Topics in Computability and Learning

Meenakshi D'Souza

International Institute of Information Technology
Bangalore.

Course Outline

- Brief re-cap of finite state automata, Monadic second-order logic and finite state automata, Presburger arithmetic and finite state automata, Learning regular languages.
- Decision trees, ID3 algorithm, learning program invariants using regular languages an decision trees.
- Push down automata, context-free languages, visibily push down systems.
- Turing machines, recursive and recursively enumerable languages, alternate models of Turing machines, non-deterministic Turing machines, some properties.
- Halting problem, reductions, undecidability, Rice's theorem, analytical hierarchy.
- Complexity theory: Class P, Classes NP, NP-hard and NP-complete, Cook-Levin theorem, Class PSPACE, Savitch's theorem.

Text books

- *Theory of Computation* by Michael Sipser, Cengage, 3rd edition, October 2014.
- *Automata and Computability* by Dexter C. Kozen, Springer, New York, 1997.
- *Machine Learning* by Tom Mitchell, McGraw Hill, 1997.
- Research papers on relevant topics.

Evaluation

- Two class tests, mid-semester and final exams will be conducted.
- One assignment will be a seminar or a third class test.
- Final grade will be given based on performance on all of the above, 50% of marks for mid-semester and final exam put together, 50% of marks for the class tests and seminar.
- All tests will focus on problem solving.
- There is no project work in this course.