Curriculum for Algorithm Engineering (INF237)

Spring 2018

A series of lecture notes will be compiled that covers the content of the course. The topics included will be approximately:

- Basic graph algorithms: Breadth First Search, Depth First Search and applications
- Graph algorithms: Computing minimum spanning trees, Dijkstra's algorithm, the Bellmann-Ford Algorithm and the Floyd-Warshall Algorithm.
- Advanced graph algorithms: Matchings in bipartite graphs, cuts and flows
- Dynamic programming: From sequences to bit masks. LIS, Knapsack, Edit Distance, TSP, DP on trees.
- Counting- and Fenwick Trees: Dynamically counting over intervals
- Geometry: Basic computations, computing the area of a polygon, and testing for polygon containment
- Advanced geometry: Computing convex hulls and finding closest pair of points in the plane
- Searching: Binary- and ternary search, data structures for fast containment tests and sliding window algorithms
- Greedy algorithms: Strategies and proofs
- Exponential time algorithms: Branching, bidirectional search, permutations and subsets
- String algorithms: The Knuth-Morris-Pratt algorithm, Suffix-trees and various Dynamic programming schemes on strings.
- Solving 2-SAT instances
- The inclusion-exclusion principle
- Combinatorics: Applications of Fibonacci, Binomial and Catalan Numbers
- Number theory: Greatest common divisor, Least common ancestor, testing and generating prime numbers, the Extended Euclidean algorithm and modulo arithmetic.

Note: the lecture notes might (probably will!) be incomplete for some of the above topics, however each of the topics is properly covered by appropriate google searches.

Each of the following two books cover *a good fraction* of the course, and you are welcome to buy them. Some students prefer learning from these books. However, it is perfectly doable to get through the course using only the lecture notes that will be published online, and searching for each topic individually online.

Competitive Programming 3: The New Lower Bound of Programming Contests. *by Steven Halim and Felix Halim*

Programming Challenges: The Programming Contest Training Manual *by Steven S Skiena, Miguel A. Revilla*

These books are hard to find in Norway, however they are very available on Amazon. I suggest students go together and order several books at once in bulk to minimize the shipping cost.