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CS 3310

Assignment 2

Gupta

Stack and Queue Time Complexities

Over the past week or so I have been writing a program to compare the implementation of stacks and queues with linked lists and arrays. The program starts by asking the user for a number n. It then proceeds to generate a random number from range 0 to MAX_INT. After this is complete the program stores the number in binary form in all of the following data structures; array based queue, linked list based queue, array based stack, and linked list based stack. Once this is complete the program uses a method toDecimal (which is a method of each data structure class) to convert the stored binary digits back to the original randomly generated decimal number. After this process is complete the program prints out the time that this took for each data structure, n times, as well as the average time for each data structure. For test purposes I have generated results for n = 1, 50, 500, 1000, 50000, and 100000.

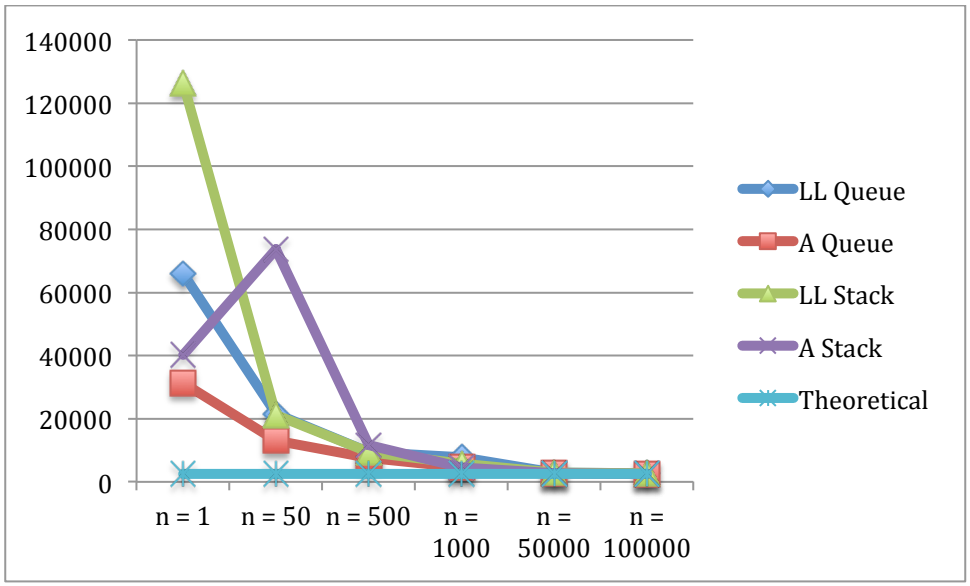
Theoretically all of the data structures should take about the same time to process this data since they all have a time complexity of O(1). As you can see in the table and plots below my observed time complexities seems to be accurate for any results over n = 500. The results before n = 500 seem scattered and random, most likely because there were not enough iterations minimize the effects of the outliers that appeared. Results after n = 500 seem to fall within about 1000 nanoseconds of

each other, as it should.

In conclusion, I cannot say any one data structure is better than the other. The preferred data structure would depend on how you would like to be able to store and access the different data.

Average time complexities of array based queue, linked list based queue, array based stack, and linked list based stack

	n = 1	n = 50	n = 500	n = 1000	n = 50000	n = 100000
LL Queue	65971	21636	9354	7773	2904	2661
A Queue	31265	13020	7518	4498	2671	2489
LL Stack	126411	21263	9344	5818	2913	2696
A Stack	40176	73642	11597	4576	2697	2509



^^^^Average and Theoretical time complexities of array based queue, linked list based queue, array based stack, and linked list based stack