

**CSC702**                      **Spring 2015**  
**Theory of Computation**

**Professor:** Torgersen

**Office Phone:** 758-5536

**Office Hours:** MWF 3:00 – 4:30 and by appointment

**Text:** Introduction to the Theory of Computation, 3<sup>rd</sup> edition, by Michael Sipser (2<sup>nd</sup> edition OK).

**Goals:**

1. Survey of various models of computation, corresponding classes of languages, and an understanding of the fundamental limits of computation.
2. Models of computation and languages
  - (a) Finite Automata and Regular Languages
    - i. Equivalence theorems for regular languages
    - ii. Non-regular languages
  - (b) Non-determinism
  - (c) Context free grammars, pushdown automata, and context free languages
    - i. Equivalence theorems for CFG and pushdown automata
    - ii. Non-regular (but context free) languages
    - iii. Non-context-free languages
  - (d) Turing Machines, Turing decidable languages, and Turing recognizable languages
    - i. Deterministic Turing Machines
    - ii. Non-Deterministic Turing Machines
3. Turing Decidability
  - (a) The Halting Problem and related undecidable problems
  - (b) Decidability of acceptance, emptiness, and equality problems for Finite Automata, Pushdown Automata, and Turing Machines
  - (c) Mapping reducibility
4. Additional Topics
  - (a) The Recursion Theorem
  - (b) Information and incompressible strings (as time allows)
5. Time Complexity
  - (a) The classes  $\mathcal{P}$  and  $\mathcal{NP}$
  - (b) Cook-Levin Theorem
  - (c)  $\mathcal{NP}$ -complete problems
  - (d) Proofs using polynomial time mapping reductions
6. Space complexity,  $\mathcal{P}$ -space, and  $\mathcal{P}$ -Space Complete Languages
7. Space and time Hierarchies

**Expectations:**

1. Attendance
2. Your best effort
3. Communicate your thoughts and concerns

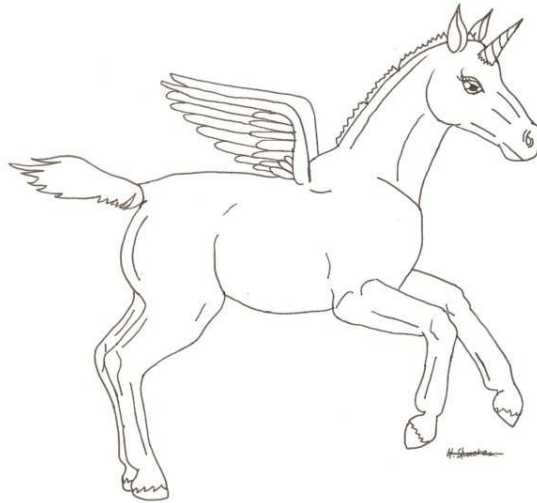
**Grading:** 3 exams (65%). As many take home problem sets as we can schedule (expected 5 to 6) (35%).

**Disability Notice:**

If you have a disability that may require an accommodation for taking this course, then please contact the Learning Assistance Center (758-5929) within the first two weeks of the semester.

**Pandemic Planning Notice:**

The University has requested that faculty collect personal contact information as part of emergency planning and preparation. The information you provide is strictly confidential.



Never proven to exist nor proven to not exist