ARC 2018

53rd Actuarial Research Conference | August 8-11
Western University | 1151 Richmond Street | London, Ontario, Canada

Overview

Wednesday, August 8

5:00 - 7:00 p.m. Welcome Reception
Museum London
421 Ridout Street N.

sponsored by the Canadian Institute of Actuaries

Thursday, August 9 - Conference Day 1

Western University, 1151 Richmond St. N.
University Community Centre (UCC)

8:00 - 8:45 a.m. Coffee & Registration Community Room

8:45 - 10:00 a.m. 1A: Plenary Session I McKellar
Opening Remarks
Welcome by Dean of Science, Matt Davison
Keynote speaker: *Katrien Antonio, KU Leuven (Belgium) and University of Amsterdam*

10:00 - 10:30 a.m. Coffee Break Community Room
sponsored by SOA Education & Research Section

10:30 - 12:00 p.m. Parallel Sessions 2A - 2E

12:00 - 1:15 p.m. Lunch Great Hall, Somerville House
sponsored by the Society of Actuaries
with presentation by SOA Past President Jerry Brown

1:15 - 2:45 p.m. Parallel Sessions 3A - 3F

2:45 - 3:15 p.m. Coffee Break Community Room

3:15 - 4:45 p.m. Parallel Sessions 4A - 4E

4:45 - 6:15 p.m. Poster Reception P&AB Atrium

Friday, August 10 - Conference Day 2

8:00 - 9:00 a.m. Coffee & Registration Community Room

9:00 - 10:15 a.m. 5A: Plenary Session II McKellar
Keynote speaker: Greg Kopp, Western University

10:15 - 10:45 a.m. Coffee Break Community Room
sponsored by SOA Health Section

10:45 - 12:00 p.m. 6A: Plenary Session III McKellar
Keynote speaker: Santiago Montenegro, *President, Colombian Association of Pension and Unemployment Fund Administrators, Asofondos.*

12:00 - 1:15 p.m. Lunch Great Hall, Somerville House
sponsored by the Casualty Actuarial Society; with presentation by CAS President Brian Brown

1:15 - 2:45 p.m. 7A: Invited Session I: InsurTech McKellar
7B: Invited Session II: Cyber Risk UCC 146
Parallel Sessions 7C - 7E

2:45 - 3:15 p.m. Coffee Break Community Room

3:15 - 4:45 p.m. 8A: Invited Session III: Human Sustainability McKellar
8B: Invited Session IV: Mortality Improvement UCC146
Parallel Sessions 8C - 8E

6:00 - 7:00 p.m. Cocktails (Cash Bar) Great Hall

7:00 - 9:00 p.m. Conference Dinner Great Hall
sponsored by London Life

Saturday, August 11 - Conference Day 3

8:00 - 8:45 a.m. Coffee Community Room

8:45 - 10:15 a.m. Parallel Sessions 9A - 9E

10:15 - 10:30 a.m. Coffee Break Community Room

10:30 - 11:45 a.m. 10A: Plenary Session IV McKellar
Keynote speaker: Bonnie-Jeanne MacDonald, Ryerson University

11:45 a.m. Closing and Box Lunch Community Room

12:00 p.m. Departure for Stratford Social Science parking lot

Western
UNIVERSITY · CANADA

ARC 2018

Conference Schedule

Wednesday, August 8

5:00 - 7:00 p.m. **Welcome Reception** **Museum London**
421 Ridout Street N.
Sponsored by the Canadian Institute of Actuaries

Thursday, August 9 - Conference Day 1

8:00 - 8:45 a.m. **Coffee and Registration** **Community Room**

1A Plenary Session I, Chair: Xiaoming Liu, McKellar

8:45 - 8:50 a.m. **Announcements and introduction of Dean of Science**
Bruce Jones, Conference Chair

8:50 - 9:00 a.m. **Welcome to Western,**
Matt Davison, Dean of Science

9:00 - 10:00 a.m. **Keynote presentation: Data analytics for insurance pricing,**
Katrien Antonio, Professor in actuarial science and insurance analytics at KU Leuven (Belgium) and Associate Professor at the University of Amsterdam (the Netherlands)

10:00 - 10:30 a.m. **Coffee Break** **Community Room**
sponsored by the SOA Education and Research Section

PARALLEL SESSIONS: 2A - 2E

2A: Actuarial Education I, Chair: Jeff Beckley **McKellar**

10:30 - 11:00 a.m. Specific Guidelines for Creating Two-Dimensional Syllabi with Challenging but not Overly- Difficult Problems by Russell Hendel, Towson University

11:00 - 11:30 a.m. Professionalism in Actuarial Science: Teaching Our Students to Be Actuaries, Not Just Test- Takers, by Alisa Walch, University of Texas at Austin

11:30 - 12:00 p.m. Getting Students to Think Like Actuaries: Incorporating Professional Skills in the Classroom, by Diana Skrzydlo, University of Waterloo

2B: Pensions and Retirement I, Chair: Bruce Jones **UCC 146**

10:30 - 11:00 a.m. AHP application to Post- Retirement Planning and Decision, by Marie-Claire Koissi, University of Wisconsin-Eau Claire

11:00 - 11:30 a.m. A review of the proposed University Pension Plan for Ontario, by Mary Hardy, University of Waterloo

11:30 - 12:00 p.m. Retirement planning with ambiguous investment and mortality risks, by Yang Shen, York University

2C: Probability and Statistical Methods, Chair: Brian Hartman **UCC 37**

10:30 - 11:00 a.m. The Laplace transform of the lognormal distribution, by Justin Miles, York University

11:00 - 11:30 a.m. Ratemaking application of Bayesian LASSO with conjugate hyperprior, by Himchan Jeong, University of Connecticut

11:30 - 12:00 p.m. Smoothing of ratemaking errors to identify spatial auto-correlation, by Christopher Blier-Wong, Université Laval

2D: Financial Modeling I, Chair: Marcos Escobar-Anel **UCC 41**

10:30 - 11:00 a.m. Risk selection using live textual data from the web for commercial underwriting, by Jean-Thomas Baillargeon, Laval University

11:00 - 11:30 a.m. Effect of Withdrawal Frequency on the Retirement Funds, by Kris Nilsson and Kaitlyn Fleigle, Maryville University of St. Louis

11:30 - 12:00 p.m. Assessing the financial viability of the Road Accident Benefit Scheme in South Africa, by Coetzee Marais, University of Cape Town

2E: Measuring and Modeling Risk, Chair: Elias Shiu, **UCC 60**

10:30 - 11:00 a.m. Poissonian Potential Measures for Levy Risk Models, by Di Xu, University of Nebraska Lincoln

11:00 - 11:30 a.m. Stochastic approximation algorithms applications in variable annuities, by Anne MacKay, Université du Québec à Montréal

11:30 - 12:00 p.m. Sign Patterns in Correlation Matrices, by Phelim Boyle, Wilfrid Laurier University

Conference Schedule

Thursday, August 9 - Conference Day 1

12:00 - 1:15 p.m.	**Lunch** **Great Hall, 2nd floor Somerville House** *Presentation by SOA Past President Jerry Brown* *sponsored by the Society of Actuaries*
	PARALLEL SESSIONS: 3A - 3F
	3A: Optimal Insurance, Chair: Wei Wei McKellar
1:15 - 1:45 p.m.	Optimal Insurance with Belief Heterogeneity. by Mario Ghossoub, University of Waterloo
1:45 - 2:15 p.m.	Pareto-Optimal Risk Sharing among insurers under Mean- Variance Criterion, by Lyu Chen, University of Waterloo
2:15 - 2:45 p.m.	On optimal reinsurance treaties under a cooperate game, by Jiandong Ren, Western University
	3B: Education Updates from the SOA, CAS and CIA, Chair: Steve Kopp UCC 146
1:15 - 1:45 p.m.	Society of Actuaries Education Update, by Stuart Klugman, SOA
1:45 - 2:15 p.m.	Casualty Actuarial Society Education Update, by Jeanne Crowell, CAS
2:15 - 2:45 p.m.	Canadian Institute of Actuaries Education Update, by Marc Tardif, CIA
	3C: P&C Insurance, Chair: Jeyaraj (Jay) Vadiveloo UCC 37
1:15 - 1:45 p.m.	Predictive analytics of insurance claims using multivariate decision trees, by Zhiyu Quan, University of Connectict
1:45 - 2:15 p.m.	Implementation of Dependence between Frequency and Severity in Bonus-Malus System, by Rosy Oh, Ewha Womans University
2:15 - 2:45 p.m.	Some observations on the time patterns in the surplus process of an insurer, by Yang Miao, Western University
	3D: Actuarial Topics I, Chair: Jean-François Bégin UCC 41
1:15 - 1:45 p.m.	Blockchains: what they are, how they work, and their implications for the insurance industry, by Arnold Shapiro, Penn State University
1:45 - 2:15 p.m.	Ordering Prospects by Insurance Premiums, by Mostafa Mashayekhi, University of Nebraska-Lincoln
2:15 - 2:45 p.m.	The Economics of the Secondary Market for Variable Annuities, by Thorsten Moenig, Temple University
	3E: Reinsurance, Chair: Xiaoming Liu UCC 60
1:15 - 1:45 p.m.	Simulation of Correlated Levy Negative Binomial Processes for Quantitative Risk modelling. by Maral Mazjini, University of Regina
1:45 - 2:15 p.m.	Optimal Investment and Reinsurance Strategies with Bayesian Learning, by Jingyi Cao, University of Waterloo
2:15 - 2:45 p.m.	Optimal reinsurance considering synergy potential, by Wenjun Jiang, Western University
	3F: Health, Retirement and Social Security, Chair: Shu Li UCC 59
1:15 - 1:45 p.m.	Unsupervised Clustering with All Categorical Variables, by Margie Rosenberg, University of Wisconsin
1:45 - 2:15 p.m.	A Multi-faceted Analysis of Solvency and Sustainability of the U.S. Social Security system. by Ken Buffin, Buffin Foundation
2:15 - 2:45 p.m.	*Cancelled*
2:45 - 3:15 p.m.	**Coffee Break** Community Room
	PARALLEL SESSIONS: 4A - 4E
	4A: Health Topics, Chair: Margie Rosenberg, McKellar
3:15 - 3:45 p.m.	Measuring and analyzing Individual Healthy Life Expectancy, by Jeyaraj Vadiveloo, University of Connecticut
3:45 - 4:15 p.m.	Predicting High-cost Members in the HCCI Database, by Brian Hartman, Brigham Young University
4:15 - 4:45 p.m.	Doubly Enhanced Annuities and the Impact of Price and Quality of Long Term Care on Retiree Decisions, by Colin Ramsay, University of Nebraska-Lincoln
	4B: Pensions and Retirement II, Chair: Yang Shen UCC 146
3:15 - 3:45 p.m.	*Cancelled*
3:45 - 4:15 p.m.	Retirement Consumption, Risk Perception and Planning Objectives, by Saisai Zhang, University of Waterloo
4:15 - 4:45 p.m.	What the Heck is HECM? by Stephanie Lee, University of California - Santa Barbara

Western UNIVERSITY · CANADA

ARC 2018

Conference Schedule

Thursday, August 9 - Conference Day 1

	4C: Actuarial Modeling II, Chair: Jed Frees UCC 37
3:15 - 3:45 p.m.	Bivariate Kumaraswamy- Distorted Copulas, by Ranadeera Samanthi, Central Michigan University
3:45 - 4:15 p.m.	A global approach to modeling flood risk diversification for (re) insurers, by David Carozza, Université du Québec à Montreal
4:15 - 4:45 p.m.	Estimating Veterans' Health Benefit Grants Using the Generalized Linear Mixed Cluster-Weighted Model with Incomplete Data, by Petar Jevtic, Arizona State University
	4D: Actuarial Modeling II, Chair: Mary Hardy UCC 41
3:15 - 3:45 p.m.	Portfolio Optimization under Solvency II Constraints, by Marcos Escobar-Anel, Western University
3:45 - 4:15 p.m.	Utility maximization under regime -switching: a Laplace method, by Adriana Ocejo, University of North Carolina - Charlotte
4:15 - 4:45 p.m.	Multivariate Scenario Reduction-- Applied to Segregated Funds Guarantees, by Yvonne Chueh, Central Washington University
	4E: Mortality/Longevity, Chair: Chris Groendyke UCC 60
3:15 - 3:45 p.m.	The pricing of a guaranteed minimum maturity benefit under a regime-switching framework, by Yixing Zhao, Western University
3:45 - 4:15 p.m.	A Further Investigation of Longevity Greeks: Dynamic Delta, Leverage Effect and Security Structures, by Kenneth Zhou, University of Waterloo
4:15 - 4:45 p.m.	Spatial filtering approach to mortality modeling, by Kyran Cupido, Arizona State University
4:45 - 6:15 p.m.	**Poster Reception - Physics & Astronomy Building Atrium**

Friday, August 10 - Conference Day 2

8:00 - 9:00 a.m.	**Coffee and Registration Community Room**
	5A: Plenary Session II, Chair: Bruce Jones McKellar Room
9:00 - 9:05 a.m.	Announcements
9:05 - 9:15 a.m.	IAA Mortality Working Group Resources, Brian Ridsdale
9:15 - 10:15 a.m.	**Keynote presentation: Mitigation of insured losses to extreme weather: Can we build houses to resist tornadoes?** *Greg Kopp, Professor and Associate Dean (Graduate and Postdoc Studies) in the Faculty of Engineering, Western University*
10:15 - 10:45 a.m.	**Coffee Break Community Room** *sponsored by the SOA Health Section*
	6A: Plenary Session III, Chair: Stephen Camilli McKellar Room
10:45 - 10:55 a.m.	Society of Actuaries International Section, Ken Seng Tan
11:00 - 12:00 p.m.	**Keynote presentation: The impact of demographic changes and labor markets malfunctioning on pay-as-you-go pension systems: the case of Colombia** *Santiago Montenegro*, *President of the Colombian Association of Pension and Unemployment Fund Administrators, Asofondos.*
12:00 - 1:15 p.m.	**Lunch Great Hall, 2nd floor Somerville House** *Presentation by CAS President Brian Brown* *sponsored by the Casualty Actuarial Society*
	PARALLEL SESSIONS: 7A - 7E
	7A: Invited Session I: InsurTech Chair: Ben Marshall McKellar Room
1:15 - 2:00 p.m.	InsurTech: New Products, Technology and Innovation *Ron Stokes, Partner, Canadian Financial Services Transaction Leader, Ernst & Young*
2:00 - 2:45 p.m.	InsurTech is Applied Insurance Research *Don Mango, Principal, Innovensure Advisory Solutions LLC*
	7B: Invited Session II: Cyber Risk Chair: Jiandong Ren UCC 146
1:15 - 2:00 p.m.	A Fundamental Approach to Cyber Risk Insurance *Stefan Laube, Cyber Solutions Team, PwC Germany*
2:00 - 2:45 p.m.	Practical Analysis and Management of Cyber Risk *Ben Goodman, Founder and CEO, 4A Security and Compliance*

Western UNIVERSITY · CANADA

ARC 2018

Conference Schedule

Friday, August 10 - Conference Day 2

	7C: Distributions and Dependence Chair: Peng Shi UCC 37
1:15 - 1:45 p.m.	Moment-Based Density Approximation Techniques as Applied to Heavy-tailed Distributions, by John Sang Jin Kang, Western University
1:45 - 2:15 p.m.	On the Class of Tail Dependence Matrices Generated by Commonly Used Copula Families, by Siyang Tao, University of Iowa
2:15 - 2:45 p.m.	Dependence within micro-level model for loss reserving, by Roxane Turcotte, Laval University
	7D: Actuarial Topics II, Chair: David Stanford UCC 41
1:15 - 1:45 p.m.	Big Data, Small Talk, by Benjamin Ku and Rahul Narula, University of California, Santa Barbara
1:45 - 2:15 p.m.	Eigen Portfolio Selection: A Robust Approach to Sharpe Ratio Maximization, by Danqiao Guo, University of Waterloo
2:15 - 2:45 p.m.	Ruin, the R_n class of distributions and total dividends, by Ruixi Zhang, Western University
	7E: Topics in Life Insurance, Chair: Michael Sherris UCC 60
1:15 - 1:45 p.m.	Modeling Obesity Prevalence for the US Population, by Tatjana Miljkovic, Miami University
1:45 - 2:15 p.m.	Equity Indexed Universal Life Insurance in College Funding, by Zhixin Wu, DePauw University
2:15 - 2:45 p.m.	*Cancelled*
2:45 - 3:15 p.m.	**Coffee Break Community Room**
	PARALLEL SESSIONS: 8A - 8E
	8A: Invited Session III: Human Sustainability Chair: Ben Marshall McKellar
3:15 - 4:00 p.m.	Climate Change (Actuaries Climate Index), Steve Kolk, Consulting Actuary, Kolkulations and current member, Actuaries Climate Index Working Group
4:00 - 4:45 p.m.	Food - A Key to Sustainability? Caterina Lindman, Former chair and current member, Actuaries Climate Index Working Group
	8B: Invited Session IV: Mortality Improvement Chair: Michael Stinchcombe UCC 146
3:15 - 4:00 p.m.	Recent Developments in Longevity, Internationally, Brian Ridsdale, Chair, IAA Mortality Working Group
4:00 - 4:45 p.m.	Difference in Mortality by Socio-economic Status: How Much, Why and Is It Getting Better?, Assia Billig, Senior Actuary, Office of the Chief Actuary, Office of the Superintendent of Financial Institutions (Canada)
	8C: Statistical Methods I Chair: Vytaras Brazauskas UCC 37
3:15 - 3:45 p.m.	Data mining techniques for actuaries: an overview, by Banghee So, University of Connecticut
3:45 - 4:15 p.m.	Shared Random Effect Models for Frequency and Severity of Forest Fires, by Devan Becker, Western University
4:15 - 4:45 p.m.	Efficient Nested Simulation for CTE of Variable Annuities, by Ou (Jessica) Dang, University of Waterloo
	8D: Financial Modeling III Chair: Anne MacKay UCC 41
3:15 - 3:45 p.m.	Hedging of Dynamic Withdrawal Guarantees of Variable Annuities in the Presence of Basis Risk, by Zhiyi Shen, University of Waterloo
3:45 - 4:15 p.m.	Local Time and Guaranteed Lifetime Withdrawal Benefit with Step-up Feature, by Chongda Liu, University of Illinois at Urbana–Champaign
4:15 - 4:45 p.m.	Predicting the time of the highest gain for the money makers (in share/stock market), by Mian Adnan, Indiana University Bloomington
	8E: Risk Measures and Models Chair: Yvonne Chueh UCC 60
3:15 - 3:45 p.m.	Simulation of systemic events based on random banking networks, by David Hoskins, University of California - Santa Barbara
3:45 - 4:15 p.m.	Maximum Likelihood Estimation for phase-type aging models, by Boquan Cheng, Western University
4:15 - 4:45 p.m.	Evaluation of the Ruin Probability in Ordered Risk Models, by Michael Brown and Daniel Rondon, University of California - Santa Barbara
6:00 - 7:00 p.m.	**Cocktails** (Cash Bar)- **Great Hall, 2nd floor Somerville House**
7:00 - 9:00 p.m.	**Conference Dinner** - **Great Hall, sponsored by London Life**

Western
UNIVERSITY · CANADA

ARC 2018

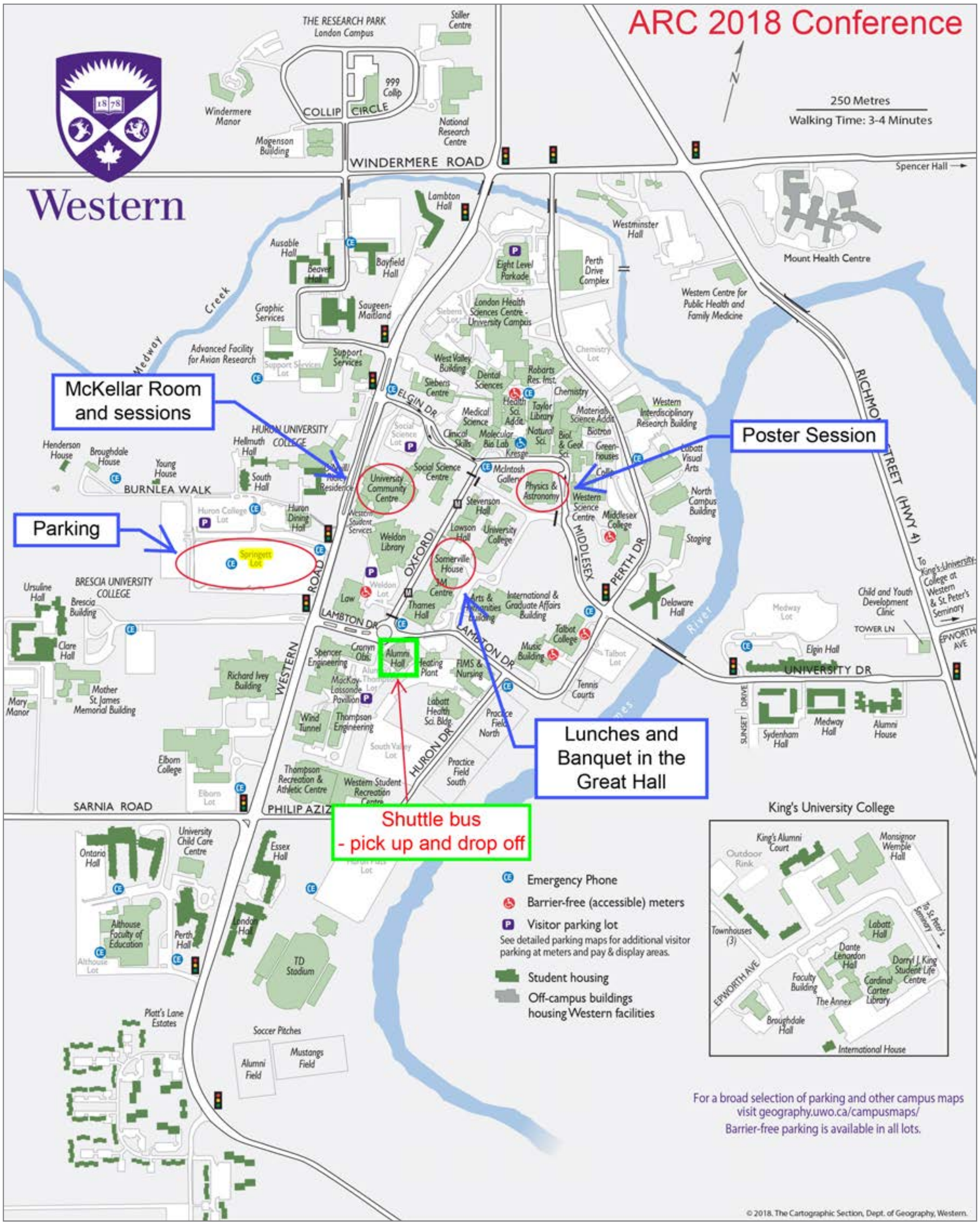
Conference Schedule

Saturday, August 11 - Conference Day 3

8:00 - 8:45 a.m.	Coffee **Community Room**
	PARALLEL SESSIONS: 9A - 9E
	9A Actuarial Education II, Chair: Jim Trimble McKellar
8:45 - 9:15 a.m.	Open Actuarial Textbooks Project, by Edward W. (Jed) Frees, University of Wisconsin - Madison
9:15 - 10:15 a.m.	Best Practices in Exposing Actuarial Students to Property and Casualty Insurance, Featuring the CAS University Award Winners, by Tamar Gertner, Casualty Actuarial Society, John Zicarelli, Arizona State University, and Alisa Walch, University of Texas at Austin
	9B Risk Measures and Dependence, Chair: Arnold Shapiro UCC 146
8:45 - 9:15 a.m.	Properties of risk measures inspired from a ruin model with interest, by Ilie Radu Mitric, Université Laval
9:15 - 9:45 a.m.	Introducing dependence between frequency and severity in collective risk model, by Peng Shi, University of Wisconsin-Madison
9:45 - 10:15 a.m.	Estimating Loss Reserves Using Hierarchical Bayesian Gaussian Process Regression with Input Warping, by Nathan Lally, The Hartford Steam Boiler Inspection and Insurance Co.
	9C Statistical Methods II, Chair: David Stanford UCC 37
8:45 - 9:15 a.m.	Economic Scenario Generator and Parameter Uncertainty: A Bayesian Framework, by Jean-François Bégin, Simon Fraser University
9:15 - 9:45 a.m.	Actuarial Applications of Word Embedding Models, by Gee Lee, Michigan State University
9:45 - 10:15 a.m.	Robust and Efficient Fitting of Severity Models and the Method of Winsorized Moments, by Vytaras Brazauskas, University of Wisconsin - Milwaukee
	9D: Insurance Topics Chair: Mario Ghossoub UCC 41
8:45 - 9:15 a.m.	Optimal Index Insurance Design, by Chengguo Weng, University of Waterloo
9:15 - 9:45 a.m.	Optimal Insurance under Rank- Dependent Utility and Incentive Compatibility, by Shengchao Zhuang, University of Nebraska Lincoln
9:45 - 10:15 a.m.	Optimal insurance with background risk: an analysis of general dependence structures, by Wei Wei, University of Wisconsin- Milwaukee
	9E: Actuarial Modeling II Chair: David Corozza UCC 60
8:45 - 9:15 a.m.	Simulated Minimum Hellinger Distance Estimation for Some Continuous Financial and Actuarial Models, by Claire Bilodeau, Université Laval
9:15 - 9:45 a.m.	Clustering the events from the earthquake catastrophe modeling catalog, by Baldvin Einarsson, AIR-Worldwide
9:45 - 10:15 a.m.	Conventions of quantification and the good use of actuarial models: encouraging critical thinking by humanities, by Christian Walter, Fondation Maison des sciences de l'homme
10:15 - 10:30 a.m.	**Coffee Break Community Room**
	10A: Plenary Session IV Chair: David Stanford McKellar
10:30 - 10:40 a.m.	Invitation to ARC 2019, Jeff Beckley
10:45 - 11:45 a.m.	Keynote presentation: Replacing the Replacement Rate: How Much is ENOUGH Retirement Income? *Bonnie-Jeanne MacDonald, Senior Research Fellow of the National Institute on Ageing (NIA) at Ryerson University*
11:45 a.m.	**Box Lunch Community Room**
12:00 p.m.	**Departure for Stratford Alumni Hall**

ARC 2018

Map


ARC 2018 Conference
Western
McKellar Room and sessions
Poster Session
Parking
Lunches and Banquet in the Great Hall
Shuttle bus - pick up and drop off
250 Metres
Walking Time: 3-4 Minutes
WINDERMERE ROAD
COLLIP CIRCLE
THE RESEARCH PARK London Campus
BURNLEA WALK
SARNIA ROAD
WESTERN ROAD
LAMBTON DR
ELGIN DR
OXFORD DR
MIDDLESEX DR
PERTH DR
UNIVERSITY DR
HURON DR
PHILIP AZIZ
RICHMOND STREET (HWY 4)
HURON UNIVERSITY COLLEGE
BRESCIA UNIVERSITY COLLEGE
King's University College
Mount Health Centre
Springett Lot
University Community Centre
Physics & Astronomy
Somerville House
Alumni Hall
TD Stadium
Emergency Phone
Barrier-free (accessible) meters
Visitor parking lot
See detailed parking maps for additional visitor parking at meters and pay & display areas.
Student housing
Off-campus buildings housing Western facilities
For a broad selection of parking and other campus maps visit geography.uwo.ca/campusmaps/
Barrier-free parking is available in all lots.
© 2018. The Cartographic Section, Dept. of Geography, Western.

Western
UNIVERSITY · CANADA

ARC 2018

Conference Sponsors

Diamond Sponsor

The Great-West Life Assurance Company

London Life

Canada Life™

Platinum Sponsor

Canadian Institute of Actuaries / Institut canadien des actuaires

Gold Sponsor

CAS — Expertise. Insight. Solutions.®

Western — School of Mathematical & Statistical Sciences

Silver Sponsor

Society of Actuaries®
Education and Research Section
Health Section

Bronze Sponsor

ACTEX Learning

Society of Actuaries®
Actuary of the Future Section
Financial Reporting Section
International Section
Long Term Care Section
Modeling Section
Predictive Analytics and Futurism Section

Special Thanks

David Core, *Casualty Actuarial Society*
Ben Marshall, *Society of Actuaries*
Michael Stinchcombe, *London Life*

Local Organizing Committee

Bruce Jones
Kristina Sendova
Jiandong Ren
Xiaoming Liu
David Stanford