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Lab 10: Stacks and Queues

1.1   Information

Topics: Stacks, Queues

Turn in: Your work in a text le, PDF le, scanned or photographed images.

This is another on-paper \lab", which is meant to help you become more familiar with how stacks and queues work.

1.2   About: Queues

Queues are rst-in- rst-out (FIFO) structures. The main functionality of a Queue is Push (to the back), Pop (from the front), and Front, which accesses the rst item in the queue.

Since items are pushed into the back of the queue and pulled out from the front, we essentially will work with the item that has been waiting the longest period of time before any of the items that were added after it get removed.

0	1	2	3	4
FRONT				BACK

1.3   About: Stacks

Stacks are last-in- rst-out (LIFO) structures. The main functionality of a Queue is Push (to the back), Pop (from the back), and Top, which accesses the last item in the stack (aka the \top" of the stack).

Stacks are usually thought of as items being stacked vertically, but if you're thinking of an array in a horizontal manner, the \bottom" is at index 0, and the \top" is at the index n 1, for a stack of size n.

Items are both pushed into the back and popped from the back, so before the \bottom-most" (rst-most) item is removed, all items added after it must be removed rst.

0	1	2	3	4
BOTTOM				TOP

Or...

4	TOP
3	
2	
1	
0	BOTTOM

1.4   Questions: Queues

Question 1   ____/2

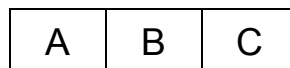Draw a queue structure at each step:
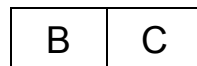
    Push("A");

1.
    | A |

    Push("B");

2.
    | A | B |

    Push("C");

3.
    | A | B | C |

    Pop();

4.
    | B | C |

    Push("D");

5.
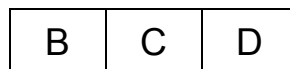 | B | C | D |

Question 2   ____ / 2

For the following queue, write out code commands for the queue (e.g., Push(\..."), Pop(), or Front()) to access element "D". Write in a linear order. At the end of your steps, the Front() function should return the requested item.

0	1	2	3	4	5
A	S	D	F	G	H

Pop(), Pop(), Front()

Question 3   ____ / 2

For each set of commands, what will be returned by the Front() function after all the commands have been executed?

     a. Push('A'); Push('B'); Push('C');

       Front() returns   __A__

     b. Push(2); Push(3); Push(4); Pop(); Push(5); Push(6);

       Front() returns   __3__

     c. Push(0); Pop(); Push(1); Push(2); Pop(); Push(3); Push(4);

       Front() returns   __2__

Question 4   ____ / 1

Give at least one example of how a queue may be used in computer science. Try to nd an example online if you can't think of anything. If you can't nd any good examples of software uses for programming, think of other technology/engineering elds and given an example.

        Queues are useful in applications like a printer queue. It takes the first "order" in and does that job first.
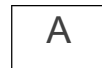
1.5   Questions: Stacks

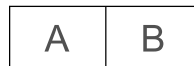Question 5   ____ / 2

Draw a stack structure at each step:
        Push("A");
    1.
```
| A |
```

2. Push("B");
```
| A | B |
```

3. Push("C");
```
| A | B | C |
```

4. Pop();
```
| A | B |
```

5. Push("D");
```
| A | B | D |
```

Question 6   ____ / 2

For the following stack, write out code commands for the queue (e.g., Push(\..."), Pop(), or Top()) to access element \D". Write in a linear order. At the end of your steps, the Front() function should return the requested item.

0	1	2	3	4	5
A	S	D	F	G	H

Pop(H), Pop(G), Pop(F), Top(D)

Question 7   ____ / 2

For each set of commands, what will be returned by the Top() function after all the commands have been executed?

   a. Push('A'); Push('B'); Push('C');

      Top() returns   ___C___

   b. Push(2); Push(3); Push(4); Pop(); Push(5); Push(6);

      Top() returns   ___6___

   c. Push(0); Pop(); Push(1); Push(2); Pop(); Push(3); Push(4);

      Top() returns   ___4___

Question 8   ____ / 1

Give at least one example of how a stack may be used in computer science. Try to nd an example online if you can't think of anything. If you can't nd any good examples of software uses for programming, think of other technology/engineering elds and given an example.

        Stacks are very significant regarding the Undo button. It takes away the current, most recent action. Last in, first out.