UNIVERSITY OF VIRGINIA, DEPARTMENT OF COMPUTER SCIENCE

Queues - Stack and Queue Analysis

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1 SUMMARY

NOTE: This homework requires that you have a working implementation for the Stacks homework assignment as well as the Queues homework assignment. You must finish both those module homeworks before doing this assignment.

The goal of this homework is to write a report comparing the efficiency of linked-list based queues to array-based stacks. Theoretically, the runtimes for all operations on both these data structures is constant time. So, it is ok that we are comparing stacks to queues here. What we are really interested in is how much the resize operation on the stack, which is linear time and should slow us down, affects the overall performance of the stack versus the queue.

You will perform an experiment by doing the following:

1. Write some test code to time the various methods of your stack and queue. We are interested in testing enqueue versus push and dequeue versus pop

2. Run a small experiment timing each method. Because these methods are very fast, you'll need to invoke each MANY times before you see a slow enough performance and be able to compare your findings.

3. Write a report summarizing and analyzing your findings

4. **FILES TO DOWNLOAD:** None

5. **FILES TO SUBMIT:** stackAndQueueAnalysis.pdf

For this experiment, you should time your stack and queue by calling each method i. You may play around with i until you find a number that works well, but they should be the same for each method (e.g., don't execute enqueue 10^5 times and push 10^7 times). You should test the following methods:

```
/* You will test these methods: */

/* Compare the speeds of these two methods */
Queue.enqueue(T data);
Stack.push(T data);

/* Seperately, compare the speeds of these two */
Queue.dequeue();
Stack.pop();
```

1.1 Report

Summarize your experiment and your findings in a report. Make sure to adhere to these general guidelines:

- Your submission MUST BE a pdf document. You will receive a zero if it is not.

- Your document MUST be presented as if submitted to a professional publication outlet. You can use the template posted in the course repository or follow Springer's guidelines for conference proceedings.

- You should write your report as if it is original novel research.

- The grammar / spelling / professionalism of this document should be sound.

- When possible, do not use the first person. Instead of "I ran the code 60 times", use "The code was executed 60 times...".

In addition to the general guidelines above, please follow the following rough outline for your paper:

- **Abstract**: Summarize the entire document in a single paragraph

- **Introduction**: Present the problem, and provide details regarding the two strategies you implemented.

- **Methods**: Describe your methodology for collecting data. How many method calls, how many executions, how you averaged things, etc.

- **Results**: Describe your results from your execution runs.

- **Conclusion**: Interpret your results. Which methods were fast and which were slow? Did this surprise you? Does this align with the theoretical runtimes of those methods? How large did the lists need to get before you witnessed a slowdown?

Lastly, your paper MUST contain the following things:

- A table (methods section) summarizing the different methods and how many execution runs were done in each group.

- A table (results section) summarizing each method and the averages / std. dev. of runtimes for each (as well as any other data you decided to collect).

- Some kind of graph visualizing the results of the table from the previous bullet.