CIS 675

Analysis of Algorithms

Syllabus

Text

Introduction to Algorithms, T. Cormen, C. Leiserson, & R. Rivest, McGraw Hill/MIT Press.

Course Work

Weekly homeworks, a midterm and a final. Some computer work!

Core Topics

All of following topics are covered in the course.

- Mathematical foundations, including: asymptotic notation, summations and their approximations, and recurrences.
- Sorting algorithms, including: insertion sort, heap sort, merge sort, quick sort, counting sort, radix sort, and hybrid schemes. Worst case analyses of all of the above. Average time analyses of insertion, heap, and quick sorts.
- Heaps and priority queues.
- Advanced data structures : Binomial trees etc.
- Hashing, including: open and closed addressing and universal hashing.
- Binary search trees.

- Dynamic programming algorithms, including: transitive closure, shortest paths, memoization.
- Greedy algorithms, including: minimal spanning trees, shortest paths (single source), scheduling.
- Divide-and-Conquer Algorithms, including: binary search, merge sort, quick sort, FFT.
- Graph algorithms, including: tree and graph traversals, depth-first-search, biconnected components, strongly connected components, topological sorting, and backtracking in searching di-graphs.
- Balanced tree schemes: red-black trees, B-trees.
- (Depending upon time) String-searching, including Knuth-Morris-Pratt and Boyer-Moore.
- Maximum Flow—the Ford-Fulkerson method
- Elementary computational geometry, including convex hulls and finding closest pairs of points.
- Elementary computational number theory, including greatest common divisor, modular arithmetic, the Chinese remainder theorem, application to public-key cryptosystems (depending upon time).
- NP-completeness and related topics.