Homework 1

2.1-1 Using Figure 2.2 as a model, illustrate the operation of INSERTION-SORT on the array $A = \langle 31, 41, 59, 26, 41, 58 \rangle$

2.1-3

Consider the ***searching problem***:

Input: A sequence of *n* numbers $A = \langle a_1, a_2, \ldots, a_n \rangle$ and a value v_i.

Output: An index *i* such that $v = A[i]$ or the special value NIL if *v* does not appear in A.

Write pseudocode for linear search, which scans through the sequence, looking for *v*. Using a loop invariant, prove that your algorithm is correct. Make sure that your loop invariant fulfills the three necessary properties.

2.2-1 Express the function $n^3/1000 - 100n^2 - 100n + 3$ in terms of θ notation

2.3-1 Using Figure 2.4 as a model, illustrate the operation of merge sort on the array $A = \langle 3, 41, 52, 26, 38, 57, 9, 49 \rangle$

Homework2

1. Show that the solution of $T(n) = 2T(\lceil n/2 \rceil) + 1$ is $O(\lg n)$

2. Solve the recurrence $T(n) = 2T(\sqrt{n}) + 1$ by making a change of variables. Your solution should be asymptotically tight. Do not worry about whether values are integral.

3.(4.4-1) Use a recursion tree to determine a good asymptotic upper bound on the recurrence $T(n) = 3T(\lfloor n/2 \rfloor) + n$ Use the substitution method to verify your answer.

4. The recurrence $T(n)=7T(n/2)+n^2$ describes the running time of an algorithm A. A competing algorithm A' has a running time of $T'(n)=aT'(n/4)+n^2$. What is the largest integer value for a such that A' is asymptotically faster than A?

5.(4.5-3) Use the master method to show that the solution to the binary-search recurrence $T(n)=T(n/2)+\Theta(1)$ is $T(n)=\Theta(\lg n)$ (See Exercise 2.3-5 for a description of binary search.)

Homework3

6.1-1 What are the minimum and maximum numbers of elements in a heap of height h?

6.2-1 Using Figure 6.2 as a model, illustrate the operation of MAX-HEAPIFY(A,3) on the array $A = \langle 27, 17, 3, 16, 13, 10, 1, 5, 7, 12, 4, 8, 9, 0 \rangle$.

7.2-2 What is the running time of QUICKSORT when all elements of array A have the same value ?

8.2-1 Using Figure 8.2 as a model, illustrate the operation of COUNTING-SORT on the array $A = \langle 6, 0, 2, 0, 1, 3, 4, 6, 1, 3, 2 \rangle$

Homework4

1. Show how to modify the PRINT_STATIONS procedure to print out the stations in increasing order of station number. (Hint: Use recursion)

15.2-1 Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions is $\langle 5, 10, 3, 12, 5, 50, 6 \rangle$.

15.4-1 Determine an LCS of $\langle 1, 0, 0, 1, 0, 1, 0, 1 \rangle$ and $\langle 0, 1, 0, 1, 1, 0, 1, 1, 0 \rangle$

Homework5

24.1-1 Run the Bellman-Ford algorithm on the directed graph of Figure 24.4, using vertex *z* as the source. In each pass, relax edges in the same order as in the figure, and show the *d* and π values after each pass. Now, change the weight of edge *(z, x)* to 4 and run the algorithm again, using s as the source.

25.1-1 Run SLOW-ALL-PAIRS-SHORTEST-PATHS on the weighted, directed graph of Figure 25.2, showing the matrices that result for each iteration of the loop. Then do the same for FASTER-ALL-PAIRS-SHORTEST-PATHS.

25.2-1 Run the Floyd-Warshall algorithm on the weighted, directed graph of Figure 25.2. Show the matrix $D^{(k)}$ that results for each iteration of the outer loop.