Analysis of Algorithms

Homework 2

Due Febraury 24, 2017

1. (25 Points) Indicator Variable Exercises

    (a) From Cormen 5.4-1, 5.4-6

2. (25 Points) Priority Queue

    Implement the Max Priority Queue using a Max-Heap with all the operations described using the programming language C++. Then using the clock ticks, prove that the complexities described in the Cormen's book are correct by using adequate scales and plots with:

    (a) Worst Input

        i. Best Input
        ii. Random Input

    Note: You need a precise empirical analysis, be careful with the plotting.

3. (25 Points) Linear Sorting

    (a) Bucket Sort

    Implement the Bucket Sort using the programming language C++. Then using the clock ticks, prove that the complexities described in the Cormen's Book are correct by using adequate scales and plots with:

        i. Worst Input
        ii. Best Input
        iii. Random Input

    (b) Implement the Radix Sort Using C using decimal numbers with queues variant and prove if the complexities are correct for the Lemma 8.3 using the clock ticks, adequate scales and plots with:

        i. Worst Input
        ii. Best Input
        iii. Random Input

4. (25 Points)

    (a) Hash Tables

    Implement the Hash table using link list as collision policy, then test the complexity $O(1 + \alpha)$ for successful or unsuccessful search of the table using a correct range. For the hash table test the following hash functions:

        i. Universal Hashing using the Random Matrix (Using the bit counting idea).
        ii. The Division Method.
        iii. The Multiplication Method using the computer implementation.