Algorithms Assignment 1

Your name here & Computing ID

1 Introduction

This assignment is shared between algorithms sections.
Credit: Assit Prof. Brunelle & Assit Prof. Hott

PROBLEM 1 *Asymptotic*

Prove or disprove each of the following conjectures.

1. $2^{n+1} = O(2^n)$.
2. $2^{2n} = O(2^n)$.
3. Given that: $\forall \varepsilon > 0,\ \log(n) = o(n^\varepsilon)$,
   show:
   $\forall \varepsilon, k > 0,\ \log^k(n) = o(n^\varepsilon)$

PROBLEM 2 *Solving Recurrences*

Prove a (as tight as possible) O (big-Oh) asymptotic bound on the following recurrences. You may use any base cases you'd like.

1. $T(n) = 4T(\frac{n}{3}) + n \log n$
2. $T(n) = 3T(\frac{n}{3} - 2) + \frac{n}{2}$
3. $T(n) = 2T(\sqrt{n}) + n$

PROBLEM 3 *Karatsuba Example*

Illustrate the Karatsuba algorithm on 20194102×37591056. Use 2-digit multiplication as your base case.