Punjab University College of Information Technology
Allama Iqbal Campus (Old Campus), University of the Punjab, Lahore.

CS-515 – Theory of Computation

Course Description:

The course of CS-515 – Theory of Computation gives a broad introduction to the computability theory and the complexity theory. It starts off with giving a mathematical model of computation, and develops the notion of what it means for something to be computable. It explores notions like decidability, undecidability, and complexity of problems. It then gives a broad introduction to the key results of complexity theory, covering both time and space complexity.

Goals and Objectives:

Developing a theoretical understanding of computation is one of the key objectives. It involves becoming aware of, and developing appreciation of, the key questions that were asked regarding computation. Getting comfortable with approaching computational problems on solid mathematical foundations is another objective.

Course Contents

Mathematical preliminaries, automata theory (review), Turing machines, Church-Turing thesis, decidable languages, the halting problem, reducibility, undecidability, time complexity, the class P, the class NP, P vs NP, NP-completeness, Cook-Levin theorem, polynomial time reductions of different problems to prove them NP-Complete, space complexity, Savitch's theorem, the class PSPACE

Related Text / Reading Material:

1. *Michael Sipser, "Theory of Computation",* 3rd edition
2. *Christos H. Papadimitriou, "Computational Complexity"*
3. *Thomas H. Cormen et al. "Introduction to Algorithms",* 3rd edition