1. (20 points) Assume that $T(1) \in \Theta(1)$. Solve the following recurrences using the recursion tree method.

   a. $T(n) = 4T(n/2) + n^2$
   b. $T(n) = T(n-2) + n$
   c. $T(n) = T(n/2) + T(n/3) + n$
   d. $T(n) = 2T(n-2) + 1$

2. (50 points) Assume that $T(1) \in \Theta(1)$. Solve the following recurrence functions using the master method. If the master method cannot be applied, state the reason, and give an upper bound (big-Oh) as tight as you can. Justify your answer.

   a. $T(n) = 8T(n/2) + n^2$
   b. $T(n) = T(3n/5) + n$
   c. $T(n) = 9T(n/3) + n^2$
   d. $T(n) = 16T(n/4) + n \log n$
   e. $T(n) = 2T(n/4) + \log^2 n$
   f. $T(n) = 3T(n/3) + \log n$
   g. $T(n) = 4T(n/4) + n \log n$
   h. $T(n) = 2T(n/4) + \sqrt{n}$
   i. $T(n) = 3T(n/3) + (n + \log n)$
   j. $T(n) = 2T(n/2) + n/\log n$

3. (15 points) Assume that $T(1) \in \Theta(1)$ and $T(n) = T(n/4) + T(n/2) + n$. Prove $T(n) \in \Theta(n)$ using the substitution method.

4. (15 points) Analyze and compare the running time of the three algorithms described in HW2 Q4. You can use either recursion tree of master method to solve the recurrences.