CS302
Assignment 3
Due Date: Wednesday, September 25th at the beginning of class

1. (10 points) Evaluate the following summation $\sum_{i=0}^{\infty} \frac{1}{4^i}$

2. (10 points) Evaluate the following summation $\sum_{i=0}^{\infty} \frac{i}{4^i}$

3. (10 points) If our machine takes 0.5ms to finish for input size of 100, how large a problem can be solved in 1 minute if the running time is the following?
   (a) $O(n)$
   (b) $O(n \log n)$
   (c) $O(n^2)$
   (d) $O(n^3)$

4. (10 points) If our machine takes 0.5ms to finish for input size of 100, how long will it take to finish with input size of 500 for the following?
   (a) $O(n)$
   (b) $O(n \log n)$
   (c) $O(n^2)$
   (d) $O(n^3)$

5. (15 points) Rearrange the following functions from smallest asymptotic growth rate to the largest asymptotic growth, if any functions have the same asymptotic growth rate, please indicate that (use $<$ to denote the function on the right has a larger growth rate and use $=$ to denote same growth rate, for example $n < n^2$ and $3n = 4n$)

$$n\sqrt{n},\ 1000000,\ n\log n - 4n + 12,\ 2^n,\ 4000\log n + \frac{13n^2}{n}$$

6. (15 points) Perform insertion sort on the following list, show the steps of the inner loop and show when an iteration of the outer loop finishes.

$$10, 4, 5, 3, 1, 2, 7$$

7. (15 points) Perform mergesort on the following list, draw the recursive tree to shows how the problem is broken up and how the merge is done.

$$10, 11, 5, 16, 33, 12, 9, 5, 40, 18, 22, 4, 13, 1$$

8. (15 points) Perform quicksort on the following list, show the pivot and show how the left and right pointers are moving and how the elements are swapped after in each step, choose the leftmost element of each sublist as the pivot.

$$10, 11, 5, 16, 33, 12, 9, 5, 40, 18, 22, 4, 13, 1$$