CS566 Homework-1

Due – Jan 29, 6:00 PM, at the class beginning

Student's Name: ___________________________________

Upload copy of your homework and any supporting materials (source code and test cases) online to Assignment1 in the CS566_A2 course site on the blackboard.

No extensions or late submissions for anything other than major emergency.

(1) [20 pts.]
Suppose Algorithm-1 does f(n) = *n***2 + *n* steps in the worst case, and Algorithm-2 does *g*(*n*) = 14n**1.25 + 10 steps in the worst case, for inputs of size *n*. For what input sizes is Algorithm-1 faster than Algorithm-2 (in the worst case)?

(2) [15 pts.]
Prove or disprove: T(n) = SUM{*i***4} = theta(*n***4),
where *i* changes from *i*=1 to *i*=*n*.

(3) [25 pts.]

Write out the algorithm (pseudocode) to find *K* in the **ordered** array by the method that compares *K* to every m-th entry (1< m is less than array size n) until *K* itself or an entry larger than *K* is found, and then, in the latter case, searches for *K* among the preceding m. How many comparisons does your algorithm do in the worst case?
Test your algorithm for m=3,4,5 … and come up with the general formula.

(4) [20 pts.] Compare two algorithms to raise an integer to an integer power
assume in both cases that n, the exponent, is a power of 2:

<u>Algorithm 1</u>

X**n = X* X**(n-1)
X**0 = 1

<u>Algorithm 2</u>

n = 2**m

Xn = ((X**2)**2)**2…, etc.**
NOTE: the symbol of power (**) is used *m* times here, i.e., X**8 = ((X**2)**2)**2, because 8 = 2**3.

Which algorithm is more efficient with respect to the number of multiplications

(5) [20 pts]

You are given 18 bags of gold coins. One bag contains all false coins that weigh several gram less. What is the minimum number of weighting required to identify false coins bag? Does the answer depend on the balance type: digital or not?