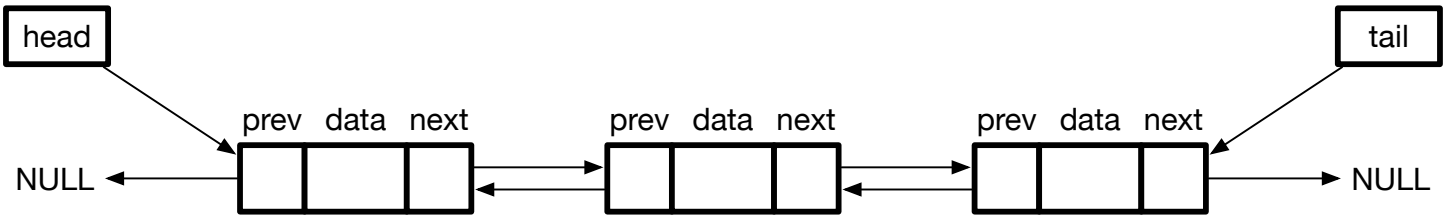
CMSC204
Assignment #3

Doubly Linked Lists



Assignment Description

Your assignment is to write a generic doubly-linked list class with an iterator, and a generic sorted doubly-linked list class with an iterator that inherits from your generic doubly-linked list class. The GUI has been provided for you for this assignment to help you visualize your linked list. Your list classes will also be tested with JUnit tests. Upload the initial files from Blackboard and your working files in a directory into the repository in GitHub you created in Lab 1 and take a screen shot of the files.

More information about doubly-linked lists can be found here: https://www.geeksforgeeks.org/difference-between-singly-linked-list-and-doubly-linked-list/

Concepts tested by this assignment

Exception handling
Generic Classes
Double Linked List
Ordered Double Linked List
Iterators
Comparators

Classes

BasicDoubleLinkedList

This generic doubly-linked list relies on a head (reference to first element of the list) and tail (reference to the last element of the list) where the last node points to the first element of the list. Both the head and the tail are set to null when the list is empty. Both point to the same element when there is only one element in the list, and now the element's "next" reference points to itself. A node structure has only two fields: data and the next references. The class must only define the following entities: an inner class Node, an inner class that implements ListIterator (for the iterator method), head and tail references and an integer representing the list

size. However only the next(), hasNext(), previous() and hasPrevious() methods of the ListIterator are you required to implement. The rest of the methods can throw the UnsupportedOperationException, such as:

```
public void remove() throws UnsupportedOperationException{
      throw new UnsupportedOperationException();}
```

All the entities are defined as protected so they can be accessed by the subclass. Follow the Javadoc that is provided.

SortedDoubleLinkedList

A generic sorted double linked list will be constructed using a provided Comparator to determine how the list is to be sorted. It extends BasicDoubleLinkedList class. The **addToFront** and the **addToEnd** methods will not be supported and an **add** method will be added that inserts to the double linked list in sorted order dependent on the Comparator. Follow the Javadoc that is provided.

Exception Handling

- UnsupportedOperationException – this exception is a Java library exception and will be returned by the addtoFront and addToEnd implementations of the SortedDoubleLinkedList class and by the remove method of the iterator.
- NoSuchElementException – this exception is a Java library exception and will be returned by the next function within the iterator class when there are no more elements in the linked list.

GUI driver (provided for you)

A GUI driver has been provided for you to help you visualize your doubly-linked lists. Here is the minimum that must be in place to start using the GUI driver effectively.

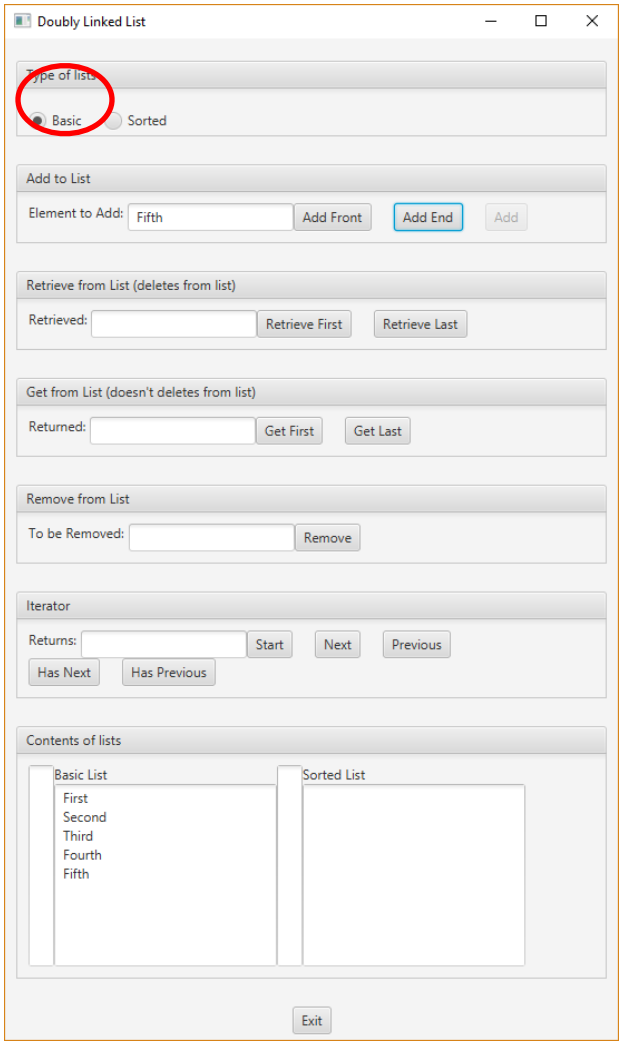
- All methods in your BasicDoubleLinkedList and SortedDoubleLinkedList must be stubbed.
- The **addToFront** or **addToEnd** method of the BasicDoubleLinkedList must be implemented to create a basic double singly-linked list.
- The **add** method of the SortedDoubleLinkedList must be implemented to create a sorted double singly-linked list.
- The **toArrayList** method in both the BasicDoubleLinkedList and SortedDoubleLinkedList, which returns an arraylist of the items in the list from the head of list to the tail of list. This method is used to display the contents of the lists.

Testing

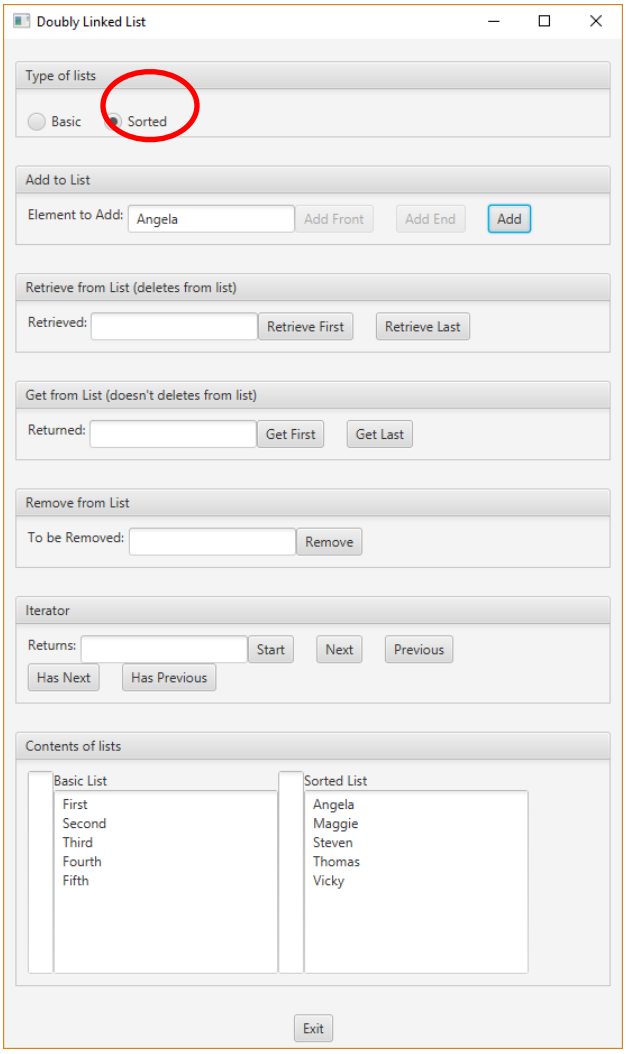
1. Your code should cause the BasicDoubleLinkedList_Test tests to succeed.
2. Your code should cause the SortedDoubleLinkedList_Test tests to succeed.
3. Create a JUnit Test – BasicDoubleLinkedList_STUDENT_Test.
4. Create a JUnit Test – SortedDoubleLinkedList_STUDENT_Test.

Examples using GUI driver

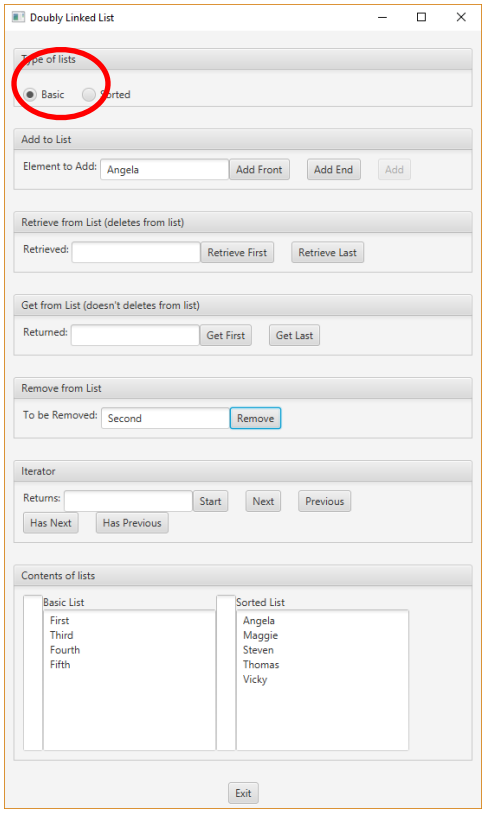
Adding to a Basic List



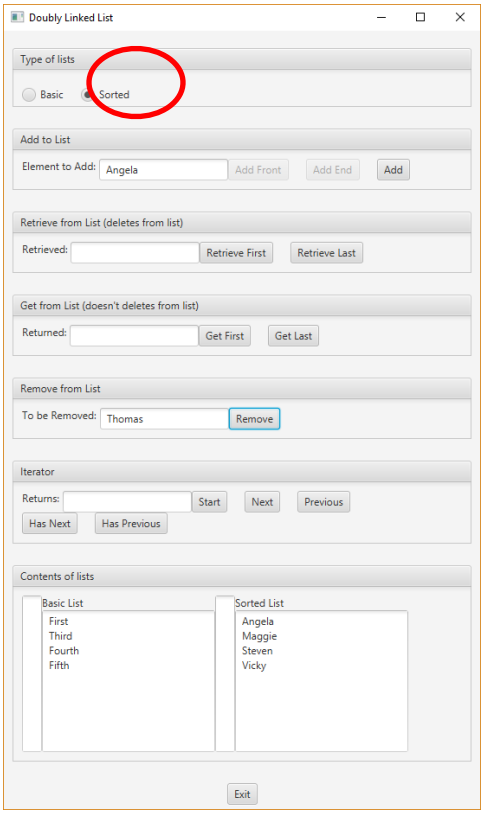
Adding to a Sorted List



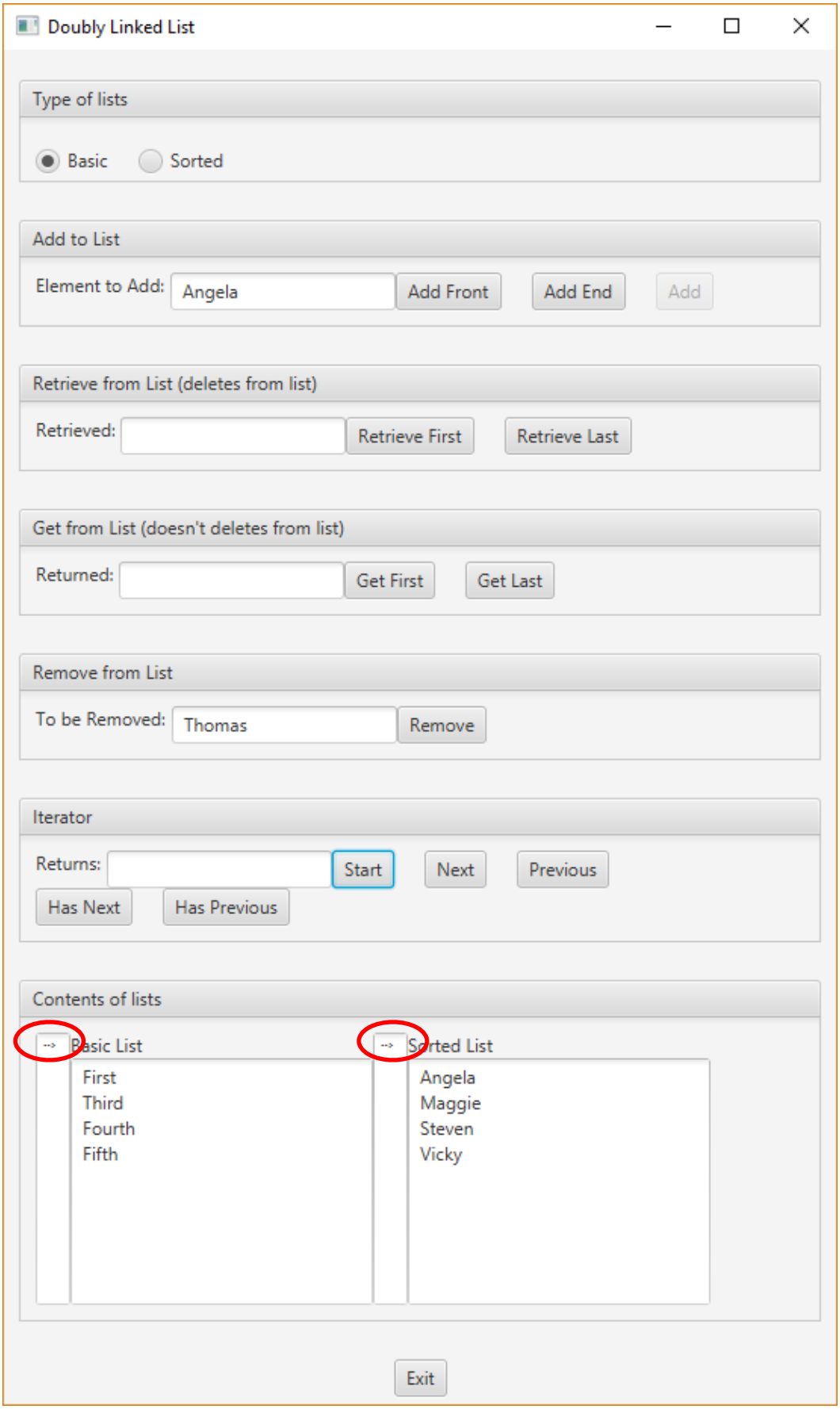
Removing Second from basic



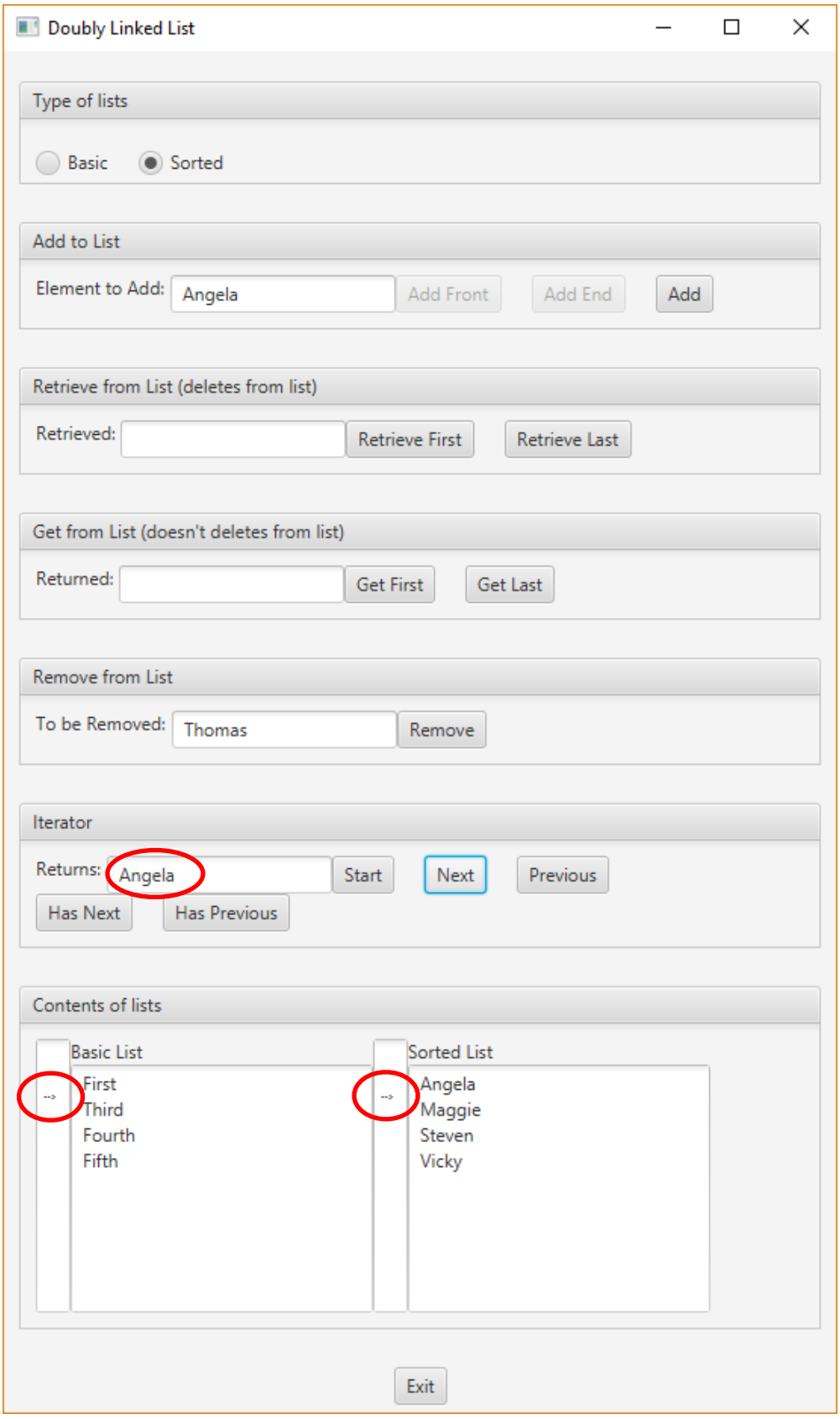
Removing Thomas from sorted



Start the iterators for Basic and Sorted. Think of iterators being “in between” nodes.

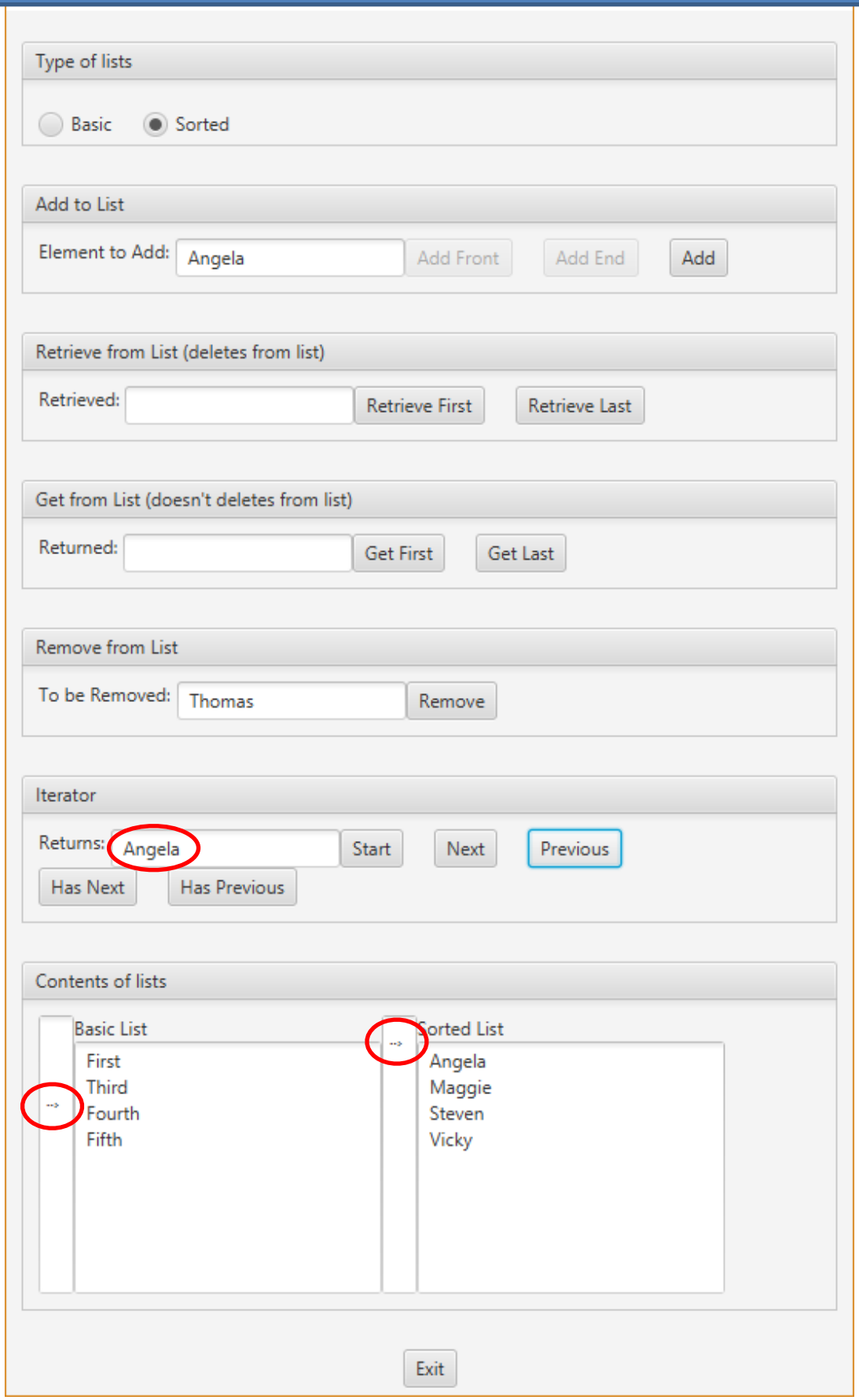

Doubly Linked List
Type of lists
Basic
Sorted
Add to List
Element to Add:
Angela
Add Front
Add End
Add
Retrieve from List (deletes from list)
Retrieved:
Retrieve First
Retrieve Last
Get from List (doesn't deletes from list)
Returned:
Get First
Get Last
Remove from List
To be Removed:
Thomas
Remove
Iterator
Returns:
Start
Next
Previous
Has Next
Has Previous
Contents of lists
Basic List
First
Third
Fourth
Fifth
Sorted List
Angela
Maggie
Steven
Vicky
Exit

Example of selecting “Next” for Basic and then for Sorted list. Think of iterators being “in between” nodes.



Example of “Next” for basic and “Previous” for Sorted. Think of iterators being “in between” nodes.

Deliverables



Deliverables / Submissions:
Design: UML class diagram with algorithm (pseudo-code) for methods

Implementation: Submit a compressed file containing the follow (see below): The Java application (it must compile and run correctly); Javadoc files **in a directory**; a write-up as specified below. Be sure to review the provided project rubric to understand project expectations. The write-up will include:

- Final design: UML diagram with pseudo-code
- In three or more paragraphs, highlights of your learning experience

Deliverable format: The above deliverables will be packaged as follows. Two compressed files in the following formats:

- LastNameFirstName_Assignment3_Complete.zip, a compressed file in the zip format, with the following:
    - Write up (Word document) - reflection paragraphs
    - UML Diagram - latest version (Word or jpg document)
    - doc (directory) - Javadoc
        - File1.html (example)
        - File2.html (example)
        - Sub-directory (example)
    - src (directory)
        - File1.java (example)
        - File2.java (example)

- LastNameFirstName_Assignment3_Moss.zip, a compressed file containing one or more Java files:
    - File1.java (example)
    - File2.java (example)

  This folder should contain Java source files only