CSE222 - Homework4 - Question2

Report

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Problem Solution Approach :

* Problem Definition :

Implement a Deque class which implements Deque interface and can extend AbstractCollection. Deque is a queue that supports adding or removing items from both ends of the data structure. To implement it, your class should keep two linked list. One for the elements in the deque and the other to keep the nodes removed. You should use a removed node, if any available, when a new node is needed instead of creating a new node. With this type of operation, you can save time for constructing new nodes and garbage collection the nodes that are not used anymore. You are not allowed to use any class in Collection hierarchy as a member. So, you need to define your own Node class to build a linked list. Note that you need to implement all required methods and Iterator class.

* Approach :

When we examine the **deque** interface of java utility collection , will be realized that most functions have exact same functionality with another function in deque interface as peer. Deque can be used as LIFO or FIFO easily because interface defines methods to access the elements at both ends of the deque.

Deque also include Queue , Iterable , Collection interface as a superinterface. Implemented concrete class of deque interface can be used for different number of cases because it is like containing several unique collections in it also provide their functionality. For the purpose of providing same functionality of these superinterface , most function exists as pair.

In implementing process , considering pair relationship is a significant consideration. Pair of functions behave exactly same but one of them throws an exception. In proper use , these functions behave same. For avoiding code duplication and making more compact object-oriented design , there should be an implemented one functional.

Dealing with nodes were sweet because , I wrote a private function for each three different function which are used for particular task while creating list.

- **Inserting to head of the list**

- **Inserting to tail of the list**

- **Unlink the specific node from the list**

Deque (Java Platform 8) : https://docs.oracle.com/javase/8/docs/api/java/util/Deque.html

Test Cases:

Constructors Test:

Test ID	Scenario	Test Data	Expected Result	Actual Result	Pass	Fail
T01	Taking already generated list as an argument		Deque is initialized as same as list given as argument.	Expected result occurred.	✓	
T02	Initiate an empty deque with no parameter constructor.		Empty deque is initialized.	Expected result occurred.	✓	

Methods Test:

Test ID	Scenario	Test Data	Expected Result	Actual Result	Pass	Fail
T01	- add(A1)	Size : 1 Deque : [A1] Garbage node number : 0	Added at the end of the deque.	Expected result occurred.	✓	
T02	- addFirst(A2)	Size : 2 Deque : [A2, A1] Garbage node number : 0	Added at the beginning of the deque.	Expected result occurred.	✓	
T03	- addLast(A3)	Size : 3 Deque : [A2, A1, A3] Garbage node number : 0	Added at the end of the deque.	Expected result occurred.	✓	
T04	-contains(A4)	Size : 3 Deque : [A2, A1, A3] Garbage node number : 0	Return false.	Expected result occurred.	✓	
T05	- element()	Size : 3 Deque : [A2, A1, A3] Garbage node number : 0	A2.	Expected result occurred.	✓	
T06	- clear()	Size : 0 Deque : [] Garbage node number : 3	Clear the deque.	Expected result occurred.	✓	
T07	- element()	Size : 0 Deque : [] Garbage node number : 3	NoSuchElementException is thrown.	Expected result occurred.	✓	
T08	- add("A2") - add("A1") - add("A3")	Size : 3 Deque : [A2, A1, A3] Garbage node number : 0	Given elements added consecutively.	Expected result occurred.	✓	
T09	- getFirst()	Size : 3 Deque : [A2, A1, A3] Garbage node number : 0	A2	Expected result occurred.	✓	
T10	- clear()	Size : 0 Deque : [] Garbage node number : 3	Clear the deque.	Expected result occurred.	✓	
T11	- getFirst()	Size : 0 Deque : [] Garbage node number : 3	NoSuchElementException is thrown.	Expected result occurred.	✓	
T12	- getLast()	Size : 0 Deque : [] Garbage node number : 3	NoSuchElementException is thrown.	Expected result occurred.	✓	

T13	- offer("A2") - offer("A1") - offer("A3")	Size : 3 Deque : [A2, A1, A3] Garbage node number : 0	Add a three-consecutive element at the end of the deque.	Expected result occurred.	✓
T14	- offerFirst("A4")	Size : 4 Deque : [A4, A2, A1, A3] Garbage node number : 0	Add an element at the first of the deque.	Expected result occurred.	✓
T15	- offerLast("A5")	Size : 5 Deque : [A4, A2, A1, A3, A5] Garbage node number : 0	Add an element at the last of the deque.	Expected result occurred.	✓
T16	- peek()	Size : 5 Deque : [A4, A2, A1, A3, A5] Garbage node number : 0	Return the first element of the deque which is A4	Expected result occurred.	✓
T17	- clear()	Size : 0 Deque : [] Garbage node number : 5	Clear the deque.	Expected result occurred.	✓
T18	- peek()	Size : 0 Deque : [] Garbage node number : 5	Return null.	Expected result occurred.	✓
T19	- peekFirst()	Size : 0 Deque : [] Garbage node number : 5	Return null.	Expected result occurred.	✓
T20	- peekLast()	Size : 0 Deque : [] Garbage node number : 5	Return null.	Expected result occurred.	✓
T21	- poll()	Size : 0 Deque : [] Garbage node number : 5	Return null.	Expected result occurred.	✓
T22	- pollFirst()	Size : 0 Deque : [] Garbage node number : 5	Return null.	Expected result occurred.	✓
T23	- pollLast()	Size : 0 Deque : [] Garbage node number : 5	Return null.	Expected result occurred.	✓
T24	- pop()	Size : 0 Deque : [] Garbage node number : 5	NoSuchElementException is thrown.	Expected result occurred.	✓
T25	- remove()	Size : 0 Deque : [] Garbage node number : 5	NoSuchElementException is thrown.	Expected result occurred.	✓
T26	- removeFirst()	Size : 0 Deque : [] Garbage node number : 5	NoSuchElementException is thrown.	Expected result occurred.	✓
T27	- removeLast()	Size : 0 Deque : [] Garbage node number : 5	NoSuchElementException is thrown.	Expected result occurred.	✓
T28	- add("A1") - add("A2") - add("A3") - add("B1") - add("B2") - add("B3")	Size : 6 Deque : [A1, A2, A3, B1, B2, B3] Garbage node number : 0	Add a six-consecutive element at the end of the deque.	Expected result occurred.	✓

T29	- peekFirst()	Size : 6 Deque : [A1, A2, A3, B1, B2, B3] Garbage node number : 0	Return A1.	Expected result occurred.	✓	
T30	- peekFirst()	Size : 6 Deque : [A1, A2, A3, B1, B2, B3] Garbage node number : 0	Return B3.	Expected result occurred.	✓	
T31	- poll()	Size : 5 Deque : [A2, A3, B1, B2, B3] Garbage node number : 1	Remove A1 and return A1.	Expected result occurred.	✓	
T31	- pollFirst()	Size : 4 Deque : [A3, B1, B2, B3] Garbage node number : 2	Remove A2 and return A2.	Expected result occurred.	✓	
T32	- pollLast()	Size : 3 Deque : [A3, B1, B2] Garbage node number : 3	Remove B3 and return B3.	Expected result occurred.	✓	
T33	- pop()	Size : 2 Deque : [B1, B2] Garbage node number : 4	Remove first element , return A3.	Expected result occurred.	✓	
T34	- push("C3") - push("C2") - push("C3") - push("C1")	Size : 6 Deque : [C1, C3, C2, C3, B1, B2] Garbage node number : 0	Push four-consecutive element at the beginning of the deque.	Expected result occurred.	✓	
T35	- remove()	Size : 5 Deque : [C3, C2, C3, B1, B2] Garbage node number : 1	Return C1.	Expected result occurred.	✓	
T36	- remove("C3")	Size : 4 Deque : [C2, C3, B1, B2] Garbage node number : 2	Remove first C3 , return true.	Expected result occurred.	✓	
T37	- remove("C7")	Size : 4 Deque : [C2, C3, B1, B2] Garbage node number : 2	Return false.	Expected result occurred.	✓	
T38	- add("D1") - add("D2") - add("D3") - add("D3") - add("D2") - add("D1")	Size : 10 Deque : [C2, C3, B1, B2, D1, D2, D3, D3, D2, D1] Garbage node number : 0	Add a six-consecutive element at the end of the deque.	Expected result occurred.	✓	
T39	removeFirstOccurrence("D1")	Size : 9 Deque : [C2, C3, B1, B2, D2, D3, D3, D2, D1] Garbage node number : 1	Remove first D1 and return true.	Expected result occurred.	✓	
T40	removeLastOccurrence("D2")	Size : 8 Deque : [C2, C3, B1, B2, D2, D3, D3, D1] Garbage node number : 2	Remove last D2 and return true.	Expected result occurred.	✓	

Iterators Test:

Test ID	Scenario	Test Data	Expected Result	Actual Result	Pass	Fail
T01	- iterator()	Size : 0 Deque : [] Garbage node number : 0	Initialized an iterator points at the beginning.	Expected result occurred.	✓	
T02	- hasNext()	Size : 0 Deque : [] Garbage node number : 0	Return false.	Expected result occurred.	✓	
T03	- next()	Size : 0 Deque : [] Garbage node number : 0	NoSuchElementException is thrown.	Expected result occurred.	✓	
T04	- remove()	Size : 0 Deque : [] Garbage node number : 0	IllegalStateExceptionis thrown.	Expected result occurred.	✓	
T05	- add("F1") - add("F2") - add("F3")	Size : 3 Deque : [F1, F2, F3] Garbage node number : 0	Added three-consecutive element to deque for testing iterator.	Expected result occurred.	✓	
T06	- iterator()	Size : 3 Deque : [F1, F2, F3] Garbage node number : 0	Initialized an iterator points at the beginning.	Expected result occurred.	✓	
T07	- hasNext()	Size : 3 Deque : [F1, F2, F3] Garbage node number : 0	Return true.	Expected result occurred.	✓	
T08	- next()	Size : 3 Deque : [F1, F2, F3] Garbage node number : 0	Return F1.	Expected result occurred.	✓	
T09	- remove()	Size : 2 Deque : [F2, F3] Garbage node number : 1	First element is removed.	Expected result occurred.	✓	
T10	- clear()	Size : 0 Deque : [] Garbage node number : 3	Clear the deque.	Expected result occurred.	✓	
T11	- descendingIterator()	Size : 0 Deque : [] Garbage node number : 3	Initialized a descendingIterator points at the beginning.	Expected result occurred.	✓	
T12	- hasNext()	Size : 0 Deque : [] Garbage node number : 3	Return false.	Expected result occurred.	✓	
T13	- next()	Size : 0 Deque : [] Garbage node number : 3	NoSuchElementException is thrown.	Expected result occurred.	✓	
T14	- remove()	Size : 0 Deque : [] Garbage node number : 3	IllegalStateExceptionis thrown.	Expected result occurred.	✓	
T15	- add("F1") - add("F2") - add("F3")	Size : 3 Deque : [F1, F2, F3] Garbage node number : 0	Added three-consecutive element to deque for testing iterator.	Expected result occurred.	✓	
T16	- descendingIterator()	Size : 3 Deque : [F1, F2, F3] Garbage node number : 0	Initialized an iterator points at the beginning.	Expected result occurred.	✓	
T17	- hasNext()	Size : 3 Deque : [F1, F2, F3] Garbage node number : 0	Return true.	Expected result occurred.	✓	

T18	- next()	Size : 3 Deque : [F1, F2, F3] Garbage node number : 0	Return F3.	Expected result occurred.	✓	
T19	- remove()	Size : 2 Deque : [F1, F2] Garbage node number : 1	Last element is removed.	Expected result occurred.	✓	

Class Diagram :

Class diagram is inserted to the homework file.

Running Commend and Result:

Running command and result stage is inserted to the homework file.