Algorithm Analysis Homework 1

Due by 3/26(Mon.) in class

1. For the functions, 4^n and 2^n, what is the asymptotic relationship between these functions? Select all that apply.

   (a) $4^n = O(2^n)$

   (b) $4^n = \Omega(2^n)$

   (c) $4^n = \Theta(2^n)$

2. For bubble sort algorithm,

   (a) Express the time complexity ($T(n)$) of selection sort in terms of data size n.

   (b) Solve above recurrence equation. You may use any method covered in class.

3. Use a recursion tree to determine a good asymptotic upper bound on the recurrence.

   $T(n) = 3T(n/2) + cn$, where $T(1) = 1$.

4. Using the recursion tree method, prove that $T(n) = \Theta(n^2)$.

$$T(n) = T(\frac{n}{4}) + T(\frac{n}{2}) + n^2$$

5. Use the master method to give tight asymptotic bounds for the following recurrences.

   (a) $T(n) = 6T\left(\frac{n}{3}\right) + n$

   (b) $T(n) = 9T\left(\frac{n}{3}\right) + n^2$