

Data Structures and Algorithms

Lab Exercises Week 3

1. Write your best attempt at each of the following without first looking at notes or a textbook.
 - Define the Stack ADT
 - Name the five principal operations of the Stack ADT
 - Under what circumstances does Stack throw an exception?
2. Use your implementation of a linked list from the Week 2 lab exercises to create a Stack ADT. Refer to Part 3 of the lecture notes for guidance if needed.
3. Devise an algorithm (pseudo-code or Java) that uses three stacks to sort letters. In the initial configuration all the letters are in random order on one of the stacks. At the conclusion of the algorithm all the letters must be sorted in order, with the lowest value (e.g. A) at the top of the stack. They can be on any one of the three stacks.

In the final version of your algorithm the moves should be represented by the Stack operations `pop()` and `push()`, with `size()` or `isEmpty()` controlling the progress of the process.

Hint: if you can distribute letters onto two stacks then you can selectively merge them onto the third.

4. Use your implementation of a linked list from the Week 2 lab exercises to create a Queue ADT. Refer to Part 4 of the lecture notes for guidance if needed.
5. Write your best attempt at each of the following without first looking at notes or a textbook.
 - Define the Queue ADT
 - Name the five principal operations of the Queue ADT
 - Under what circumstances does Queue throw an exception?

6. Complete the following table for the Queue ADT implemented by a circular array with five cells. The columns headed 0, 1, 2, 3, 4 are for the corresponding cells of the array. Refer to Part 4 of the lecture notes for guidance if needed.

operation	head	tail	0	1	2	3	4
enqueue(S)							
enqueue(J)							
enqueue(G)							
dequeue()							
dequeue()							
enqueue(C)							
dequeue()							
enqueue(B)							
enqueue(H)							
enqueue(E)							
dequeue()							
enqueue(M)							

7. In the circular array implementation of the Queue ADT it is necessary to copy the queue contents (in the right order) to a larger array when there is an enqueue operation and the queue is already full,. Devise an algorithm for the copying.