

# Practice Test

August 24, 2016

1. In the class `ArrayLinearList` a linear list is represented in a one-dimensional array element. The data member `size` is such that the list elements are in positions 0 through  $size - 1$  of the array. The member method `rightShift` shifts the elements of the linear list right by  $k$  positions and fills the empty positions at the left end with 0. For example, if the list element `[0:5] = [1, 2, 3, 4, 5, 6]`, whose size is 6, is shifted right by 3, the result is `[0, 0, 0, 1, 2, 3, 4, 5, 6]`, whose size is 9.
  - (a) Write Java code for the `rightShift` member method.
  - (b) What is the time complexity of your code as a function of the list size?
2. Consider the class `Chain` which has the data members `firstNode` and `size`. The data type of `firstNode` is `ChainNode`. Objects of type `ChainNode` have the data members `element` and `next`. Nodes on a chain are linked together using the field `next`. The method `isSorted`, which is a member of `Chain` determines whether the chain elements are in ascending (more accurately nondecreasing) order of their element values. The method returns `true` if the chain is sorted and `false` if it is not.
  - (a) Write Java code for the `isSorted` member method. To compare two objects `a` and `b` you may do something like

```
if (((Comparable) a).compareTo(b) > 0)
{
    // come here only if a greater than b
}
```

    - i. Comparable class define a natural ordering
      - A. `a < b` return - int
      - B. `a == b` return 0
      - C. `a > b` return +int
  - (b) What is the time complexity of your code as a function of the list length?

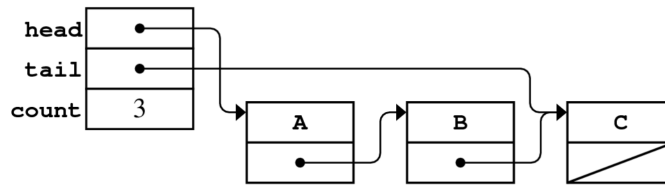
3. In an  $n \times n$  N-matrix, all terms other than those in column 1, column  $n$ , and the main diagonal are zero. An N-matrix has at most  $3n - 2$  nonzero terms. An N-matrix can be compactly stored in a one-dimensional array by first storing column 1, then column  $n$ , and then the remaining elements of the main diagonal.

$$\begin{matrix} x & 0 & 0 & 0 & x \\ x & x & 0 & 0 & x \\ x & 0 & x & 0 & x \\ x & 0 & 0 & x & x \\ x & 0 & 0 & 0 & x \end{matrix}$$

- (a) Give a sample 4 x 4 N-matrix and its compact representation.
- (b) Suppose that we are defining a class NMatrix that represents an  $n \times n$  N-matrix in a one-dimensional array element as above. Besides element, the class has the data members  $n$  and zero (the zero element for the matrix). Write Java code for the member method `set(i, j, newValue)` which stores `newValue` as the (i,j) element of the N-matrix,  $1 \leq i \leq n$  and  $1 \leq j \leq n$ . The element is to be stored in the proper position of the one-dimensional array element.
4. Suppose that you are implementing the Queue type using a linked list with head and tail pointers, and you are interested in adding the following member function:

- (a) `public void reverse()`

This member function should reverse the contents of the queue. You have originally the following Chain based Queue



Calling `myqueue.reverse()` should change that structure to

