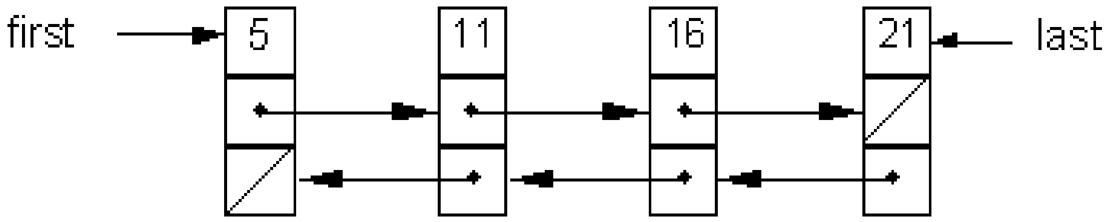
Implementing Doubly Linked Lists

1. The DListNode of a doubly-linked list will contain the information field(s) and two reference fields. One reference will refer to a previous node while the other reference will refer to the next node in the list.

2. Here is a picture of a doubly-linked list, of type DListNode containing Integer objects.



3. A **`null`** value must be placed at each end of the list to signify the end of the data structure. In the diagram, a **`null`** is indicated with the diagonal line.

4. A doubly-linked list should have two external references to access the data structure. In the case above, `first` and `last` are the two entry points.

5. A doubly-linked list can be traversed in either direction.

6. Inserting values into an ordered doubly-linked list is a similar process to the algorithm used with a singly-linked list. However, the number of reference manipulations will double.

7. The addition of a new node to a position between two existing nodes will require four reference hookups.

In a paired programming activity you will design and implement a Doubly Linked List. Implement methods that will be more efficient than your SinglyLinkedList implementation

1. Here is the DListNode that we will use for this assignment. You will complete the setter/getter and any other helper methods

```java
public class DListNode
{
    private Object value;
    private DListNode next;
    private DListNode previous;

    public DListNode(Object initValue, DListNode initNext, DListNode initPrev)
    {
        value= initValue;
        next = initNext;
        previous = initPrev;
    }
```

2. You will need a DLinkedList Class to allow insertion and removal and access to the head and tail of the DLL. You will also include the setter/getter methods

```java
public class DLinkedList {
private DListNode firstNode;
private DListNode lastNode;

/**
 * Construct an empty list
 */
public DLinkedList() {
     firstNode = null;
     lastNode = null;
}

/**
 * Returns true if the list contains no elements
 */
public boolean isEmpty()

/**
 * Inserts the argument as the first element of this list.
 */

public void addFirst(Object o) {

/**
 * Inserts the argument as the last element of this list.
 */
```

```
public void addLast(Object o)

/**
 * Removes and returns the first element of this list.
 */

public Object removeFirst()

/**
 * Removes and returns the last element of this list.
 */

public Object removeLast()


/**
 * Returns a String representation of the list.
 */
public String toString()


/**
 * Returns the number of elements in the list as an int.
 */
public int size() {


/**
 * Removes all of the elements from this list.
 */
private void clear() {

/**
 * Returns a DListIterator.
 */

public DListIterator iterator() {
      return new DListIterator(this);

}
```

3. You will need a DListIterator Class to allow insertion and removal and access to middle DLL.

```
public class DListIterator  {

      private DListNode current;
      private DListNode previous;
      private DLinkedList myList;
      private boolean canRemove; // for remove() method. true if OK to call
                                                  // remove()

      public DListIterator(DLinkedList list) {
            myList = list;
            current = null;
            previous = null;
            canRemove = false;
      }

      public String toString()

      public boolean hasPrevious()

      public boolean hasNext()

      public Object next()

      public Object previous()

      public void remove()

      public void add(Object element)

      public void set(Object element)
```

4. You will need many test cases to ensure that your methods work correctly.