

CS180 Homework 4

Due: June 5, 11:59pm

1. (25 pt) A palindrome is a string that reads the same from left to right and from right to left. Design an algorithm to find the minimum number of characters required to make a given string to a palindrome if you are allowed to insert characters at any position of the string. For example, for the input “aab” the output should be 1 (we’ll add a ‘b’ in the beginning so it becomes “baab”).
The algorithm should run in $O(n^2)$ time if the input string has length n .
2. (25 pt) Consider the problem of “Approx-3SAT”: The input is the same as 3-SAT, which is a boolean expression $C_1 \wedge C_2 \wedge \dots \wedge C_n$ where each C_i is an “or” of three literals (each literal can be one of $x_1, \dots, x_m, \neg x_1, \dots, \neg x_m$). Note that we assume a clause cannot contain duplicate literals (e.g., $(x_1 \vee x_1 \vee x_2)$ is not allowed). Instead of determining whether there’s a truth assignment on $\{x_i\}_{i=1}^m$ that satisfies this boolean expression (which means it satisfies all the clauses), instead for Approx-3SAT we want to determine whether there’s an assignment that satisfies at least $n - 1$ clauses.

Prove that 3-SAT can be polynomial time reduced to Approx-3-SAT.

★ Homework assignments are due on the exact time indicated. Please submit your homework using the Gradescope system. Email attachments or other electronic delivery methods are not acceptable. To learn how to use Gradescope, you can:

- 1. Watch the one-minute video with complete instructions from here:
<https://www.youtube.com/watch?v=-wemzvnvGPfg>
- 2. Follow the instructions to generate a PDF scan of the assignments:
http://gradescope-static-assets.s3-us-west-2.amazonaws.com/help/submitting_hw_guide.pdf
- 3. **Make sure you start each problem on a new page.**

★ We recommend to use \LaTeX , \LyX or other word processing software for submitting the homework. This is not a requirement but it helps us to grade the homework and give feedback. For grading, we will take into account both the correctness and the clarity. Your answer are supposed to be in a simple and understandable manner. Sloppy answers are expected to receive fewer points.

★ Unless specified, you should justify your algorithm with proof of correctness and time complexity.