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DequeImplementation.java

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```

1  /*
2  * HSLU / ICS/AIML : Modul ADS : Algorithmen & Datenstrukturen
3  * Version: Sun Sep 22 16:01:15 CEST 2024
4  */
5
6  package uebung02.as.aufgabe02;
7
8  import java.util.LinkedList;
9  import java.util.stream.Collectors;
10
11 /**
12  * Double linked list and DE-Queue (double ended queue: Deque)
13  */
14 public class DequeImplementation<E> {
15
16     private Node<E> header, trailer;
17     private int size;
18
19     public DequeImplementation() {
20         header = new Node<>();
21         trailer = new Node<>();
22         header.setNext(trailer);
23         trailer.setPrev(header);
24         size = 0;
25     }
26
27     public void insertFirst(E element) {
28         Node<E> second = header.getNext();
29         Node<E> first = new Node<>(element, header, second);
30         second.setPrev(first);
31         header.setNext(first);
32         size++;
33     }
34
35     public E removeLast() throws DequeEmptyException {
36         if (isEmpty()) {
37             throw new DequeEmptyException("Deque is empty!");
38         }
39         Node<E> last = trailer.getPrev();
40         E o = last.getElement();
41         Node<E> secondtolast = last.getPrev();
42         trailer.setPrev(secondtolast);
43         secondtolast.setNext(trailer);
44         size--;
45         return o;
46     }
47
48     public E removeFirst() throws DequeEmptyException {
49         // TODO: Implement here...
50         return null;
51     }
52
53     public void insertLast(E element) {
54         // TODO: Implement here...
55     }
56
57     public E first() throws DequeEmptyException {
58         // TODO: Implement here...
59         return null;
60     }
61
62     public E last() throws DequeEmptyException {
63         // TODO: Implement here...
64         return null;
65     }
66
67     public int size() {
68         // TODO: Implement here...
69         return -1;
70     }

```

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DequeImplementation.java

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71
72     public boolean isEmpty() {
73         // TODO: Implement here...
74         return true;
75     }
76
77     @Override
78     public String toString() {
79         LinkedList<String> elements = new LinkedList<>();
80         Node<E> node = header.getNext();
81         while (node != trailer) {
82             elements.add(node.getElement().toString());
83             node = node.getNext();
84         }
85         return elements.stream().collect(Collectors.joining(", ", "[", "]"));
86     }
87
88
89     public static void main(String[] args) {
90
91         DequeImplementation<Integer> deque = new DequeImplementation<>();
92         deque.insertFirst(3);
93         deque.insertFirst(2);
94         deque.insertFirst(1);
95         System.out.println(deque);
96         deque.insertLast(4);
97         deque.insertLast(5);
98         deque.insertLast(6);
99         System.out.println(deque);
100        System.out.println("size : " + deque.size());
101        System.out.println("empty : " + deque.isEmpty());
102        System.out.println("first : " + deque.first());
103        System.out.println("last : " + deque.last());
104        for (int i = 0; i < 3; i++) {
105            System.out.print(deque.removeFirst() + " ");
106        }
107        System.out.println();
108        for (int i = 0; i < 3; i++) {
109            System.out.print(deque.removeLast() + " ");
110        }
111        System.err.println();
112        deque.removeFirst();
113
114    }
115
116 }
117
118 /* Session-Log:
119
120 [1, 2, 3]
121 [1, 2, 3, 4, 5, 6]
122 size : 6
123 empty : false
124 first : 1
125 last : 6
126 1 2 3
127 6 5 4
128
129 Exception in thread "main" uebung02.as.aufgabe02.DequeEmptyException: Deque is empty!
130     at uebung02.as.aufgabe02.DequeImplementation.removeFirst(DequeImplementation.java:50)
131     at uebung02.as.aufgabe02.DequeImplementation.main(DequeImplementation.java:125)
132
133 */
134
135

```

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Node.java

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```
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4  */
5
6  package uebung02.as.aufgabe02;
7
8
9  public class Node<E> {
10
11     private E element;
12     private Node<E> next, prev;
13
14     Node() {
15         this(null, null, null);
16     }
17
18     Node(E e, Node<E> p, Node<E> n) {
19         element = e;
20         next = n;
21         prev = p;
22     }
23
24     void setElement(E newElem) {
25         element = newElem;
26     }
27
28     void setNext(Node<E> newNext) {
29         next = newNext;
30     }
31
32     void setPrev(Node<E> newPrev) {
33         prev = newPrev;
34     }
35
36     E getElement() {
37         return element;
38     }
39
40     Node<E> getNext() {
41         return next;
42     }
43
44     Node<E> getPrev() {
45         return prev;
46     }
47 }
48
49
50
```

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DequeEmptyException.java

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```
1  /*
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4  */
5
6  package uebung02.as.aufgabe02;
7
8  /**
9   * Runtime exception thrown when one tries to perform operation on an empty
10   * queue.
11   */
12
13  public class DequeEmptyException extends RuntimeException {
14
15     private static final long serialVersionUID = 1L;
16
17     public DequeEmptyException(String err) {
18         super(err);
19     }
20 }
21
22
```