

IT422 Models of Computation

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Objectives

The theoretical foundations of computer science have expanded substantially in recent years. The objective of this course is to introduce students to this fundamental area of computer science which enables students to focus on the study of abstract models of computation. These abstract models allow the students to assess via formal reasoning what could be achieved through computing when they are using it to solve problems in science and engineering. The course exposes students to the computability theory, as well as to the complexity theory. The goal is to allow them to answer fundamental questions about problems, such as whether they can or not be computed, and if they can, how efficiently.

The course introduces basic computation models and their properties, and the necessary mathematical techniques to prove more advanced attributes of these models. The students will be able to express computer science problems as mathematical statements and to formulate proofs. Upon completion of this course the students are expected to become proficient in key topics of theory of computation, and to have the opportunity to explore the current topics in this area.

Contents

Finite Automata, Regular expressions and Languages, Properties of regular languages, Context-Free grammar and Languages, Pushdown automata, Properties of Context-Free languages, Introduction to Turing Machine, Undecidability, Intractable problems

Prerequisite

Algorithms and Complexity, Discrete Mathematics

Text Books

1. Introduction to Automata Theory, Languages and Computations, J. E. Hopcroft, R Motwani, J. D Ullman, Addison Wesley

References

1. Introduction to the Theory of Computation, Michael Sipser, PWS Publishing
2. Elements of the Theory of Computation, H.R. Lewis, C.H. Papadimitriou, Prentice Hall PTR Upper Saddle River, NJ, USA
3. Computers and Intractability: A Guide to the Theory of NP-completeness, M. Garey and D. Johnson, W.H. Freeman and Company, New York, 1979.

Grading Scheme

Assignments 20%
InSem 1 20%
InSem 2 20%
Final Exam 40%