

CS344: Design And Analysis of Computer Algorithms

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Details

- TAs:
 - André Madeira. Rec: Wed 3.05 to 4 PM, SEC 217.
Office Hours: Mondays 2 - 4 pm (Hill 206)
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 - Rohan Fernandes: Rec: Fri 3.05 to 4 PM, SEC 211
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- Howeworks:
 - Out on fridays, due on tuesdays 11 days after.
 - Due at the beginning of the class.
 - Groups of 5. No exceptions (except possibly one).

Example

- Problem: Maximum subarray sum
- Input: Array $A[1..n]$ of integers.
- Output: $[i,j]$ such that $A[i]+\dots+A[j]$ is largest.
- We designed n^3 and n^2 algorithms. What is the best possible?

Why we care about running time?

- Say $n=10^6$. Using a 10MIPS machine.
 - n^3 algorithm takes time 10^{11} , roughly 500 years.
 - n^2 algorithm takes time 10^5 , roughly 1 day.
 - n algorithm takes time 0.1sec.

Clever algorithms beats fast machine.

- Think about the following back-of-the-envelope calculation. If you had one day to solve a problem on your PC, what is the largest n you can handle if you are using an algorithm that takes time n^3 , n^2 or n .

How do we measure running time?

- OS clock?
- Compile, determine the number of instructions and time per instruction, and add?
- Factors affecting speed:
 - Compiler optimization
 - Machine speed
 - Memory access.
 - Coding tricks
 - Good algorithms

This course is about good algorithms.

Example

- Find any number of algorithms you can for
 - finding the number of 1's in an unsigned integer
 - finding what is the position of the most significant bit in an unsigned integer.
- Check out <http://www/db.stanford.edu/~manku/bitcount.html> for a wonderful expose'.
- Lessons:
 - even on simple problems, creative solutions abound.
 - difficult to develop a theory of algorithms for measuring *exact* performance of algorithms on all machines and environments.

A Warm Up Problem

- A celebrity is a person who knows nobody but whom everyone knows. Say there are n people. You can ask any person A if they know person B . How many questions do you have to ask to determine the celebrity?
- I/p: n I/p Size: n O/p: Name of celebrity Straightforward: Yes Best: Yes Correctness: Yes Number of questions? $2n - 2$