Master’s in Computational Mathematics
Faculty of Mathematics, University of Waterloo
Master’s in Computational Mathematics

• One-year, interdisciplinary Master’s (duration of study 12 months, starts September 2016)

• Organized by ‘computational’ professors from CS, AM, CO, STAT, PM (40 faculty members)

• Target audience:
  students with a bachelor’s degree in mathematics, statistics, computer science, or in another program with a strong math component, including engineering, economics, or any of the physical sciences.
Master’s in Computational Mathematics

• Six courses in the first two terms, and a supervised research project in the third term

• Potential research project areas:
  – computational finance
  – machine learning
  – numerical linear algebra
  – computer algebra
  – computational fluid dynamics
  – biomedical computing
  – image processing
  – …
Comp Math in Bio-Medical Applications

- Medical Imaging (fMRI), 3D reconstruction
- Biochemical Models, Parameter estimation
Comp Math in Data-Mining Applications

- Visualizing web requests on a single server and different requesters (IP addresses) over time.
Comp Math in Earth and Space Applications

“Ice Age” simulation

Generating “grids”
Comp Math in Finance/Econ Applications

- Computational finance, game theory, statistical simulation
- E.g. stock prices cannot be predicted with certainty; determine the least cost strategy with minimal risk

![Graph showing efficient frontiers of Mean Variance-optimal strategies. The frontiers labeled with PDE are obtained from the PDE value functions. The frontiers labeled with Hybrid are obtained from Monte Carlo simulations which use the optimal controls determined by solving the HJB PDE (3.2.7).]
Master’s in Computational Mathematics

Core courses (take 4 out of 5)

1. Numerical Analysis (AM/CS)
2. Fundamentals of Optimization (CO)
3. Computational Statistics (STAT)
4. Introduction to Symbolic Computation (CS)
5. Numerical Solution of Partial Differential Equations (AM)

+ 2 ‘computational’ electives (from any department)
Master’s in Computational Mathematics

• This is a *challenging, ‘elite’* program:
  – 6 courses over 2 terms, highly interdisciplinary
  – intensive, high-paced (3 terms, instead of 4-6 terms for some other Master’s programs)

• Provides students with a *fast track* to:
  – PhD studies (you can start PhD after one year)
  – exciting jobs in technology, industry, finance, banking, biomedical applications, research labs, ...
Master’s in Computational Mathematics

• **Funding**: approximately $20,000 for domestic students and $24,000 for international students for one year
  – Teaching Assistantships, Research Assistantship

• **Scholarships and Awards**:
  – Fong Computational Mathematics Graduate Award
  – Keith and Debbie Geddes Graduate Scholarship in Computational Mathematics
  – External scholarships, e.g. NSERC, OGS
Examples of Research Projects

• “Numerical Comparisons of Iterative Methods for Pricing American Options under Regime Switching”

• “Predicting Results of Biological Experiments Using Matrix Completion Algorithms”

• “Minimal Curvature Variation Flow in Image Inpainting”

• “Modelling of Shallow Water Equations and the Weather Research and Forecasting (WRF) Model”

• “The Application of Deep Kernel Machines to Various Types of Data”

• “Computing the Nearest Correlation Matrix using Difference Map Algorithm”

• “Determining Solution of Rational Linear Systems of Polynomials over Abstract Fields”

• “Matrix-Matrix Multiplications on GPUs for Accelerating a Parallel Fluid Dynamics Code”
CM Grads at Work

- Technology Analyst at Citigroup
- Analyst at Deloitte
- Java Developer at Rethink Solutions Inc
- Research Assistant at RNA Diagnostics Inc
- Statistics Canada
- Open Text
- Oracle, California
- GDF Suez Energy, Texas
- Consultant with Accenture
- PhD studies at UW, UoT, McGill, UWO, Stanford