integer programs. This presentation describes an implementation of a dual decomposition and branch-and-bound algorithm for general (multi-stage) stochastic integer programs with recourse, which we are currently implementing. We describe the main ideas of the algorithm and their implementation as well as the features and options which are determined by the user. The code is being developed in C/FORTRAN 77 on the UNIX platform, and builds on the CPLEX Callable Library for handling mixed-integer subproblem, and (for the time being) NOA 3.0, a FORTRAN 77 package for non-differentiable optimization by K.C. Kiwiel.

Robert Entriken and John Stone (Stanford University): SMPS.PL Users Guide. SMPS.PL is software for generating data in the standard SMPS format that is used to describe multi-stage stochastic programs. Its input can be generated from deterministic AMPL and GAMS models, and has successfully run under the Mac, MS-DOS, and UNIX operating systems. With a deterministic AMPL model as an example, we demonstrate the minor additions that need to be made to the model in order to generate the proper input files. We also show how to translate the solution of the multi-stage model into a form that can subsequently be interpreted by AMPL in the context of the deterministic model. There is yet no method to return the solution from a GAMS model.

Session 1C. Theory

Vlasta Kankova (Institute of Information Theory and Automation, Prague) A note on empirical estimates in multistage stochastic programming. Multistage stochastic programming problems belong to optimization problems that depend on a probability measure. In applications mostly this measure have to be replaced by some its statistical estimate. The talk deals with the case when the empirical measure substitutes the theoretical one. Our attention will be focused on estimates based on one realization of the corresponding (generally dependent) random sequence. The new results will be demonstrated on an unemployment model

Urmila Diwekar (Carnegie Mellon University): An efficient approach to optimization under uncertainty. The generalized approach to stochastic optimization involves two computationally intensive recursive loops; (1) the outer optimization loop; (2) the inner sampling loop. Inclusion of discrete decision variables adds to the complexity. Birge in the recent state-of-the-art review on stochastic programming indicated the intractability of solving such problems. The focus here is to reduce computational intensity of the two recursive loops. Towards this goal, this paper presents two algorithmic developments; (1) a very efficient sampling approach, (2) a discrete optimization algorithm which interacts with the sampling loop and provides an efficient and accurate stochastic optimization framework for discrete variable optimization. The efficiency of the algorithms is presented in the context of the optimal waste blending problem of nuclear waste at Hanford. These developments reduced the computational intensity for solving this problem from 20 days of CPU time on a dedicated Alpha workstation to 18 hours of CPU time on the same machine.

Janos Mayer and Peter Kall (University of Zürich): On model management for recourse models. We consider stochastic linear multistage recourse models from the model management point of view. After identifying the basic constituents as building blocks for these types of models, we discuss model manipulation operations concerning multistage models. Besides the standard data management facilities these operations include model transformations, the handling of stochastic structures and scenarios as well as interfacing solvers. We also consider the problem of implementing the discussed model management facilities and give an overview how this has been done in our model management system SLP-IOR.

Masami Kurano (Chiba University), Masami Yasuda (Chiba University), and Yoshinobu Kadota (Wakayama Universtiy): Stopped decision processes in conjunction with general utility. A combined model of Markov decision process and the stopping problem, called Stopped Decision Processes, with a general utility is considered in this paper. This model is important for the various applications including Bandit problems and piecewise deterministic Markov processes. Our aim is to formulate the general utility-treatment of processes with a countable state space and give a functional characterization from points of seeking an optimal pair, that is, a policy and a stopping time. Further results concerning an optimality equation of our model are given. If we restrict the problem as the choice of a policy for a given fixed stopping time, these results are consistent with our previous paper, especially, in the case of the exponential utility functions, the optimal pair can be derived concretely using the idea of the one-step look ahead policy. Also, a simple numerical example is given to illustrate the results.

Session 1D. Financial Models I

Thomas Burkhardt (University of Freiberg): A mean-variance of first passage time approach to portfolio selection in a lognormal world. In practice, investors are often unable to define a precise investment horizon, but care about the time needed to reach their investment goal. Mean and variance of the first time at which the portfolio reaches a given goal are considered as criteria for growth and security, respectively. A model of portfolio selection based on a tradeoff between these quantities is developed, assuming that all available securities follow a lognormal diffusion. The model is shown to include the traditional Kelly model of capital growth as a special case, for which it provides an appropriate risk measure for finite investment horizons. Furthermore, it establishes an illuminating link between the capital growth and Markowitz type models of portfolio selection by using stochastic Euler approximations to the underlying stochastic differential equations.

Robert R. Grauer (Simon Fraser University) and Nils H. Hakansson (UC Berkeley): Applying the Grinbaltt-Titman and the conditional (Ferson-Schadt) performance measures: the case of industry rotation via the dynamic investment model. This paper applies Grinblatt and

Titman's portfolio change measure and Ferson and Schadt's conditional performance measure to the problem of assessing the performance of the dynamic investment model applied to industry rotation over the period 1934–1995 as well as various sub-periods. The dynamic investment model used in the study employs the empirical probability assessment approach with a rear-view moving window, both in raw form and with adjustments for estimation error based on a James-Stein, a Bayes-Stein, and a CAPM-based correction. Both tests were unanimous in their conclusion that the excess returns attained by the (unadjusted) historic, the Bayes-Stein, and the James-Stein estimators are (sometimes highly) statistically significant over the 1966–95 and 1966–81 sub-periods.

David Edelman (University of Woologong): Quantifying the financial value of information. A general formula for the quantification of marginal financial advantage attainable from a particular financial opportunity given superior knowledge or information of a probabilistic nature is given. This work generalises results of Kelly and Breiman for certain simple types of gambling games, such as those with multinomial outcome, and includes a more satisfactory answer to the analogous question later posed by Thorp and others in relation to share price returns.

Yuming Li (California State University at Fullerton), Leonard C. MacLean (Dalhousie University), and William T. Ziemba (University of British Columbia): Security and wealth aspects of optimal capital growth models with minimum expected time criteria. This paper investigates the dynamic growth versus security tradeoff problem using a continuous time model with one risk-free and n risky, lognormally distributed assets. The model is consistent with expected utility. An exact investment strategy is developed which minimizes the expected time to reach an investor's target level of wealth subject to a given probability of reaching the goal, before ruin or falling to some undesired level of wealth. When the opportunity set is constant, the strategy, which is mean-variance efficient, is to invest fractions in the safe asset and the growth optimal expected log maximizing portfolio. The optimal strategy involves multiple mutual funds when the opportunity set is stochastic. Comparative statistics are developed and are similar in both cases. For example, the proportion of wealth allocated to the growth-optimal portfolio is an increasing function of initial wealth and the expected time to reach the investor's goal is a strictly decreasing function of current wealth.

Session 2A. Application: Engineering II

Roger J-B Wets (UC Davis), Armen der Kiureghian (UC Davis), and Elijah Polak (UC Berkeley): Design of structures that are subject to seismic shocks. We consider a class of optimization problems with reliability costs and/or constraints that arise in the design of structures that are subject to shocks. These problems come under the general heading of stochastic programs with chance-constraints. On the theoretical side, an analysis of the continuity properties of the chance-constraint reveals that its locally Lipschitz continuous. On the numerical side, the evaluation of the chance-constraint remains the major obstacle in the design of a solution method. The goal will be to obtain an approximate solution. The approach that was followed involves solving parametrized deterministic semi-infinite optimization problems. Numerical results will be presented.

Kurt Marti and Gerald Stoeckl (Federal Armed Forces University): Optimal design of trusses by stochastic linear programming with recourse. To get robust designs with respect to stochastic variations of the model parameters, the basic truss optimization problem under stochastic uncertainty must be replaced by an appropriate deterministic substitute problem. Starting from the linear yield/strength conditions and the equilibrium equation, the problem can be formulated as a stochastic linear program "with complete fixed recourse", where the cost factors for evaluating the violations of the yield/strength constraints are selected by using the displacements of the elements of the truss or by considering certain strength or volume "reserves" of the elements. The numerical solution of the resulting deterministic substitute problems is discussed, and some numerical examples are given

Shanling Li, Richard Loulou and Atiqur Rahman (McGill University): Technological progress and technology acquisition: a stochastic programming approach. A non-linear stochastic programming model is developed and solved to aid manufacturing firms make technology acquisition decisions facing rapid technological developments. Manufacturing firms in high-tech sectors like computers and telecommunications often find their markets eroded by the emergence of new technologies. Increasingly shorter life cycles of technologies make the choice of technology crucial to the success of a firm. The model maximizes a manufacturing firm's profit given uncertain technological developments. The difficulty in the current model stems from two factors: a large number of scenarios representing different technological development paths, and the economy of scale in acquisition. To solve the large-scale non-linear optimization problem, an efficient decomposition technique is employed to decompose the problem based on scenarios. An algorithm is then used to efficiently solve the non-linear subproblems. Numerical results are presented to evaluate the overall efficiency of the procedure.

Shogo Shoide (Kobe-Gakuin University): A stochastic location problem of a break point on a linear barrier. There are n demand points and a linear barrier on a plane. The linear barrier divides the plane into two areas. We consider a problem to locate a break point on the linear barrier in order to be convenient for the traffic between two areas. We assume the weights of demand points

are random variables. Then we consider a chance constraint and find the solution procedure to solve our problem.

Session 2B. Modeling Languages and Computer Systems II

Peter Kall (University of Zurich), Janos Mayer (University of Zurich) and Suvrajeet Sen (University of Arizona): A scenario generation algorithm for multistage stochastic LPs. We consider multistage stochastic linear programs (MSLP) in which the right hand side depends on continuous random variables. Such problems often arise in production-inventory systems in which demands and capacities may be governed by stochastic processes. We devise an algorithm in which the original random variables are successively discretized, and a succession of discretized (or aggregated) MSLPs are solved. We will present convergence results for the method and discuss our computational results. This new algorithm is available within the SLP-IOR system which also allows the capability of managing data associated with a multistage model.

Chanaka Edirisinghe and G.M. You (University of Tennessee) Implementation of bound-based solution methods for two-stage asset allocation. We discuss an implementation of bound-based approximations for two-stage asset allocation models. Basic methodology for bounding, as well as refinement schemes will presented. Computational issues and many advanced features in the implementation will also be discussed.

Tamas Szantai (Technical University of Budapest): Improved bounds and simulation procedures on the value of some multivariate probability distribution functions. For the approximation of the multivariate probability distribution function values a simulation procedure using the best Boole-Bonferroni bounds was developed earlier by the author. Since then many new bounds have been published by Hunter, Worsley, Tomescu, Prekopa, Vizvari, Regos, Bukszar and others. These new techniques are applied to obtain sharper bounds on the multivariate probability distribution function values. These sharper bounds have immediate benefit when they are used in the stochastic programming codes. They provide further variance reduction in the simulation procedure

Janos Mayer and Peter Kall (University of Zurich): SLP - IOR: a modeling system for SLP. SLP-IOR is a model management system for stochastic linear programming (SLP). The system has been developed at the Institute for Operations Research of the University of Zurich. The idea is to provide support for the modeling cycle including model formulation, solution and analysis. The present version of the system is for chance constrained and recourse models, the latter also including the multistage case in an experimental stage of development. In the lecture we concentrate on the following issues: model formulation, available facilities and system structure from the software point of view. Martin H van der Vlerk, University of Groningen, Experiences with SLP-IOR This presentation consists of two parts. First, we discuss the implementation of two algorithms for simple integer recourse models in the model management system SLP-IOR (Kall and Mayer). Next, based on our experience over the last six years, we consider the use of SLP-IOR as a teaching tool.

Session 2C. Algorithms

Gongyun Zhao (National University of Singapore): A log-barrier decomposition method for solving stochastic programs. An algorithm incorporating the logarithmic barrier into the decomposition technique is proposed for solving stochastic programs. Basic properties concerning the existence and uniqueness of the solution and the underlying path are studied. When applying to the problems with a finite number of scenarios, the proposed algorithm is shown to converge globally at the linear rate and to run in polynomial-time.

K. A. Ariyawansa (Washington State University) Polynomial cutting plane algorithms for stochastic programming. Recently, the author and one of his graduate students have presented three classes of polynomial cutting plane algorithms for stochastic linear programming problems. The algorithms are based on ellipsoids, volumetric centers and analytic centers respectively, and are interior point analogs of the L-shaped algorithm of Van Slyke and Wets. We are currently engaged in a project to extend these algorithms to certain nonlinear cases and report on our progress.

Leon Lasdon (University of Texas at Austin): Solving nonconvex financial models. We briefly describe some important classes of financial models which lead to nonconvex nonlinear programs. These include multiperiod multiscenario asset allocation with fixed mix constraints. We then discuss solution procedures for these problems, in both single-solve and parametric settings. These include local optimization using widely available modeling software like the Excel Solver, GAMS and AMPL, and Fortan or C solvers like GRG2. Then we describe some approaches which attempt to find a global solution using metaheuristics. These include the Tabu search methods of Mulvey and Glover for the fixed mix problem. Finally, we consider an approach using Glover's "Scatter Search" heuristic, coupled with an efficient local solver.

Alan J. King (IBM Research) and Stephen E. Wright (Miami U, Ohio): The flexible partition L-shaped method. Effective decomposition of multistage stochastic programs requires careful attention to the grain size of the subproblems. A flexible partition, nested L-shaped method gives the user control over this grain size, leading to excellent speedup statistics. The authors' implementation of this method in OSL also includes several other refinements to the traditional L-shaped method

Session 2D. Financial Models II

Robert R. Grauer (Simon Fraser University) and Frederick C. Shen (Manulife Financial): On estimation risk and discrete-time dynamic portfolio theory: the evidence from asset allocation. Previous studies show that discrete-time dynamic portfolio theory, combined with the empirical probability assessment approach to estimating the joint return distribution, frequently generates economically and statistically significant abnormal returns. In this paper, we examine eight additional ways of estimating the joint return distribution in industry rotation and global asset-allocation settings. The results show that the empirical probability assessment approach holds its own against the eight other methods. However, the rankings of the estimation methods differ (sometimes dramatically) across data sets, time periods, evaluation methods, and investor risk aversion.

Karel Janacek (Charles University): Maximum growth strategies in gambling and investing. For a class of utility functions and a given investment opportunity I calculate the optimal betting strategy. The optimal strategy is a certain vector of betting fractions f* of one's current capital level. Analysis of overbetting is provided. In the discrete case, for some investment opportunities, overbetting is impossible. A relation between Kelly-optimal f* and overbetting borderline fc betting fraction is discussed. An application of the one-dimensional optimal betting problem with constraints on player's bets is the casino game of blackjack. An analysis for the continuous case portfolio investment problem is also discussed.

Elena Medova (University of Cambridge): VAR methodology and the limitation of catastrophic or unquantifiable risk. Value-at-Risk (VAR) methodology became a financial industry standard due to the simplicity of its concept. Practical implementation is much more complex and requires well-formulated model assumptions about market variables. These only constitute a fraction of overall risk, with operating risks considered most common and intractable. We adapt the engineering concept of 'acceptance policy' which allows one to make a probabilistic statement about value at risk due to catastrophic events. Such probability estimates must be chosen by the risk manager and constitute additional 'chance-constraint' to any overall optimization problem. Large deviation techniques are applied for analysing the "rare" occurrence of undesirable events.

Nieves H. Pedron (University of Cambridge): Performance of alternative asset allocation models on recent US market history. This paper describes the results of a study comparing the performance of alternative asset allocation models fitted to recent US financial market data. The basic Markowitz, fixed-mix, optimal control and dynamic stochastic programming models and solution techniques are introduced and numerical results displayed. Experiments to validate the relative performance of the models and their biases will be discussed.

Petter E. de Lange (Norwegian University of Science and Technology): The impact of derivatives on the portfolio choices of insurance. In this paper, we use a dynamic stochastic multiperiod asset liability management model, to investigate the role of derivative hedging in the financial portfolio of a casualty insurer. The model is set up in discrete time on a discrete probability space. We compare solutions in which derivative hedging is permitted, to solutions where this possibility is absent. Special attention is paid to avoid arbitrage scenarios. Norwegian insurance companies are not permitted to employ derivatives in their portfolios.

Session 4A. Applications: Engineering III

Asgeir Tomasgard (Norwegian University of Science & Technology), Stein W Wallace (Norwegian University of Science & Technology), L. Stougie (University of Groningen), Martin H. van der Vlerk (University of Groningen), and Shane Dye (Univeristy of Canterbury): Heuristics for a stochastic service provision problem in telecommunications. We present heuristics for a problem that comes from service provision in a distributed telecommunications network. The problem can be modeled as a two-stage stochastic integer program with binary first stage and continuous second stage. Some worst case results are presented. Also we discuss existence of polynomial approximation methods and give some complexity results.

Asgeir Tomasgard (Norwegian University of Science & Technology) and Stein W. Wallace (Norwegian University of Science & Technology), L. Stougie (University of Groningen), Martin H. van der Vlerk (University of Groningen), and Shane Dye: Solving a stochastic service provision problem in telecommunications using branch and bound and relaxations. The

service provision problem can be modeled as a two-stage stochastic integer program with binary first stage and continuous second stage. When services are to be installed on several computers the deterministic problem is strongly NP- complete. We try to solve the stochastic problem, possibly with a duality gap, using branch and bound and relaxations. The strength of different relaxations and specialized algorithms to solve subproblems are discussed.

Elena Medova and James Scott (University of Cambridge): Mathematical programming solvers and visualisation tools for network dimensioning. In our work on a prototype network planning system for British Telecom we realised that a significant amount of the overall modelling effort entails a comparison of different problem formulations. In addition, data preparation and reports on the solutions require considerable time and special skills. We consider a set of linear programming models for the dimensioning of proposed B-ISDN network topologies, which have been extended to account for the stochastic nature of multimedia traffic, and integer constraints imposed by the types of network resources available. A variety of modelling languages and solvers have been compared, both from the point of view of their technical performance, and their potential for integration within a wider decision-making framework. We adopted an 'open-system' philosophy for the presentation of modelling data and results, and are building a collection of components which the network planner may be used in a Java or Microsoft application environment.

V. S. Kirilyuk (Glushkov Institute of Cybernetics): On minimizing the demand for parallel-series systems with two failure modes. What parallel-series system configuration composed of at most n components, minimizes the mean system damage, if components are capable of failing in both "operating" and "shorted" failure modes, assuming failures are statistically independent and identically distributed? The expected damage function is nonconvex and discontinuous, and the number of possible system configurations is large if n is large. This paper deals with studying specific properties of the problem and the proposed algorithm to find the solution for any n.

Session 4B. Sampling Algorithms I

Greg Godfrey, Warren G. Powell and Joel Shapiro (Princeton University): Approximation methods for multistage dynamic programs for discrete dynamic resource transformation problems. Dynamic resource transformation problems arise in a variety of problems in operations research that involve the evolution of complex systems. We are particularly interested in large, complex problems that arise in fleet management, stochastic machine scheduling, dynamic vehicle routing and multi-item inventory management. Deterministic instances of these problems are often intractably hard due to their size and presence of integer variables. We review this problem class and offer a new representational paradigm that summarizes the elements and properties of these systems in a compact way. These systems can often be formulated as multistage stochastic, dynamic programs with a large state space. We describe special types of dynamic programming approximations that provide optimal solutions for certain two-stage applications, and appear to give exceptionally high quality solutions when applied in an approximate way to multistage problems. These methods also give integer solutions.

Greg Godfrey, Warren G. Powell and Joel Shapiro (Princeton University): Approximation methods for multistage dynamic programs for discrete dynamic resource transformation problems. This paper discuses a genetic algorithm approach to stochastic programming. The fitness functions are regarded as fluctuations that may occur under stochastic circumstances specified by the distribution functions of variables appearing there. We apply this method to the stochastic optimal assignment problem, the stochastic knapsack problem and stochastic image compression problems, to maximize the expected value of the objective function. We confirm that the most individual all of the generations gives the best solution.

Alexander Shapiro (Georgia Institute of Technology) Simulation based optimization - theory and algorithms. Consider the minimization of an expected value function over a feasible region. Suppose that the expected value function cannot be calculated explicitly and is estimated, by a Monte Carlo simulation. The original optimization problem can then be solved using estimates of the expected value function. There are two approaches to such an optimization, namely the stochastic approximation (SA) method and the stochastic counterpart (SC) (sample path) optimization. In the SC method a large sample is generated and the sample-average function is minimized using nonlinear programming. In this talk I mainly discuss the SC approach focusing on statistical inference and argue that it can be incorporated into numerical algorithms. This allows estimation of the stochastic error which leads to an iterative update of the sample size, efficient stopping rules and variance reduction techniques. Examples in manufacturing applications are discussed.

G. Pritchard and Golbon Zakeri (Argonne National Labs): Sorting sampled right hand sides for stochastic programs. We present a construction which gives deterministic upper bounds for stochastic programs with Gaussian right hand sides. Computation of these bounds requires the solution of only as many LPs as the program has variables.

Session 4C.
Bond and Interest Rate Modeling

Enrico Moretto (University of Verona): A stochastic programming approach to duration analysis: an application to the Italian market. The paper aims to find a new way in dealing with bond portfolios. Using discrete time models for term structure one can generate scenarios in order to forecast the future behaviour of interest rates. From the given structures it is possible to find out which is the optimal bonds portfolio with a given duration and convexity. This approach can be seen as a discrete counterpart of continuous time models already used. Results from the Italian market are given.

Karl Frauendorfer and Michael Schuerle (University of St Gallen): Interest rate models in stochastic optimization. Stochastic optimization models of asset & liability management require interest rate scenarios. Term structure models with features including mean reversion can be exploited. Using a barycentric approximation discretization technique, upper and lower bounds for the multistage problem with continuously distributed risk factors are obtained. We consider one-factor models of Cox/Ingersoll/Ross and Vasicek and extensions with additional state variables. An empirical analysis for the Swiss market showed that a Vasicek-type model with two normally distributed risk factors best describes the dynamics of interest rates. This was implemented in a stochastic optimization model for the management of savings accounts by a major Swiss bank. A case study using seven years' data indicates that a substantial increase in the bank's margin can be achieved compared to the former interest rate model with three factors reflecting shift, tilt, and humped movements but without mean reversion. The reduced dimension of the distribution allows extension of the horizon or the number of scenarios to obtain higher accuracy.

K. O. Kortanek (University of Iowa) and V. G. Medvedev (Byelorussian State University): Models for estimating the structure of interest rates from observations of yield curves. We present a dynamical systems approach for modelling the term structure of interest rates based on a linear differential equation under uncertainty. Impulse or point-impulse perturbations are introduced on either the spot (shortest-term, risk neutral) interest rate, or its integral, the yield function, or both simultaneously. Parameters are estimated minimizing the maximum absolute value of the measurement errors, which is a nonlinear semi–infinite programming problem. Beyond the learning period, the solved-for spot rate function becomes the forecast of the unobservable function while its integral approximates the yield function. A sufficient condition to guarantee non-arbitrage is developed. Mean-reversion is preserved and functional estimates are provided for the market price of risk. Analogous concepts to "drift" and "volatility" provide a criterion for the choice of perturbation. We test the approach using daily Treasury yield curve rates for discount bonds with 3 to 6 month maturities over periods of up to one year. Computational results are reported on. www.biz.uiowa.edu/kwel/kwel. To computationally explore the methodology for the full 30-year yield surface requires supercomputing resources, which we have recently obtained.

Hercules Vladimirou (University of Cyprus): Nested simulations for pricing floating-rate Brady bonds. The valuation of floating-rate securities is complicated by the fact that their cashflows are path-dependent. This study illustrates the use of a nested simulation framework on the state-space of lattice models for interest rate paths to price floating-rate Brady bonds. The nested simulation framework enables the computation of other measures that are necessary inputs in optimization models for managing portfolios of such securities (e.g., risk spreads/premia, duration, convexity, scenario-contingent holding period returns). The computations have a naturally parallel structure and can be executed efficiently on multiprocessor computers.

Session 4D.
Financial Models III

Emmanuel Fragniere, Jacek Gondzio and Jean-Philippe Vial (Université de Lausanne (HEC) BFSH1): A financial planning model with one million scenarios solved on an affordable virtual parallel machine. Stochastic programs need to be huge in order to model real life problems accurately. Nowadays only massive parallel machines can solve them but at a cost very few decision-makers can afford. We report here on a deterministic equivalent LP of 1,111,112 constraints and 2,555,555 variables generated by GAMS. It was solved by an interior point based decomposition method in less than 3 hours on a cluster of 10 Linux PC's.

Cees Dert (ABN-AMRO and Free University Amsterdam) and Roy Kouwenberg (Erasmus University) Bart Oldenkamp (Erasmus University), and Shuzhong Zhang (Erasmus University): A stochastic programming approach to guaranteed return portfolio modeling. We study portfolio optimization problems for investors who attempt to maximize expected return given worst case return and/or chance constraints. Our approach explicitly uses exchange-listed index options with different strikes and maturities and allows for several trading moments. The model is formulated as a multi-stage stochastic programming problem and is solved efficiently using a primal-dual interior point method. We discuss how arbitrage-free scenarios are generated and present computational results.

Alan J. King (IBM Research): Duality and Martingales in contingent claims analysis. The pricing of contingent claims in the discrete time, discrete state case is analyzed from the perspective of stochastic programming duality. Arbitrage and the existence of Martingales on security price filtrations are shown to be dual concepts. Evaluation of contingent claims is analyzed in the same framework.

Yves Smeers (CORE/UCL): Strategic investments and stochastic multistage equilibrium problems. In this paper we try to bring together the theories of strategic investments and stochastic programming. We first survey some economic models of strategic investments. In these models the operation of the equipment in the second stage is formulated as a game. The outcome of this game depends on external uncertain events and on the capacities invested in the first stage. The first stage decision to invest is also a game. Examples of these problems are presented from the field of electricity restructuring. The last part of the talk discusses the possible application to these problems of computational techniques taken from stochastic programming and from equilibrium constrained optimization.

Session 6A. Applications: Power and Water I

Emmanuel Fragniere (Université de Lausanne (HEC) BFSH1): Uncertainty management of urban energy systems. The aim of this study was to provide the decision makers with a tool for technology assessment (based on stochastic programming techniques) to direct long-term management of the energy system in Geneva. We report on a development that took place over a period of six years, encompassed three important consulting contracts for the Geneva government during the period 1994-1997, and culminated in direct involvement in the preparation of the energy plan submitted to the Parliament.

Benedikt Krasenbrink, Samer Takriti and L. S-Y. Wu (IBM Watson Research Center): Incorporating fuel constraints and electricity prices into the stochastic unit commitment problem. With deregulation of the electric power, the load on the generating units of a utility is becoming increasingly unpredictable. Furthermore, electric utilities may need to buy power or sell their production to a power pool which serves as a spot market for electricity. These trading activities expose utilities to volatile electricity prices. We present a stochastic model for the unit commitment that incorporates power trading and fuel constraints and prices, which may vary with electricity prices and demand. This model is a mixed-integer program, which is solved using Lagrangian relaxation and Bender's decomposition. We solve problems with 729 demand scenarios on a single processor to within 0.1solution in less than 10 minutes. Numerical results indicate that significant savings can be achieved when the spot market is entered into the problem and when a stochastic policy is adopted instead of a deterministic one

Alejandro Jofre (Universidad de Chile) and Francisco Ortega (Université Catholique de Louvain): Power generation planning model with investments and parallel stochastic optimization. In the next 10 years, Chilean demand for electricity is expected to increase by 8installation of new generation plants to satisfy this increasing demand. This problem can be modeled as a non-linear stochastic programming problem that includes energy losses in the transmission lines, technical constraints in the generation and integer variables to represent investment decisions. There are no efficient algorithms to solve the complete problem; consequently simplifications must be made to obtain desirable solutions in reasonable time. Still the dimensions of the problem are very large and parallel algorithms might be more suitable to solve them. We present two versions of the extended Bender's Decomposition method, the first one based on a Distributed Memory Model (DMM) and the second based on a Shared Memory Scheme (SMM). Numerical experiences for both models using parallel DMM and SMM computers are discussed.

Matthias P. Nowak (Humboldt University of Berlin): Stochastic lagrangian relaxations for the optimization of a hydro-thermal power system. We present a model for the power generation planning of a system comprising thermal units and pumped hydro storage plants. Due to the operation cycle of the hydro storage plants we consider a planning horizon of at least one week. Therefore the uncertainty of the load has to be included. The optimization model is a multistage stochastic program containing mixed-integer (stochastic) decisions, which reflect the on/off schedules and production levels of the generating units. It is decomposed by relaxing the load and reserve constraints. The resulting stochastic subproblems are efficiently solved by a network flow algorithm for the hydro storage subproblems and by stochastic dynamic programming for the commitment problem. The dual problem is solved by a nonsmooth optimization method. Numerical results are reported.

Session 6B.
Sampling algorithms II

Davaadorjin Monhor (University of Sopron): Bounds for multivariate probability distribution functions. Bounds for expectations and probabilities have found wide range of applications in stochastic programming and related areas. Well-known examples are Edmundson-Madansky type inequalities, Chebyshev type inequalities and Boole-Bonferroni inequalities. Bounds for certain probabilities play significant role in probabilistic constrained programming, reliability problems and stochastic PERT. The present paper considers several bounds and approximations for some multi-variate probability distribution functions. We present numerical results on these bounds and approximations. We also discuss application possibilities and illustrative examples.

David Morton and Kevin Wood (University of Texas at Austin): Optimistic Monte Carlo bounds for stochastic programming. Solving a stochastic program under an empirical probability measure yields an optimistic estimate of the original program's solution value. Higle and Sen have developed an optimistic duality-based Monte Carlo bound that may be constructed via a Lagrangian relaxation of the non-anticipativity constraints. We combine ideas from the Lagrangian-relaxation bound and the empirical-measure bound to create a hybrid bound in an attempt to exploit the advantages of both approaches.

Istvan Deak (Technical University of Budapest): Subroutines for computing normal probabilities of sets — computer experiences. A subroutine package, called NORSET, has been prepared, that can be used for evaluating via Monte Carlo integration several types of probabilities related to the n dimensional normal distribution. The following probabilities can be computed: the distribution function value, the probabilities of rectangles, convex polyhedral, hyperellipsoids and circular cones in case of normal distribution. Three digit accurate probabilities can be computed in less than 0.3 sec up to 20 dimensions and in less than 10secs up to 100 dimensions. The description of the subroutines, results of the computer testing and experiments, together with the conclusions are presented here.

Christian Condeveaux-Lanloy, Emmanuel Fragniere, and Jacek Gondzio (Université de Lausanne (HEC) BFSH1): Using SET to bridge the gap between AML's and S-MPS based codes. SET (Structure Exploiting Tool) is a concept for linking Algebraic Modeling Languages (AML's) with Structure Exploiting Solvers. It is used here to produce a dynamically ordered core model (baseline scenario) from GAMS that is sent automatically to SP/OSL (a specialized code based on the S-MPS format). Definition of stochastic parameters is then left to SP/OSL. This approach could complement recent attempts to include the possibility of writing multistage stochastic programs directly in AML's

Session 6C.
Economic and Financial Models

Alexei A. Gaivoronski (Norwegian University of Science and Technology): Combining simulation and optimization for portfolio management. Dynamic portfolio management problems often lead to problems of very high dimension which is difficult to treat even with the most advanced large scale linear programming techniques. Moreover, many realistic problem settings include nonlinearities, which further increase dimension of linearized problem. We argue that in this case intelligent combination of simulation and stochastic nonlinear optimization may bring about some reasonable results.

Eckhard Platen (University of Technology, Sydney): Consistent financial market modelling. This paper presents recent work on financial market modelling in the framework of continuous time vector diffusion processes. On the basis of a number of modelling principles it turns out to be possible to derive a market model with a number of features that explain many of the actually observed empirical facts. As an example a dynamics for stochastic volatility is obtained that yields for instance for stock market indices Student t distributed log returns that are actually observed in almost all markets. Similarly a non-linear model for the short term interest rate arises that shows close resemblance to what empirical studies on interest rates reveal. Since all these quantities result from a few modelling principles and fulfill certain optimality properties several theoretically and practically important properties of the asset dynamics can be deduced. These have significant consequences for asset and liability management.

Gregory C. Chow (Princeton University): Pricing contingent claims by the Lagrange method. The problem of investing y(0) dollars at time 0 to duplicate a contingent claim is formulated as a dynamic optimization problem and solved by the Lagrange method. As an example the well-known formula of Black-Scholes on option pricing is derived. If the function defining dy(t) is concave in y(t), due to costs of trading in complete markets, there is economy of scale in producing many claims simultaneously, thus explaining the profitability of institutions in providing such financial services.

B. Curtis Eaves, Donald J. Brown and Peter M. DeMarzo (Stanford University): The general equilibrium model of economics with incomplete assets. The paper considers simulation models for two applications: (1) Dynamic Population Model, and (2) Model for Evaluating of Cancer Risk. The performance functions for these applications are formulated using probability functions, which can be calculated only numerically. The approach is based on new analytical differentiation formulas for integral and probability functions. A key element of the approach is presentation of performance functions and their derivatives in a similar integral form that allows parallel calculations of partial derivatives with respect to control variables. An efficient sensitivity procedure calculates performance function and sensitivities during the same simulation/calculation run, resulting in savings in time and effort. Such procedure can be used with stochastic and nonlinear optimization methods, which need efficient and fast subroutines for calculating gradients. In the talk we present experimental results for the two applications.

Session 6D. Financial Models IV

Adam J. Berger (Lattice Financial LLC) and John Mulvey (Princeton University): A portfolio management system for catastrophe property liabilities. As catastrophe modeling systems become more sophisticated, the property insurance portfolio manager can receive better account loss information. This paper describes a software system called SmartWriter, which uses these data to address the following issues: How to determine appropriate pricing. Where to grow or shrink business geographically to achieve maximum diversification benefits. Which accounts to remove from a portfolio to maximize risk-adjusted return, What to do if many parts of the organization are taking on catastrophe risk in one area, including transfer pricing of risk. We utilize several optimization techniques. The problem is modeled as a large mathematical program with numerous loss scenarios (10,000 or more). We then describe an algorithm to solve the resulting stochastic optimization problem to maximize risk-adjusted return, expected utility or other user-defined performance measures. The SmartWriter system has been implemented as a PC-based Windows application and is used by a large U.S. property and casualty insurance company.

Jerome Kreuser (World Bank): Asset and liability management models.

David Heath (Carnegie Mellon University): Some new term structure models. The two common modelling approaches for the evolution of interest rates are the spot rate approach, in which the evolution of the short term interest rate is modelled under the equivalent Martingale measure, and the HJM approach, in which the evolution of the entire forward curve is modelled. Each of these methods has deficiencies. It is difficult to understand the implications of different model forms for the spot rate evolution, and multifactor spot rate models are usually written in terms of unobserved components. HJM models, on the other hand, typically lead to very difficult problems in computing security values. We present a new class of models which seems to have a different (and more attractive) set of advantages and disadvantages. In particular, multifactor models can be fit from historical data, and pde methods can be used for valuation.

Karl Frauendorfer (University of St Gallen): Test problems in stochastic multistage programming. We report on experiences with a series of real life problems that are modelled as linear stochastic multistage programs. Investigations of refinement techniques, EVPI, computational effort, and of the impact of the planning horizon will reveal open issues for the applicability of these programs in practice.

Session 7A. Applications: Power and Water II

Javier Salmeron (Mathematical Sciences School), Laureano F. Escudero (Iberdrola Ingenieria y Consultoria), and Margarita Sanchez (Statistical School): A robust approach for long-term hydro-thermal electric coordination planning under uncertainty. We present a modeling framework for a robust optimization of a multi-period hydro-thermal power management and energy trading under uncertainty in generators availability, fuel procurement, transport and stock costs, exogenous water inflow into river basins at each period and energy demand per subperiod of a given planning horizon. A deterministic treatment of the problem provides unsatisfactory results for a medium term (1-2 years) planning horizon. We use a 2-stage scenario analysis based on a partial recourse approach, where the generation decision policy can be implemented for a given set of initial periods and the solution for the other periods does not need to be anticipated. We present computational results on real-life electric generation systems that have been obtained while using an Augmented Lagrangean Decomposition scheme by dualizing the coupling constraints splitting control variables (fuel stock and stored water) for the last implementable period.

Patrizia Beraldi, Marino Sforna, and Chefi Triki (University of Calabria — DEIS): Real-time strategies for the electrical power pricing. The optimal pricing of electric power has crucial importance in a deregulated power market. In such problem, there is growing recognition that both planning and operations are characterized by substantial uncertainty. In this talk we propose a robust two-stage stochastic model based on the spot pricing theory as an efficient alternative to the usual peak load (time-of-use) pricing theory. Solution robustness is imposed by restricting the variability of first and second-stage decisions.

A. Philpott (University of Auckland) and E. J. Anderson (University of New South Wales): Optimal hydro-electric generation in an electricity market. We consider a hydro-electric generation facility acting as a price-taking agent in a wholesale electricity market. Ex-post nodal prices are determined in each half hour from market demand and the supply curves submitted by each generator. Given a demand and nodal price distribution, the facility must determine a supply curve and a water release plan to maximize their expected return.

Stein-Erik Fleten (National Scientific and Technical University): Risk averse power scheduling with forward contracts. Electricity producers participating in the Nordic wholesale-level market face significant uncertainty in inflow to reservoirs and prices on the spot and contract markets. Taking the view of a single risk averse producer, we propose a stochastic linear programming model for the coordination of physical generation resources with hedging through the forward market. Numerical results are shown from a model with a two year horizon, and with the first period being one week.

Session 7B.
Scenario Modeling and Generation

Stein W. Wallace (Norwegian University of Science & Technology): Constructing scenario trees. A major challenge in the use of stochastic programming is to ensure that the models represent the underlying problem especially with respect to the stochasticity. Does a scenario tree have the required statistical properties for a given problem, and how do we generate/construct a scenario tree with given properties? The goal is not to match the underlying (continuous) distributions, but to find which aspects are important, and match them. For a portfolio mean-variance model, we must match only the first two moments. For most models it cannot be determined a priori, which are the important properties. We focus on two issues: (1) how to generate a scenario tree that matches certain given properties of the underlying continuous distribution and (2) to find of way of deciding if we have matched what we should have matched. Numerical results are given for a portfolio management model developed for a Norwegian life insurance company.

Werner Romisch (Humboldt University of Berlin): Quantitative stability in stochastic programming. A class of stochastic programming problems is considered which contains multi-stage and chance constrained models. Quantitative stability refers to continuity properties of minima and (approximate) minimizers when the underlying probability distribution is subjected to perturbations in terms of probability (semi)metrics. A canonical distance of probability measures is associated with a given stochastic program leading to natural quantitative stability results. These results remain valid if the canonical distance is replaced by stronger distances that are more convenient for applications (representations, convergence rates). We show that the general methodology applies to (mixed-integer) two-stage, multi-stage and chance constrained models. Finally, we outline conclusions for empirical approximations. (The talk is based on joint work with S. T. Rachev and R. J.-B. Wets.)

Giorgio Consigli (Credito Italiano), Michael A. H. Dempster (University of Cambridge), Nieves H. Pedron (University of Cambridge), and Zhiping Chen (University of Cambridge): Scenario generation for multistage stochastic programming portfolio models in sequential sampling algorithms. A sequential sampling procedure for solution of large scale strategic financial portfolio problems relies on the definition of a complex scenario generation procedure in which the random behaviour of the considered financial variables is taken into account and correctly represented. Based on the distinction between a random vector data process and a scenario coefficient process, we describe a conditional scenario generator, which is interfaced with a recursive model generator and the EVPI - importance sampling algorithm

Jitka Dupacova (Charles University): Scenarios for multistage stochastic programs. This paper discusses the input needed for multistage stochastic programs when enough data paths can be generated according to a parametric or nonparametric stochastic model. No assumptions on convexity with respect to random parameters are required. In multistage stochastic programming applications, an adequate representation of the underlying random data process and the required form of the input (scenario tree) is a crucial problem; there often are compromises between manageable problem size and the desired precision of the results. I discuss these questions for models that do not assume convexity with respect to random parameters and for the cases when enough data paths can be generated from a parametric or nonparametric stochastic model. The notion of representative scenarios or scenario tree depends on the application.

Session 7C.
Chance Constrained Programming

Riho Lepp (Institute of Cybernetics, Estonia): Approximation of decision rules in probabilistic programming. Probabilistic programming includes two types of cost and/or constraint functions, probability, $v_t(x)$ and quantile one, $w_\alpha(x)$, where $v_t(x) = P\{s \mid f(x,s) \leq t\}$ and $w_\alpha(x) = \min_t\{t \mid P\{s \mid f(x,s) \leq t\} \geq \alpha\}$. Both functions are never convex, only in very special cases $v_t(x)$ is quasiconcave and $w_\alpha(x)$ quasiconvex. Even more, integrand that defines both functions, is a discontinuous zero–one function. A special class of probabilistic problems constitute stochastic programs with decision rules, where solution x of problems $max_x v_t(x)$, $min_x w_\alpha(x)$ itself depends on the value of a random parameter s, $x = x(s)$. We will approximate integrable decision rules by a sequence of vectors $\{x_n\}$ with increasing dimension, starting from weak convergence of discrete measures.

Nicole Growe-Kuska (Humboldt University): Asymptotic expansions of optimal values in simple recourse models. We consider two-stage stochastic programs with simple recourse and random right hand side. The distribution function of the random variables entering the expected recourse function is estimated by smoothed empirical distributions (kernel estimates). We study the estimated expected recourse function as a random variable in a certain functional space. A Functional Central Limit Theorem for kernel estimates of distribution functions yields the asymptotic distribution of the estimated expected recourse function. Using explicit formulas for directional derivatives of the optimal value function we derive a second order expansion of the estimated optimal value function. We demonstrate the potential of our approach in the context of a power generation planning model.

Stanislav Uryasev (University of Florida): Simultaneous calculation of sensitivities for probabilistic performance functions: applications in risk analysis. The paper considers simulation models for two applications: (1) Dynamic Population Model, and (2) Model for Evaluating of Cancer Risk. The performance functions for these applications are formulated using probability functions, which can be calculated only numerically. The approach is based on new analytical differentiation formulas for integral and probability functions. A key element of the approach is presentation of performance functions and their derivatives in a similar integral form that allows parallel calculations of partial derivatives with respect to control variables. An efficient sensitivity procedure calculates performance function and sensitivities during the same simulation/calculation run, resulting in savings in time and effort. Such procedure can be used with stochastic and nonlinear optimization methods, which need efficient and fast subroutines for calculating gradients. In the talk we present experimental results for the two applications.

Andrey Kibzun (Moscow Aviation Institute): On the worst distribution for stochastic programming problems. In many applied problems of stochastic programming, a random vector distribution is unknown. In this case, it is reasonable to assume that the one is the worst distribution, which provides the best guarantee. In practice, the uniform distribution is assumed usually as the worst. In the paper, this hypothesis is justified rigorously under some symmetry conditions.

Session 7D.
Financial Models V

Richard Grinold (Barclays Global Investors): A Markov approach to trading a single asset. We take a Markov programming approach to the problem of trading a single asset in a world where the forecast of exceptional return (a.k.a. alpha) is governed by an Ornstein-Uhlenbeck process. The solution, and its implications for portfolio management in a multiple asset situation are examined.

Bert Menkveld and Ton Vorst (Erasmus University): A pricing model for American options with stochastic interest rates. We develop a method to value American stock options with stochastic interest rates using a binomial tree for the forward risk adjusted measure. For each node we derive an analytic expression for the expected immediate exercise premium conditional on the quotient of the stock price and the price of the zero coupon bond maturing at the date of the option. This is added to the value derived from the backward procedure. Both European and American option prices depend on the correlation between the interest rate process and the stock price process. With increasing correlation between these, the values of European options increase, while the early exercise premium decreases. For American options this might result in a non-monotonic relation between the correlation coefficient and the option price. Evidence indicates the early exercise premium due to stochastic interest rates is much larger than established by other researchers. Finally, we consider the influence of the shape of the initial term structure

Eric Reiner (Union Bank of Switzerland): Convolution methods for exotic options. While most available analytical formulae for path-dependent derivatives assume continuous sampling of the underlying asset price process for the relevant path measure, most traded contracts for such options specify regular, discrete sampling intervals. The numerical methods available for discretely sampled exotics usually involve Monte Carlo simulation of the discretized price process or modification of approaches originally intended for continuous sampling. Convergence properties of these methods are poor in many instances, especially when the option depends on a path extremum. This paper presents examples of a general class of algorithms particularly well adapted to valuation of options depending on only a discrete set of samples of an independent returns process. These algorithms rely on the product rule for the characteristic function of the sum of independent random variables and the computational efficiency of the fast Fourier transform. High-precision valuation results and super-linear convergence properties are demonstrated.

Anthony Neuberger (London Business School) and Stewart Hodges (University of Warwick): Rational bounds on the prices of exotic options. The paper provides a methodology for setting no-arbitrage bounds on the price of exotic options. This also provides a method for obtaining robust hedges. The question posed is given the prices of a set of reference assets (say, a stock and a set of European options on that stock) together with the possibility of entering into further forward positions at future dates, what restrictions can we place on the price of some exotic option, such as a barrier option or a lookback. This work can be viewed as a generalization and extension of Merton's seminal work for conventional options.

Session 8A.
Applications: Power and Water III

Lisa A. Korf (UC Davis): A stochastic programming perspective of stochastic control problems. Traditional approaches to solving stochastic control problems involve dynamic programming techniques, and solving certain optimality equations. When recast as stochastic programming problems, structural aspects such as convexity are regained, and solution procedures based on decomposition and duality may be exploited. This talk explores a class of stationary, infinite-horizon problems with discounted cost in the framework of stochastic programming. An investment/consumption problem from stochastic control is recast in this framework. Approximating techniques relying on convexity, and solution schemes based on operator splitting methods for affine variational inequalities are developed.

David H. Salinger (Columbia Basin Research, University of Washington): A splitting algorithm for multistage stochastic programming with application to hydropower scheduling. We present an algorithm for the nonlinear (convex) multistage stochastic programming problem based on an application of Spingarn's operator splitting method to the associated saddle point problem. Splitting imposes a decomposability into two main subproblems at each iteration. One subproblem exploits the special linear-quadratic case of dynamic programming. The other exploits a separability which can only arise from the saddle point formulation. Performance and results from a 165,000 control-variable hydropower scheduling problem will also be discussed.

Chanaka Edirisinghe, Ike Patterson, and Nasreddine Saadouli (University of Tennessee): Capacity planning model for a multipurpose water reservoir with target-priority operation. We consider the capacity determination problem of a hydro reservoir. The reservoir is to be used primarily for hydropower generation, however, commitments on release targets for irrigation as well as mitigation of downstream flood hazards are also secondary objectives. The goal of this paper is to study the complex and conflicting interplay among various system reliabilities (power, flood, irrigation, etc.) and to provide decision makers a planning tool for further investigation. The main tool is an optimization model that recognizes the randomness in water inflow to the reservoir. The model incorporates a special target-priority policy according to given system reliabilities. Optimized values are then fed in to a simulation model that assesses the system behavior. Simulation not only validates the planning model solution, but it also provides a strong insight to the decision problem.

S. Brignol and A. Renaud (Electricity de France): Optimizing short-term operation of power generation: a new stochastic model. A new model using a stochastic decomposition framework, has been developed at Electricite de France to optimize the weekly start-up schedules and the water values used by the daily operation. Hydro-valleys, thermal units, nuclear plants, exchange contracts and demand side management are represented.. The model is a generalized Lagrangian Relaxation. Uncertainties are modeled as scenario trees. Prices are attached to each node and are updated at the coordination level. At each iteration, for each generation unit, a subproblem is solved which minimizes the average generation cost over a scenario tree of prices. At the coordination level, a bundle method is used to maximize the dual function. The algorithms, which have been applied to solve the subproblems dynamic programming and nonlinear interior point methods, are described and the variants of the bundle method, which have been tested at the coordination level are outlined. Numerical tests over the French generation mix show the efficiency of a new variant of the bundle method: the "disaggregated" bundle method.

Session 8B.
Aggregation and Approximation

Andrzej Ruszczynski (Rutgers University) and Arkadii V. Kryazhimskii (Steklov Institute of Mathematics): Constraint aggregation in infinite-dimensional spaces with applications to optimal control, games and stochastic programming. Optimization problems in vector spaces are convenient models of problems in control theory, game theory and stochastic programming. There are, however, difficulties associated with constraints having values in infinite-dimensional spaces: constraint qualification conditions often conflict with the desire to have an easy representation of Lagrange multipliers. Numerical solution of such problems (or their finite-dimensional approximations), usually poses a challenge, and much effort is devoted to the ways of dealing with infinite-dimensional constraints. Our objective is to show a new possibility to drastically reduce the complexity of such optimization problems: aggregation of constraints to one or finitely many scalar equations or inequalities. Together with the theory we present applications of the new approach. To cover these cases with minimum generality we describe the method in the context of convex optimization in a space that is dual to a separable Banach space. Theoretical and computational advantages of the new approach are discussed.

Stefan Mittnik, Marc Paolella, and Svetlozar T Rachev (University of Kiel): Modeling conditional risk for fat-tailed return processes. We consider the question of persistence of conditional volatility for GARCH processes with stable Paretian innovations. This class of processes is attractive because it allows for conditional skewness and leptokurtosis of financial returns without ruling out normality. We establish conditions for strict stationarity and persistence of stable Paretian GARCH processes. An application to foreign exchange rate data demonstrates that, compared to Student's t GARCH models, stable Paretian models seem to be particularly useful for capturing the tails of the conditional return distribution which are especially relevant for risk assessment.

Silvia Vogel (Technical University Ilmenau): On approximations of stochastic programming problems related to stochastic processes. We will assume that a stochastic process, e.g. a risk process in insurance, is given and one is interested in the distribution of the minimal value over a time horizon, which may depend on an other stochastic process. As, usually, the parameters of the processes under consideration are not completely known, one could, for instance, use simulation studies based on estimates for the unknown parameters to obtain estimates for the unknown distribution. The paper will provide conditions ensuring that these estimates approximate the true distribution in a suitable sense.

Darinka Dentcheva (Rutgers University): Regular Castaing representations of multifunctions with applications to stochastic programming. We consider multifunctions defined on a linear normed space with convex closed images in $\mathbb{R}^n$. It is well-known that the measurability of a multifunction is characterized by the existence of a Castaing representation for it: a countable set of measurable selections that pointwise fill up the values of the multifunction. Our aim is to construct a Castaing representation, which inherits regularity properties of the multifunction like continuity, Lipschitz-continuity, and differentiability. The construction uses Steiner points. A notion of a generalized Steiner point is introduced. A Castaing representation, called regular, is constructed by using generalized Steiner selections. All selections of this representation are measurable, resp. continuous, Lipschitz-continuousor directionally differentiable whenever the multifunction has the corresponding properties. Applications to various questions arising in stochastic programming will be discussed.

Session 8C.
Integer Programming

Shabbir Ahmed and Nikolaos V Sahinidis (University of Illinois at Urbana-Champagn): An asymptotically optimal heuristic for a multi-stage stochastic integer program. We present a multi-stage stochastic integer programming formulation for chemical process capacity expansion and operation. We prove that the deterministic version of the problem is NP-hard and develop an asymptotically optimal heuristic. This heuristic serves as the basis for an asymptotically optimal heuristic for the multi-stage stochastic integer program.

Tito Manlio Homem-de-Mello (Georgia Institute of Technology): Estimation of derivatives of nonsmooth performance measures in regenerative systems. We investigate the problem of estimatingdirectional derivatives of expected steady-state performance measures in parametric systems. For the class of regenerative Markovian systems we show that, under some assumptions, the process of directional derivatives at a fixed point regenerates together with the original process. An example illustrates that the imposed conditions must be more strict than in the differentiable case. Besides yielding an estimation procedure for directional derivatives and subgradients of equilibrium quantities, the result allows to derive necessary and sufficient conditions for nondifferentiability of the expected steady-state function. As a by-product of the analysis we provide a limit theorem for more general compact-convex multivalued processes.

P. S. Knopov (Glushkov Institute of Cybernetics): On the one class of non-stationary stochastic optimization models. Quite common class of non-stationary stochastic optimization problems with criterion function depending on discrete time and random series with dependent components is studied. Many of regression models are partial cases of this scheme. Let $\{\xi_i, i \geq 0\}$ is random series with dependent values, $\xi_i \in \mathbb{R}^m$, $m \geq 1$, J is closed subset in $\mathbb{R}^p$, $p \geq 1$, $\{f(i,x,y) : N \times J \times \mathbb{R}^m \to \mathbb{R}^+ = (0,\infty)\}$ is semicontinuous function. The problem is to minimize the functional $F_n(x) = \frac{1}{n}\sum_{i=1}^n f(i,x,\xi_i)$, $x \in J$. Let $x_n = \arg\min_{x\in J} F_n(x)$ and $A_n = \{x_n\}$. Some statements on asymptotic distribution of elements of the set A_n and convergence of A_n to some set of limit points are proved.

Claus Caroe (University of Copenhagen), Heidy Bachman (Humboldt University Berlin), Regina Urbaniak (KKZ, Berlin), and Robert Weismantel (KKZ, Berlin), and Ruediger Schultz (University of Leipzig): Recent progress in scenario decomposition of stochastic integer programs. A promising algorithmic approach to stochastic integer programming is Lagrangian relaxation of non-anticipativity combined with a branch-and-bound scheme to regain the relaxed property. In the talk we recall basic ideas of the approach, discuss improvements employing test set methods from integer programming and report on first numerical experiments in the multi-stage situation.

Session 8D.
Financial Models VI

Jitka Dupacova (Charles University) and Marida Bertocchi (University of Bergamo): Bond portfolio management in Italy. The considered bond portfolio management problem formulated as a multiperiod stochastic program concerns a big institutional investor whose portfolio consists solely of government bonds. The main stochastic factor is the evolution of interest rates modeled according to the Black-Derman-Toy model. We discuss robustness of the maximal attainable expected wealth and of the optimal initial trading strategy with respect to the input market data and the estimation and sampling procedures used to generate the interest rate scenarios.

Markus Rudolf (University of St Gallen) and William T. Ziemba (University of British Columbia): Intertemporal surplus management. This paper introduces an intertemporal portfolio selection model for pension funds that maximize the intertemporal expected utility of the surplus of assets net of liabilities. Following Merton (1973) it is assumed that both the asset and the liability return follow Ito processes as functions of a state variable. The optimum occurs for investors holding four funds: the market portfolio, the hedge portfolio for the state variable, the hedge portfolio for the liabilities, and the riskless asset. It is shown that pension funds should purchase hedging for liabilities. In contrast to Merton's result in the assets only case, this hedge depends exclusively on the funding ratio of a specific pension fund and not on preferences. With HARA utility the investments in the state variable hedge portfolios are also preference independent. With log utility the market portfolio investment depends only on the current funding ratio.

Roy Kouwenberg and Ton Vorst (Erasmus University): Scenario generation and stochastic programming in ALM. We show results of developing and testing scenario generation methods for stochastic programming models applied to ALM. Multi-stage stochastic programming models are based upon event trees that describe the distribution of asset returns and economic variables. Return distributions are represented efficiently to avoid computational difficulties as the number of nodes of the event tree grows. We consider three methods for constructing event trees: random sampling, adjusted random sampling based on Carino, Myers and Ziemba. (1998), and fitting the first few moments of the distributions. Rolling horizon simulations show that random sampling is inadequate for a 5-year ALM planning model for a Dutch pension fund. An adjustment of the random sampling technique and the tree fitting method both improve the performance of the ALM model. We propose an extension of the tree fitting method to add contingent claims on stocks to the event tree and the stochastic programming model. The event tree fits the prices of the assets, avoids arbitrage opportunities and could be consistent with current term-structure of implied volatilities.

Yuan-An Fan (Frank Russell Company): The Daido asset-liability management model. In this talk, we describe the implementation of an asset/liability management model for Daido Life Insurance Company. The description includes: an overview of the computer model, generation of market scenarios, the asset classes considered, the PC-based parallel implementation, the shortfall measurements, a rule-based simulation of portfolios, and a user interface. Finally, a few observations from running the model will be discussed.

Session 9B.
Risk Management

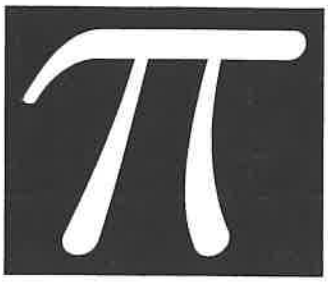
Cees Dert (ABN-AMRO and Free University Amsterdam): A multistage chance constrained programming approach to asset liability management. A multistage chance constrained programming approach to asset liability Management We present a scenario based optimisation model to analyze investment and funding policies for pension funds, taking into account the development of the liabilities in conjunction with economic environment. The model minimizes expected costs of funding, subject to acceptably small probabilities of underfunding and sufficiently stable annual contributions. It determines sequences of decisions that reflect a trade-off between short term effects and longer term effects. The proposed approach has been used to determine a dynamic asset-liability management policy for a pension fund with an actuarial reserve in excess of 8 billion USD and approximately 1,000,000 participants. The computational results corroborate the theoretical notion that this approach enables one to determine superior strategies in terms of costs of funding, risk of insolvency and stability of contributions.

Elio Canestrelli (University of Venice): Analytical and numerical approaches in multidimensional stochastic processes applied to financial investments. This talk presents a general selection model for investments in financial securities whose prices follow an Ito multidimensional stochastic process. The optimal investment shares are obtained by maximizing the expected utility of consumption at one future date, subject to the level of attained wealth. This problem is solved by applying dynamic programming techniques and requires solving a non linear partial differential equation in order to obtain the optimal shares in explicit or approximated form. We formulate this equation for more general processes than in Merton (1973), and then we study possible analytical and numerical methods to reach its solution. Particular attention is given in the approximations of the stochastic processes by Markov chains. In these situations, we show some examples, verify the practical applicability of the model, and discuss upon the methodology of empirical applications.

Arjan Berkelaar (Econometric Institute, Erasmus University): Downside-risk measures and the casino effect and its implications for financial risk-management. Recently, there is renewed interest in using downside-risk measures (e.g. Value-at-Risk) for financial risk-management. However, downside-risk measures may lead to portfolios exhibiting gambling strategies. In this talk we analyze these effects in a multi-period incomplete market and show its prevalence in the resulting optimal portfolios when employing downside-risk measures (extending Dert & Oldenkamps result in a single-period complete market). As an illustration, we apply our results to a Stochastic Programming Asset Liability Model for Pension funds.

Marc C. Steinbach (Konrad-Zuse-Zentrum für Informationstechnik): Recursive direct optimization in financial multistage stochastic programs. The lecture presents a new efficient approach to multistage stochastic programming, based on a special recursive factorization of the full KKT matrix in an interior point iteration. Careful exploitation of the scenario tree structure yields strictly linear runtime and storage complexity for KKT systems solution. Computational results for large multistage portfolio selection and asset and liability management problems will be given.

D. Kramkov and W. Schachermayer (University of Vienna): The asymptotic elasticity of utility functions and optimal investment in incomplete markets. This paper studies the problem of maximizing the expected utility of terminal wealth in the framework of a general incomplete semimartingale model of a financial market. We show that the minimal condition on a utility function for the validity of several key assertions of the theory to hold true is the requirement that the asymptotic elasticity of the utility function is strictly less then one.



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VII International Conference on Stochastic Programming:

Asset and Liability Management Seminar for Institutional Investors

University of British Columbia

Vancouver, British Columbia, Canada

Friday, August 14 to Sunday, August 16, 1998

Other Sponsors

The Fields Institute for Research in Mathematical Sciences
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Organizers

William Ziemba (University of British Columbia)
John Mulvey (Princeton University)

Introduction

This seminar covers many aspects of asset and asset-liability management modeling. The speakers are a blend of academics with investment and consulting experience and high level practitioners and researchers from leading financial institutions. There is an international focus of modeling ideas and techniques as well as implemented models. Topics to be discussed include mean variance analysis, fixed income investments, currency and asset price modeling, stochastic programming models of asset and asset-liability management problems for financial institutions and individuals, factor and stock ranking models, exotic option pricing, stochastic control and capital growth models, risk measures and value at risk and related overall risk control models.

Computer Facilities

There are two terminals in the lobby of the David Lam Management Centre which participants may use to access their home accounts, In addition, seminar participants have access to the PIMS computer lab, which is located in room 306 of the Old Computer Science Building. This is one floor above the room where the seminar lectures are held. The access code for the door of the lab will be supplied at registration. The lab contains a small mathematics library and 9 terminals. At the terminals you should login using the username "ef-guest". The password for this account will be supplied at registration. If you have any questions regarding the lab, then please ask at the PIMS office in the Old Auditorium Annex.

Schedule of Events

All lectures are held in the Old Computer Science Building (CSCI), room 200.

Friday August 14

2:00–4:00

Asset and Liability Management Models

Chair: William Ziemba (University of British Columbia)
Note: This session is joint with the *VII International Conference on Stochastic Programming*. It is to be held in the Old Computer Science Building (CSCI), room 200.

Jitka Dupacova (Charles University) and **Marida Bertocchi** (University of Bergamo): Bond portfolio management in Italy.

Markus Rudolf (Swiss Institute of Banking), and **William T. Ziemba** (University of British Columbia): Intertemporal surplus management.

Roy Kouwenberg and **Ton Vorst** (Eramus University): Scenario generation and stochastic programming in ALM.

Yuan-Au Fan (Frank Russell Company): The Daido Model.

4:00–4:30

Coffee Break

4:30–7:00

Risk Management

Chair: Enrico Moretto (University of Verona)
Note: This session is joint with the *VII International Conference on Stochastic Programming.* It is to be held in the McPhee Conference Centre, room 125.

Cees Dert (ABN-AMRO and Fee University of Amsterdam): A multistage chance contrained programming approach to asset liability.

Elio Canestrelli (University of Venice): Analytical and numerical approaches in multidimensional stochastic processes applied to financial investments.

Arjan Berkelaar (Econometric Institute Erasmus: Downside-risk measures and the casino effect and its implications for financial risk-management.

Marc C. Steinbach (Zonrad-Zuse-Zentrum für Informationstechnik): Recursive direct optimization in financial multistage stochastic programs.

D. Kramkov and **W. Schachermayer** (University of Vienna): The asymptotic elasticity of utility functions and optimal investment in incomplete markets.

Saturday, August 15

8:15–8:30

Welcome by John Mulvey and William Ziemba

8:30-10:00

Mean-Variance Analysis

Chair: Robert Heinkel (University of British Columbia)

Chris Hensel (Frank Russell Company): Fundamentals of asset allocation: Russell's approach.

Richard Grinold (Barclays Global Investors): Beyond mean variance: using expected utility with entire return distributions.

Sanjiv Das (Harvard Business School): International portfolio choice with stochastic correlations.

10:00–10:15

Coffee Break

10:15–1215

Fixed Income Investments

Chair: Jitka Dupacova (Charles University, Prague)

Karl Frauendorfer and **Michael Schuerle** (University of St. Gallen): Interest rate models in stochastic optimization.

Stavros Zenios (University of Cyprus): Asset and liability management for fixed income securities.

Jan Hoffmann (Math Consulting Group AG): Investing reinvested: the management of fixed income securities through stochastic optimization.

Jitka Dupacova (Charles University, Prague): Scenarios for bond portfolios.

12:15–2:00

Lunch Break

2:00-4:00

Currency and Asset Price Modeling

Chair: Markus Rudolf (Swiss institute of Banking)

Eckhard Platen (University of Technology, Sydney): Continous time modeling of interest rates.

Tassos Mallaris (Loyola University of Chicago) and **Marco Corazza** (University of Venice): Multifractity in FX markets.

Ken Kortanek and **V. G. Medvedev** (University of Iowa): Replicating thinly traded with actively traded options.

Michael Dempster (University of Cambridge) and **Eric Thorlacius** (Falcon Asset Management): Stochastic simulation of economic variables and returns: the Falcon asset model.

4:00-4:15

Coffee Break

4:15-6:15

Asset Liability Modeling

Chair: Eric Thorlacius (Falcon Asset Management)

Alan King (IBM Research): Eficient frontiers for multistage ALM problems.

Steve Murray and **Andrew Turner** (Frank Russell Company): Stochastic programming ALM in practice for clients with special constrints and problems.

John Mulvey (Princeton University): Experiences with the Towers Perrin Model.

Michael Dempster (Cambridge University): Risk management of option adjusted portfolios.

6:45-9:30

Reception Hosted by IBM at UBC Botanical Gardens

Sunday, August 16

8:30–10:30

Asset Pricing Models

Chair: Michael Dempster (University of Cambridge)

Eric Reiner (Union Bank of Switzerland): Pricing exotic options for alternative stochastic processes.

David Edelman (University of Wollongong): A stochastically subordinated log-stable price model for share price returns.

Wayne Ferson and **Andrew Siegel** (University of Washington): The efficient use of conditioning information in portfolios.

William T. Ziemba (University of British Columbia): U.S. and Japanese factor models.

10:30–1045

Coffee Break

10:45–12:15

Individual Asset Liability Management Models

Chair: Roger Wets (UC Davis)

Adam Berger (Lattice Financial, LLC) and **John Mulvey** (Princeton University): Asset-liability management for individuals.

Steve Murray (Frank Russell Company): A model for individual asset liability management in the Italian context.

Markku Kallio (Helsinki School of Economics): An asset management model for a Finnish Insurance Company.

12:15–1400

Lunch Break

2:00–4:00

Stochastic Control and Capital Growth Models

Chair: Ulrich Haussmann (University of British Columbia)

Michael Brennan (University of California, Los Angeles): The role of learning in dynamic portfolio decisions.

Stanley Pliska (University of Illionois at Chicago) and **Tomasz Bielecki** (Northeastern Illinois University): Risk sensitive dynamic asset management.

Robert Grauer (Simon Fraser University) and **Nils Hakansson** (University of California, Berkeley): On naive approaches to timing the market: the empirical probability assessment approach with an inflation adapter.

Leonard MacLean (Dalhousie University) and **William Ziemba** (University of British Columbia): Capital growth with security.

4:00-4:15

Coffee Break

4:15-6:35

Risk Control Models

Chair: Karl Frauendorfer (University of St. Gallen)

Stewart Hodges (University of Warwick): A generalization of the Sharpe ratio and its applications to valuation bounds and risk measures.

David Heath (Cornell University): What makes a good risk measure?

Ron Dembo and **Dan Rosen** (Algorithmics Inc.): Algorithmics' value at risk models.

Discussion

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Local Guide

Welcome

The Pacific Institute for the Mathematical Sciences welcomes you to the University of British Columbia and to the Greater Vancouver area. As a sponsor and host to all those participating in the PIMS conferences and workshops, we hope to help make your stay as comfortable as possible. Please visit the PIMS UBC office if you have any questions. The office is open from 8:30-4:30 Monday-Friday and is located at 1924 West Mall, rm 210-218 of the Auditorium Annex. Please come by if, at the time of registration, you did not receive "the Vancouver Book" (provided by Tourism Vancouver) and a detailed map of UBC. The guide to follow is designed to provide visitors with a list of services at UBC and a brief overview of services for the Greater Vancouver area.

UBC Information

Dining

Opening hours given are for July and August.

Student Union Building (SUB)

Pacific Spirit Place	Cafeteria	Open 7 days a week, 7am to 2:30pm, 4:30-7pm	822–3641
The Pendulum	licensed located in SUB basement	Open daily 8am-10pm	822–3411
The Delly	located in the SUB basement	Open Mon-Fri 7am-5:30pm	
Snack Attack	located in the SUB basement	Open Mon-Fri 10:30am-5pm	822–3481
Trekkers Restaurant	Self-serve restaurant located beside Math Building	Open 11am to 2pm	822–3256
πr^2 Pizza	Pizza by the Slice	Open Sat 10am-1pm, Sun 11am-11pm	822–4396
Pit Pub	Pub style food; located in SUB basement	Open Mon-Sat 11am to 1am and Sun noon to 11pm	822–6511
Moon Noodle Bar	Chinese food fast food; located in SUB basement	Open Mon-Fri 11am to 7pm	822–3164
Expresso on the Go	serves Starbucks coffee	Mon-Fri 7-4pm	
Blue Chips	Coffee and baked goods	Open daily 7:30-9:30	

The UBC Village

Benny's Bagels	24 hours	Open daily	822–7815
McDonald's	fast food	Open daily 7am-11pm	221–1188
Spaghetti Spaghetti	licensed	Open daily 11am-12am	221–1188
Pacific Spirit Place	Cafeteria	Open 7 days a week, 7am to 2:30pm, 4:30-7pm	822–3641
UBC Pizza	Italian/Greek	Open daily 11:30-11pm	224–6531
Red Leaf Chinese	licensed	Open Mon-Fri 11:30-9pm Sun 4pm-9pm	228–9114
Village Restaurant	Chinese/Canadian	Open Mon-Fri 10:30am-9pm Sat 11am-9pm, Sun 4pm-9pm	
Second Cup	Coffee, baked goods	Open daily 7am-11pm	
Earth Harvest Foods	Grocery, deli	Open daily 8am-8pm	224–3015
UBC Lucky Mart	grocery	Open daily 9am-11pm	
UBC Groceries	grocery	Open Mon-Sat 8am-11pm	228–0113
International Food Fair*		Open daily 10am-10pm	

*includes: Dallas Gourmet, Combo Express (Taiwanese), Pita Pocket, Hong Kong Chinese, Osaka Sushi, A-1 Vietnamese Food, SM Grill, Subway (open until midnight daily).

Other Outlets on Campus

Please call UBC INFO at 822-4636 to locate specific facilities on campus.

Copies Plus 224-6225	Photocopying and scanning; located in the University Village	Open 8am to 5pm, Mon–Fri, 10am to 6pm Sat. and Sun.
Post Office	Located in UBC Bookstore	Open 9am to 5pm, Mon–Fri, 10am to 5pm Sat.
Bank of Montreal	Located in the SUB basement	Open Mon. – Thurs. 10am to 4pm, Fri. 10am to 5pm
Canadian Imperial Bank of Commerce	Located in the Village	Open Mon. – Thurs. 9:30am to 4pm, Fri. 9:30am to 5pm

Recreational Activities on Campus

Aquatic Centre	Olympic-sized pool; located on Main Mall beside SUB	Call for times	822–4521
Botanical Gardens	Oldest university gardens in Canada; located at 6804 SW Marine Drive	Open 10am to 6pm	822–9666
Nitobe Gardens	Japanese Gardens; $2; located at Gate 4 on NW Marine Drive	Open 10am to 6pm	822–6038
Chan Center for the Performing Arts	Live performances; located at 6265 Crescent Road	Call for information	822–5574
Student Recreation Center	Weights, gym, equipment rentals; located northeast of SUB	Call for details	822–6924
Tennis Courts	Located at Totem Park Residence	Open all the time	822–6184
UBC Golf Club	licensed restaurant driving range	Call for more inormation.	224–7799
Pacific Spirit Regional Park	Hiking and biking trails; located at 4915 W16th	Open 8am to 9pm	

Education Facilities

Libraries	Asian Library, David Lam Library, Main Library, Koerner Library, etc.	Call Main Library for information	822–6375
Museum of Anthropology	Northwest Coast First Nations history; $6:00 (free on Tues. from 5pm to 9pm); located at 6393 NW Marine Drive	Open daily from 10am to 5pm and Tues. 10am to 9pm	822–3825
TRIUMF	World's largest cyclotron; free tours; located at south end of Wesbrook Mall	Open 11am to 2pm weekdays	222–1047
UBC Bookstore	Located at 6200 University Blvd.	Open Mon–Fri 9am to 5pm and Sat.10am to 5pm	822–2665

Medical Facilities

UBC Dental Clinic	Located at 2199 Wesbrook Mall	Open 8:30am to 4:00pm, Mon–Fri	822–2112
University Hospital	Located at 2211 Wesbrook Mall	24 hour emergency	822–7121
University Pharmacy	Located in the University Village	Open Mon–Sat, 9am to 10pm and Sun 12pm to 8pm	224–3202

Vancouver Information

Dining

On Tenth Avenue

Located within 10 minutes of campus.

Cactus Club Cafe	4397 W10th	Burgers and Ribs	222–1342
Candia Taverna	4510 W10th	Greek & Pizza	228–9512
Culpeppers	4450 W10th	Pub-style	224–3434
Provence Mediterranean Grill	4473 W10th Ave.	Provence Style	222–1980
Some Kinda Pasta	4409 W10th	Italian	222-0220
The Diner	4556 W10th	English Pub	224–1912
Varsity Grill	4381 W10th	Chinese	224–1822

On West Broadway

Located within 15 minutes of campus.

Athene's	3618 W Broadway	Greek	731–4135
Bavarian Room	3005 W Broadway	German	734–9012
Fortune Gardens	1475 W Broadway	Chinese Seafood	736–6868
Kamei Sushi	1414 W Broadway	Japanese	732–0112
Lou's Grill & Bistro	3357 W Broadway	Pub Style	736–9872
Montri Thai Restaurant	3629 W. Broadway	Thai	738-9888
McDonalds	3310 W Broadway	Fast Food	736–6751
Wokman's Restaurant	2523 Alma	Szechuan	224-2241
True Confections	3701 W Broadway	Dessert	222–8498
Woodlands	2582 W Broadway	Vegetarian	736–5411

In Kerrisdale

Located within 20 minutes of campus.

Le Petite Genève	2106 West 41st	French/Swiss	266-9611

On Granville Island

Located within 25 minutes of campus.

Bridges	1696 Duranleau	Continental	687–4400
Isadora's	1540 Old Bridge	Continental	681–8816
Kamei Royal Ocean	1333 Johnston St.	Japanese	602–0005
The Keg	Granville Island	Steak & Seafood	685–4735

Downtown

Located within 25 minutes of campus.

Carlos 'n Buds	555 Pacific St.	Tex-Mex	684–6436
Cafe Il Nido	780 Thurlow St.	Continental	685–6436
Kamei Sushi	811 Thrulow St.	Japanese	684–4823
La Bodega	1277 Howe St.	Spanish	684–8815
La Cantina	1376 Hornby St.	Italian Seafood	687–6621
Raintree Restaurant	1630 Alberni St.	Northwest Coast	688–5306
Sitar Restaurant	8 Powell	East Indian	687–0049
Won More	201-1184 Denman	Szechuan	688–8856
English Bay Boathouse	1795 Beach	West Coast	669–2225
Kettle of Fish	900 Pacific St.	Seafood	682–6853

Scenic Views/Fine Dining

Anderson's	1540 Old Bridge	Continental	681–8816
Bridges	1696 Duranleau	Continental	687–4400
Bishop's	2183 W. 4th Ave.	Continental (no view)	738–2025
Monk McQueens	601 Stamps Landing	Seafood	877–1351
Pelican Bay	1253 Johnton (Granville Isl.)	Continental	683–8155
Salmon House	229 Foldstone Way, W. Van	Seafood	926–3212
Seasons in the Park	Queen Elizabeth Park	Continental	874-8008
The Teahouse	Ferguson Point, Stanley Park	Continental	669–3281
Chartwell	Four Seasons Hotel;791 W. Georgia	Continental	689-9333

Lodging

Bed & Breakfast

Abigails's Kitsilano Heritage House	2455 W 6th	732–8004
English Bay Inn	1968 Comox	683–8002
Maple House Bed & Breakfast	1533 Maple St.	739–5833
Tina's Guest House in Point Grey	4103 W 11th	222–3461
West End Guest House	1362 Haro St.	681–2889

Hotels

Best Western Chateau Granville	1100 Granville St.	669–7070
Century Plaza Hotel	1015 Burrard (Downtown)	687–0575
Coast Plaza at Stanley Park	1733 Comox St.	688–7711
Hotel Vancouver	900 W Georgia St. (Downtown)	684–3131
The Holiday Inn	711 W. Broadway	879-0511
Listel O'Doul's Hotel	1300 Robson	684-8461
The Barcklay	1348 Robson	688-8850
Ramada Vancouver Centre	898 W Broadway	872–8661
Sheraton Plaza 500	500 W 12th	873–1811
Waterfront Hotel Centre	900 Canada Place Way (Downtown)	691–1991
Sylvia Hotel	1154 Gilford	681-9321

Shopping

Chinatown

Vancouver's Chinatown is the third largest in North America and well worth a visit. Here you'll find everything from ginseng to green tea, fine embroidered linens, silk robes, splendid and exotic fresh produce plus traditional Chinese tableware and cooking utensils. Located east of Downtown on Pender at Main.

Gastown

If you're looking for Northwest Coast and Inuit art and crafts, head for historic Gastown. Two must-visit shops are the government licensed Gallery of Vancouver (345 Water St., 688–7323) and Images For A Canadian Heritage (164 Water St., 685–7046).

Granville Island

If Granville Island had to be described in one word, it would be *fresh.* Fresh seafood, vegetables, plants flowers, candy, fudge and baked goods. Artisans and craftsmen—potters, weavers, textile artists, designers, jewelers—all occupy a complex of once empty warhouses, foundaries and machine shops. Check out local artists' work at the Circe Co-op (1666 Johnstone St., 669–8021). The colourful Kids Only Market

(1496 Cartwright, 689–8447) is geared to kids, from clothes to toys, but "accompanied" adults are welcome too. Open 7 days a week, 9am to 6pm.

Metrotown Shopping & Entertainment Complex

Metrotown is BC's largest shopping complex. Over 450 stores, services, theatres, and restaurants—including The Bay, Eaton's, Chapters, Zellers, and Future Shop. It is easy to get to by Sky Train, car or bus and there is free parking at all adjoining centres (Metrotown, Eaton's Centre and Station Square). Metrotown is located at 4700 Kingsway in Burnaby (433–8438).

Oakridge Centre

Oakridge Centre is the place to shop if you have a car! Situated at Cambie and W 41st, it provides free parking. For trendy shopping in glass-covered comfort, the Oakridge Centre offers over 150 stores and services featuring fashions for the whole family, gift items, gourmet foods, books and numerous label retailers. The telephone number of Oakridge Centre is 261–2511.

Pacific Centre Shopping Mall

You will find that Pacific Centre is a little closer to UBC. At 550–700 W Georgia in downtown Vancouver, it only takes one short bus ride to get to this large complex of stores, theatres and restaurants.

Parker Place

With more than 130 shops and services, Parker Place is the largest Asian shopping centre in British Columbia. Browse through European fashion boutiques, antique dealers, hi-tech Japanese electronic stores, authentic Chinese tea shops, exotic oriental grocery stores. Open daily 11am to 7pm and to 9pm on Friday and Saturday. Parker Place is located in Richmond on Number 3 Road and Cambie—nearby but a world away from the ordinary.

Robson Street

On the map it's Robson Street, a "see and be seen" street for wining, dining and shopping. Robson is to Vancouver what Rodeo Drive is to Los Angeles. Browse the high end fashion boutiques mixed among the coffee shops and small local run groceries in downtown Vancouver.

Point Grey's West Tenth Avenue

This beautiful neighbourhood street runs from Alma to the University Gates with a casual mix of stores. A pleasant walk from UBC along the perimeter of the University Golf Club will lead you to this; one of the oldest communities in Vancouver.

Recreational Activities

Arts Club Theatre

This theatre, which is located on Granville Island, stages a variety of live theatre. The theatre telephone number is 687–1644. Tickets may be obtained from Ticketmaster (280–4444) or at the box office in the SUB building on the UBC campus.

Bard on the Beach

Shakespeare's plays staged outdoors down by Kitsilano Beach in Vanier Park. The theatre telephone number is 739–0559. Tickets may be obtained from Ticketmaster (280–4444) or at the box office in the SUB building on the UBC campus.

Queen Elizabeth Theatre

Stages large live performances. Located downtown at Hamilton and Georgie St. The theatre telephone number is 299–9000. Tickets may be obtained from Ticketmaster (280–4444) or at the box office in the SUB building on the UBC campus.

The Ford Centre for the Performing Arts

Stages mostly musicals. Located downtown at 777 Homer St. The telephone number is 280–2222. Tickets may be obtained from Ticketmaster (280–4444) or at the box office in the SUB building on the UBC campus.

Varsity Theatre

Movie theatre located at 4375 W 10^{th} Ave, near UBC. Telephone: 290–0500.

5th Avenue Cinemas

Movie theatre located at 2100 Burrard. Telephone: 734–7469.

Vancouver Aquarium in Stanley Park

Open 9:30am to 7:00pm daily. Admission is $12.00 (adults), $6.00 (children).
Telephone: 268–9900.

Transportation

Automobile Rental

ABC Rent-A-Car	873–6622
Budget	668–7000
Tilden	273–3121

Bicycle Rental

Bayshore Bicycles	688–2453
Recreation Rentals	733–7368
Steveston Bicycle	271–5544

Taxi Cabs

Black Top & Checker Cabs	731–1111
Yellow Cab	681–1111

Public Transit

Bus, Sea Bus and Sky Train Service. Call Customer Info for specific directions to where you want to go.

Customer Information	521–0400
Customer Service	540–3040
Lost Property	682–7887

Medical Facilities

Alma Medical Clinic (drop-in clinic)	#303—2083 Alma St. Mon. Tues. & Thurs. from 9am to 5pm Wed. from 2pm to 8pm Fri. from 8am to 4pm	222–2256
Pine Free Clinic (drop-in clinic)	1985 W 4th Ave Mon–Fri from 9am to noon and 2pm to 5pm Wed from 9am to noon and 2:30pm to 8pm	736–2391
Kitsilano Medical Clinic (drop-in clinic)	2689 W Broadway Mon–Sun 9am to 9pm	731–9187

Canadian Goods and Services Tax

There is a 7% Goods and Services Tax currently in effect in Canada. Visitors can obtain an instant GST rebate by submitting all GST receipts (up to $500 cdn) to a participating duty-free shop when they exit Canada. Alternatively, they may file for a GST refund with Revenue Canada and be reimbursed by cheque. For further information, please call the following numbers:

From inside Canada: 1-800-668-4748

From outside Canada: 902-432-5608

There is also a non-refundable provincial sales tax of 7%

Tourism Vancouver

Visit the Vancouver Tourist info centre at 200 Burrard Street or at www.tourism-vancouver.org or call 1-800-663-6000.

More News

The Georgia Straight is Vancouver's top-rated weekly magazine, featuring the best in movies, music, the arts, restaurants, sports, outdoors, and travel. Pick up a free copy at the UBC Bookstore or outside the Pendulum restaurant in the SUB basement.

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