

CISC-471 FALL 2019

HOMEWORK 6

Please work on these problems and be prepared to share your solutions with classmates in class on Monday Nov. 4. Assignments will **not** be collected for grading.

PROBLEMS

These questions come from *An Introduction to Bioinformatics Algorithms* by Neil C. Jones and Pavel A. Pevzner.

Problem 7.3: Suppose that you are given an array A of n words sorted in lexicographic order and want to search this list for some arbitrary word, perhaps w (we write the number of characters in w as $|w|$). Design three algorithms to determine if w is in the list: one should have $O(n|w|)$ running time; another should have $O(|w|\log n)$ running time but use no space (except for A and w); and the third should have $O(|w|)$ running time but can use as much additional space as needed. (NOTE: the stated costs are expressed for answering one query. The set up cost, or the pre-processing can be ignored for the purposes of this question.)

Not from textbook: Prove using mathematical induction that:

$$\sum_{i=1}^n \frac{1}{2^i} = 1 - \frac{1}{2^n}$$

for all natural numbers $n \geq 1$.

Not from textbook: Let n be a positive integer, and x can be any floating point number.

An easy way to compute x^n uses n multiplications of x .

However, a divide and conquer strategy can be used to compute x^n using $O(\log n)$ multiplications.

Design an algorithm to do this and implement it in a programming language of your choice.

Note: you can ignore overflow issues for this exercise.