Foundations of Computer Science
University of Virginia

Professor Gabriel Robins

**Purpose:** to study the foundations of computer science, including discrete mathematics, formal languages, automata theory, computability, complexity, and algorithmics, with a focus on problem-solving.

> the Mock Turtle said, "No wise fish would go anywhere without a porpoise."

**Fundamentals:**
- Historical perspectives
- Sets, logic, and notation
- Infinities and countability
- Proof techniques
- Problem solving

**Formal languages and machine models:**
- The Chomsky hierarchy
- Regular languages / finite automata
- Context-free grammars / pushdown automata
- Context-sensitive grammars / linear-bounded automata
- Unrestricted grammars / Turing machines

**Computability and undecidability:**
- Basic models
- Capabilities and extensions
- Decidability
- Church's thesis
- Undecidability

**NP-completeness:**
- Algorithms
- Complexity
- Intractability
- Transformations
- Approximation heuristics

> "I didn't know it," the Knight said, a shade of vexation passing over his face.
**Prerequisites:** Some discrete math and algorithms background would be helpful, but not necessary.


**Grading scheme:**
- Homeworks: 25%
- Midterm: 25%
- Final: 25%
- Project: 25%
- Extra credit: 10%

- There will be several homework assignments, and solutions will be reviewed in class.
- There will often be in-class extra-credit problems: participation in these would help your grade (although non-participation in extra-credit will not hurt your grade).
- Extra credit will be given to the first finder of each mistake in my handouts and slides.
- Extra credit will be given to for turning in the project early.

"It seems a shame," the Walrus said, "To play them such a trick."

- Class handouts and Q&A will be posted on the Web at: www.cs.virginia.edu/robins

**Good advice:**

- Please start working on the homeworks early, and work in groups.
- Please solve lots of problems and ask many questions along the way.

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