Theory Concentration
Focus

- Problem Solving
  - Small scale -> Single method/function rather than an entire application
  - Hard problems
    - Difficult to find any solution
    - Difficult to find a good solution
    - Difficult to find a fast solution
  - Math and logic

- Students in this concentration will be exposed to various problem-solving techniques and algorithms, analytical thought, first order logic and will be very mathematically oriented.
Why Study Theory?

- You like solving difficult problems.
- You like math.
- Examples:
  - Good search algorithm returns fast results that are relevant.
  - Self driving car makes good decisions (and doesn’t cause accidents).
  - Mapping software must suggest a good route.
Required Courses

- Math: Linear algebra, calculus and discrete math.
- Statistics
- Logic
- CPSC 313 – Computability
- CPSC 413 – Design and analysis of algorithms (and complexity)
- 6 additional half courses (maximum of two at 300 level)
  - Mathematics 311, 313, Pure Mathematics 527,
  - Statistics 321,
  - Philosophy 379,
  - Computer Science 411, 418, 491, 502.02, 503.02, 511, 513, 517, 518, 519, 521, 522, 530, 561
• Take a lot of Math courses (beyond minimum required)
• Participate in programming competitions
What will you learn in these courses?

- Mathematical terminology and techniques
  - Unambiguous and precise
- Mathematical analysis
  - Precise and convincing
- Many problem solving approaches
  - Divide and conquer, randomized, brute force, quantum, cryptography, etc.
- Classifying problems
  - By difficulty
  - Similarity
Skills Needed

- Thorough and detail oriented
- Strong math skills
- Creative
Type of careers

- Work for any company that has difficult problems to solve:
  - Google, Amazon, Microsoft, Oil&Gas, etc.
- Software development
- Entrepreneurship
- Etc.
Who?

- Wayne Eberly (Computer Algebra)
- Peter Hoyer (Quantum)
- Philipp Woelfel (Distributed and Random Algorithms)
- Robin Cockett (Programming Languages and Category Theory)
- Michael Jacobson (Security)

Summer Research
- Complete the theory courses early (313 and 413)
- Take additional math courses!