Homework Assignment #1 **Name: _____**

Prof. Zhang

Due in class 9/11. Submit a hardcopy please.

1. Analyze the running time of the following simple functions given in pseudocode, by counting the number of computer steps when the function's input parameter is n, T(n). For (d), write a recursive formula for T(n).

(a). func_a (L[1…n]):

```
sum=0;

for i=1 to n:    // iterate through loop body for i=1, 2, … n
   sum = sum+L[i]

return sum
```

(b).

```
// calculating dot product of two vectors, L1 and L2
func_b (L1[1…n], L2[1…n]):

res = 0
for i=n to 1:
    res = res + L1[i]*L2[i]
```

(c).

```
func_c (int n):

for i= n to 1:     // this means repeat the loop body for i=n, n-1, n-2, … 2, 1
     for j=1 to (2*i+1)      // repeat the inner loop body for j=1, 2, … (2*i+1)
          sum = sum+j

return sum
```

(d). func_d (L[1…n]):

```
if n==0: return 0
if n==1: return L[1]

return (func_d(L[1…n/2]) + fund_d (L[n/2+1…n]))
```

2. (Python Coding. Please submit them by emails)

a) Revise the fib.py to add a third function that calculate Fn in linear time and constant space (memory).

b) Study the code given for sorting (see course website for the link to sort.py), and then 1) modify the code so that they sort the data in descending order, 2) read about binary search, and implement the algorithms in the code.

3. Write a pseudocode to calculate the variance of a data set given by data[1…n] (a list). Please follow the convention for pseudocode as those followed in the slides.

4. For the problem 3 above, revise the algorithm such that each data element is accessed only once. This will be important for streaming setting, or when it's time consuming to read the data element (for example, if the data set is huge and is stored in tape).