

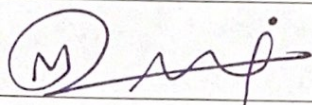
Quiz 01

COSC 211: Data Structures, Fall 2021

Instructions. This quiz is open book and open note—you may freely use your notes, lecture notes, or textbook while working on it. You may *not* consult any living resources such as other students or web forums. The quiz must be submitted by the beginning of class on Thursday, September 9th, 2021. If you do not attend class in person, you may email your scanned or typeset solution to the professor using the subject line [COSC 211] Quiz 01.

Affirmation. I attest that that work presented here is mine and mine alone. I have not consulted any disallowed resources while taking this quiz.

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Signature: 

Question 1. Suppose you are given two Stack instances with states $S_1 = (x_0, x_1, \dots, x_{n-1})$ and $S_2 = \varepsilon$ (empty), respectively. Suppose that i is an index satisfying $0 \leq i \leq n$. In the space below, describe how you can use the two Stacks to simulate the List operation $\text{add}(i, y)$. That is, you should describe a sequence of Stack operations applied to S_1 and S_2 such that after executing these operations, the state of S_1 is the same as if you had applied $\text{add}(i, y)$.

Hint: What is the effect of performing the the following three operations: (1) $S_2.\text{push}(S_1.\text{pop}())$, (2) $S_1.\text{push}(y)$, (3) $S_1.\text{push}(S_2.\text{pop}())$?

Solution

step 1 $S_2.\text{push}(S_1.\text{pop}()) \Rightarrow$ do this $(n-i)$ times

$$\begin{cases} S_1 = (x_0, x_1, x_2, \dots, x_{i-1}) \\ S_2 = (x_{n-1}, x_{n-2}, \dots, x_i) \end{cases}$$

step 2 $S_1.\text{push}(y) \Rightarrow \begin{cases} S_1 = (x_0, x_1, x_2, \dots, x_{i-1}, y) \\ S_2 = (x_{n-1}, x_{n-2}, \dots, x_i) \end{cases}$ only one time

step 3 $S_1.\text{push}(S_2.\text{pop}()) \Rightarrow$ do this $(n-i)$ times

$$\begin{cases} S_1 = (x_0, x_1, x_2, \dots, x_{i-1}, y, x_i, \dots, x_{n-2}, x_{n-1}) \\ S_2 = \varepsilon \end{cases}$$

\Downarrow
looks like $\text{add}(i, y)$ is implemented !!
final situation after a series of operations