CSE548/AMS542 Fall 2018 Analysis of Algorithms

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September 4, 2018

Due **September 16th** 9pm. Each problem, unless specified otherwise, has a maximum of 10 points. Avoid too many details. A succinct and clean proof is the best. You may use the algorithms we covered in class without referring to the details.

We may select a random subset of the problems to grade.

Homework 1

1. Textbook [Kleinberg & Tardos] Chapter 2, page 69, problem #8.
2. Textbook [Kleinberg & Tardos] Chapter 3, page 107, problem #4 .
3. Textbook [Kleinberg & Tardos] Chapter 3, page 107, problem #11 .
4. List the following functions in increasing asymptotic order. Between each adjacent functions in your list, indicate whether they are asymptotically equivalent ($f(n) \in \Theta(g(n))$, you may use the notation that $f(n) \equiv g(n)$) or if one is strictly less than the other ($f(n) \in o(g(n))$ and use the notation that $f(n) \prec g(n)$).

$5n^3 + \log n$	2^n	$3^{n/2}$	$2^{n/3}$	$\sqrt{\lg n}$
$\ln n$	$2^{\sqrt{\lg n}}$	$\min\{n^2, 1045n\}$	$\sum_{i=1}^{n} i^{77}$	$n^{\ln 4}$
$\lfloor n^2/45 \rfloor$	$\lceil n^2/45 \rceil$	$n^2/45$	$\lg \sqrt{n}$	$\lg \lg n$
$\sum_{i=1}^{n} 1/i$	$\sum_{i=1}^{n} 1/i^2$	$\sum_{i=1}^{n} (i^2 + 5i)/(6i^4 + 7)$	$\ln(n!)$	$(\lg n)^{\sqrt{\lg n}}$

5. An Euler tour of a graph G is a closed walk through G that traverses every edge of G exactly once.
   (a) Prove that a connected graph G has an Euler tour if and only if every vertex has even degree.
   (b) Describe and analyze an algorithm to compute an Euler tour in a given graph, or correctly report that no such tour exists.
6. Prove that any connected acyclic graph with $n \geq 2$ vertices have at least two vertices with degree 1. Notice that you should not use any known properties of trees and your proof should follow from the definitions directly.

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