

COT 6405 Analysis of Algorithms Project

Posted on March 3, due on April 21

Goals

The first goal is to observe empirically the complexity of different algorithms solving the same problem. The second goal is to discover how accurate the theoretical complexity estimates are when compared to real execution times.

Methodology

You need to select a problem and two competing algorithms that solve that problem. The problem/algorithms might be from the ones we studied in class, or they may be different (e.g. design and analyze your own algorithms, or research them in books, articles, online, etc.). The two competing algorithms must use different algorithmic techniques (e.g. divide-and-conquer, dynamic programming, greedy, etc.) and they preferably have different running times when expressed using asymptotic notations. An important part of this project is planning the experiments for the comparison.

You are to implement both algorithms and measure their running times. Suggested programming languages are C, C++, or Java. Consult the instructor for other programming languages.

The **project proposal** is due on March 24, 2016 and it must be submitted on Blackboard. It consists of:

- Brief description of the problem chosen
- Real-world application(s) of your problem
- Brief description of the two competing algorithms and their worst case running time. Add references for the selected algorithms.
- Planning of the experiments: (1) what graphs do you plan to generate for the comparison of the two algorithms, what metrics will you have on the x and y axes, and (2) how accurate the theoretical complexity estimates are when compared to real execution times?
- Programming language to be used to implement the algorithms

The proposal must be typed. I will review your proposal and provide feedback on Blackboard within 1 week if the proposal is approved. I will **not** approve:

- Topics that are too trivial or that are too far removed from the study of algorithms.
- Submissions of problems/algorithms that you are already studying for your MS/PhD thesis.
- Selecting the *Sorting problem*.

Others:

- Brute force technique is accepted, but you need to be careful if choosing algorithms with large complexity such as exponential or factorial, because the algorithms will run very slowly for larger n

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The **final project submission** is due on April 21, 2016 and it must be submitted on Blackboard. It consists of:

- The report document must be typed and it contains:
 - A detailed description of the project (follow the items in the project proposal)
 - Results of experiments (include graph(s) showing the running time and explain how your empirical results relate to theoretical complexity analysis)
- The code

Grading

- The maximum total is 100 points, consisting of:
 - Report document: 60 points
 - Code: 40 points
- A penalty of 10 points is applied if the project proposal is not received by the deadline.

Example of problems selected in the past:

- Single Source Shortest Path
- Closest Pair of Points
- Maximum Flow
- String Matching
- 0-1 knapsack
- Traveling salesman problem
- Subset sum problem
- Graph coloring problem
- Finding the fake coin
- Change making problem
- Longest common subsequence
- Majority Element problem