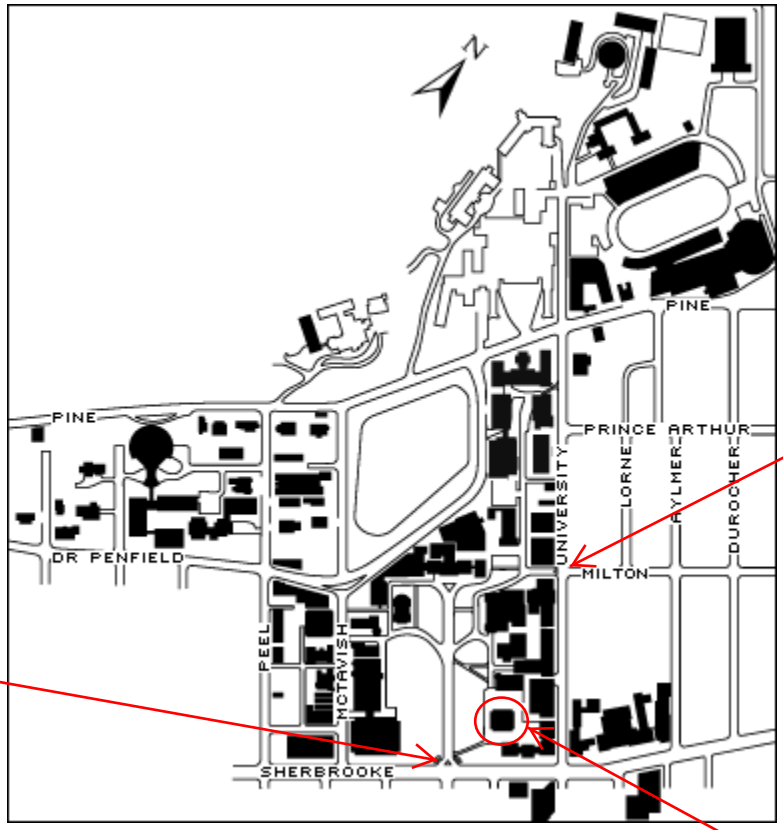
McGill University

Department of Mathematics and Statistics

Statistics and Probability Summer School

June 7th-11th 2010

The school will take place in **Room 911, Burnside Hall (9th Floor)**, at the downtown campus of McGill.



Downtown Campus Map

http://www.mcgill.ca/maps/?Campus=downtown

The School will start at 9.15 am on Monday morning, and finish at 3pm on Friday afternoon.

Schedule

Monday June 7th

9:15 am - 9:30 am-- Introductory words

Probability

9:30 am - 10:45 am Introductory Lecture I Random walks: Louigi Addario-Berry.

Introduction to random walks. Generating functions, recurrence and transience. Large deviations for random walks.

10:45 am - 11:15 am Coffee break

11:15 am - 12:30 pm Introductory Lecture II Branching processes and branching random walk: Louigi Addario-Berry.

Fundamental theorem of branching processes. The connection between geometric branching processes and simple random walks. Branching random walk and its extremes.

12:30 - 2:00 Lunch

2:00 - 3:15 Topics lecture I Scaling limits for random walks and trees: Lea Popovic.

Mapping between Random Walks and Random Trees, their scaling limits: reflected Brownian motion and the Continuum Random Tree. Point process representation of the reduced tree.

3:15 - 3:45 Break

3:45 - 5:00 Topics lecture II Extreme-value theory: Johanna Neslehova

Limiting behavior of maxima, extreme-value distributions and their domain of attraction. Threshold exceedances, the peaks-over-threshold method and its applications in practice.

Tuesday June 8th

Mathematical Statistics: High dimensional problems

9:30 am - 10 am General likelihood theory: Masoud Asgharian

- Overview of an estimation problem in a general parametric statistical model.
- Maximum likelihood estimation (MLE).
- Asymptotic properties of MLE under standard regularity conditions.
- Examples of models satisfying the regularity conditions ("regular" models)

10:00am - 10:45am. Regression, and Finite mixture models: David Stephens

- Linear regression models and inference
- Examples of applications of finite mixture models in different fields of science.
- Statistical inference in finite mixture models.
- Universality of mixture models: their relationship to other statistical models.

10:45am - 11:15am Coffee break.

11:15am - 12:00noon. Finite mixture of regression (FMR) models: Abbas Khalili

- Definition of FMR models.
- Examples of applications of FMR models.

12:00 - 2:00 Lunch

2:00 pm - 3:00 pm Masoud Asgharian

- Nonparametric maximum likelihood methods.
- Kernel estimation and mixture models.
- Nonparametric Bayesian methods.

3 pm - 3:15 pm Coffee Break.

3:15 pm - 4:15 pm Abbas Khalili

- A long-standing statistical problem in finite mixture models: order estimation.
- Motivating real data examples.
- An overview of recent developments on the order estimation problem.
- Future research directions.

4:15 pm - 5:15pm Abbas Khalili.

- Feature (variable) selection in regression modeling in high dimensional spaces.
- Motivating real data examples.
- Feature selection problem in FMR models in high dimensions.
- Future research directions.

Wednesday June 9th

Survival Analysis and Biostatistics

9:30 am – 10:00 am Alain Vandal
General overview of survival analysis and biostatistics: in particular, survival analysis and capture recapture.

10:00 am - 10:45 am Masoud Asgharian
Basic definitions of survival analysis: survivor function, hazard and cumulative hazard, random censoring. A brief description of what nonparametric estimation is in general.

10:45 am - 11:15 am Coffee break

11:15 am - 12:00 pm David Wolfson
Parametric survival models and likelihood, and parameter estimation. Covariates and the proportional hazards model, and the two different ways to arrive at Cox's partial likelihood.

12:00 - 2:00 Lunch

2:00 pm - 3 pm David Wolfson
The analysis of left truncated right censored data: Part 1.
The Canadian Study of Health and Ageing and the problem of the non-parametric estimation of the survivor function for left truncated data as well as the Weibull model with covariates for such data.

3 pm - 3:15 pm Coffee Break

3:15 pm - 4:15 pm Masoud Asgharian
The analysis of left truncated right censored data: Part 2.
The stationary case and length biased data. Robustness versus efficiency. Estimation of the survivor function and the covariate issue).

4:15 pm - 5:15 pm Alain Vandal
Capture Recapture Methods.

Thursday June 10th

Bayesian Inference and Computation

9:30 am – 10:10 am David Stephens
Basics of Bayesian Inference: Introduction to basic concepts: prior distributions, posterior distributions, summaries (credible intervals, HPD), and model selection. Binomial and Normal examples with conjugate prior distributions.

10:10 am – 10:45 am Russ Steele
Basics of Bayesian Inference II: Discussion of conjugate, semi-conjugate, and non-conjugate priors. Discussion of informative vs. non-informative prior distributions. Introduction to hierarchical models.

10:45 am - 11:15 am Coffee break

11:15 am – 12:15 pm Mylene Bedard
History of MCMC and the Metropolis Hastings sampler

12:15 pm – 12:45 pm David Stephens
Uses of MCMC sampling in Bayesian inference

12:45 pm – 14:00 pm Lunch

14:00 pm – 15:00 pm Russ Steele
Bayesian Meta-analysis: Introduction to basic ideas in meta-analysis as an example of Bayesian hierarchical modeling. One example for continuous data and one example for binomial data.

15:00 pm – 15.15 pm Coffee Break

15:15 pm – 16.00 pm Russ Steele
Missing data via Bayesian methods: Introduction to basic ideas in analysis of missing data (missing at random vs. not missing at random, motivation as to what is important). Introduction to use of Bayesian methods in analysis of missing data (i.e. treating the data as unknown parameters). Introduction to NMAR response models if time permits.

16:00 pm – 17:00 pm Vahid Partovi Nia
Bayesian Clustering: Introduction to clustering: hierarchical clustering using Euclidean distance and partitioning methods like k-means as classic methods. The connection between k-means (Classic) with fitting a Gaussian finite mixture model using EM algorithm (Modern). Bayesian approach to the clustering problem especially Bayesian parametric models for small-sample-high-dimensional situations. Basic algorithms for MCMC clustering.

Thursday evening: 6:30 Dinner at Thompson House
After-Dinner Speaker: Abraham De Moivre

Friday June 11th

Finance and Risk Modeling

9:30 am – 9:45 am Introduction

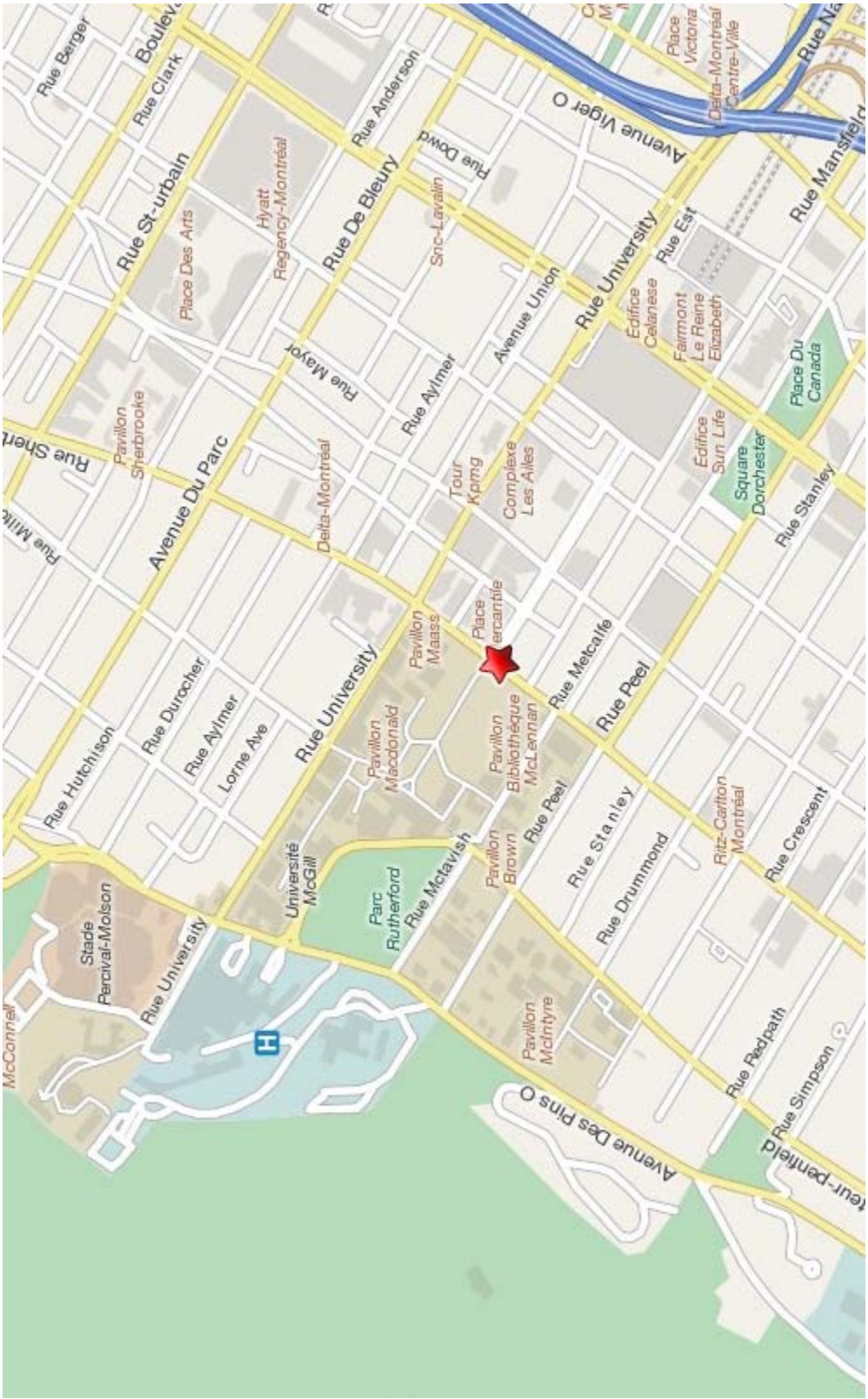
9:45 am – 10:45 am David Stephens
Time series methods
Introduction to time series methods. ARMA models, conditional heteroscedastic models, stochastic volatility models. Multivariate time series and volatility models.

10:45 am – 11:15 am Coffee break

11:15 am – 12:30 pm Christian Genest & Johanna Neslehova
Dependence modeling with copulas:
Pitfalls of linear correlation in risk modeling. Copulas, copula models and Sklar's decomposition. Quantification of dependence using rank-based methods.

12:30 pm – 2:00 pm Lunch

2:00 pm – 3:00 pm: Christian Genest & Johanna Neslehova
Inference for copula models
Copula models for financial and actuarial data. Model fitting and validation using computationally intensive methods. Practical illustrations with R.



Map of downtown Montreal