COMPSCI H311 Spring 2020 - Homework 4

Released: Friday 6 March February 2020. Due: Friday 13 March

List your collaborators if any. The writeup you present must be your own work in presentation, and you must acknowledge all sources of aid other than course staff and course material.

Divide-and-conquer Multiplication

a) Suppose the numbers we want to multiply have different lengths in digits. Describe a variant of the Karatsuba's algorithm done in class that multiplies an m-digit number and an n-digit number (with $m \leq n$) in time $O(nm^{\log_2 3-1})$.

b) Describe an algorithm that computes the decimal representation of 2^n in $O(n^{\log_2 3})$, using your algorithm from point a). (Hint: Think first about how you'd compute 2^n efficiently.)

c) Can you compute the decimal representation of any n-bit number in the same asymptotic time?