CS 343 Analysis of Algorithms, Spring 2008

Exercises: Recurrence Equations

1. Use telescoping to solve (assume T(1) = 1)

   (a) $T(n) = T(n/2) + 1$. This is binary search.

   (b) $T(n) = T(n-1) + n$.

2. Use the master equation to solve

   (a) $T(n) = 4T(n/2) + n$.

   (b) $T(n) = 4T(n/2) + n^2$.

   (c) $T(n) = 4T(n/2) + n^3$

3. Give the asymptotic bounds for T(n) in each of the following recurrences. Assume T(n) is constant for $n \leq 2$. Make your bounds as tight as possible and justify your answers.

   (a) $T(n) = 3T(3n/2) + 1$. This is stooge sort.

   (b) $T(n) = 2T(n/2) + n$. This is merge sort.

   (c) $T(n) = 2T(n/2) + n^3$.

   (d) $T(n) = T(9n/10) + n$

   (e) $T(n) = 16T(n/4) + n^2$

   (f) $T(n) = 7T(n/3) + n^2$

   (g) $T(n) = 7T(n/2) + n^2$

   (h) $T(n) = 2T(n/4) + \sqrt{n}$

   (i) $T(n) = T(\sqrt{n}) + 1$

   (j) $T(n) = 3T(n/2) + n \lg n$