Week 11: Review

CSC 236:Introduction to the Theory of Computation

Summer 2024

Instructor: Lily

Announcements

- Course evaluations are available now! *(open until August 14th)*
  - We ***highly encourage*** everyone to fill it out
  - Once you filled out the evaluation, take quiz 11 and select “true” (honor system, please don’t lie)
- Office hours will continue until the 16th of August
  - Tuesday office hours are now 5~6:00pm ***online***
- For those who missed the final
  - ***There are NO make-up exams or alternative assessments***
  - Petition to write a deferred in-person final exam with the Fall offering of the course on the Arts&Sci website
- *There is no tutorial after this class*

Iterative algorithm

Given a *zero-indexed* list P containing the price of a single stock over n days we want to ***find the maximum profit when making a single buy and a single sell trade***.

$P[i]$ is the price of the stock on day i for $i \in \{0, \dots, n-1\}$. If you buy on day i and sell on day j, then *your profit would be* $P[j] - P[i]$. You can only sell *after* you buy.

The Algorithm should compute $\max_{0 \le i < j < n} P[j] - P[i]$

Recurrence Relation

M2 Q3. Compute a tight *upper bound* for the closed form of the following recurrence relation: $T(n) = c$ for $n \leq 10$ for constant c and otherwise

$$T(n) = T\left(\left\lfloor \frac{n}{2} \right\rfloor + 1\right) + n$$

Recurrence Relation

A5 Q1 (a) Find and prove the closed form expression for the recurrence relation

$$T(n) = T(\alpha n) + T\big((1-\alpha)n\big) + cn$$

Recursive Algorithm – Divide and Conquer

Given a *zero-indexed* array P of length n, find the maximum sum of any subsequence of P.

Divide and Conquer Example

Compute x^n for integer x and natural number n.

What we learned this semester

- Combinatorics
  - Permutations, combinations, stars and bars
  - Binomial Coefficient, Fibonacci numbers
  - Pigeonhole Principle
  - Graph theory: trees, cycles, paths, etc.
- Proof of correctness
  - Iterative algorithm: simple multiplication algorithms, Prim's algorithm, etc.
  - Recursive algorithm: Karatsuba's algorithm, quicksort, divide-and-conquer, etc.
- Finite Automaton
  - **Languages are just sets of strings**
  - Regular languages
  - Definition of DFA, NFA, and regex
  - Proof of equivalence of the three
  - Limitations of regular languages: **Regular languages cannot count**