**Report**

**Question1. Linked List**

|  |  |  |
| --- | --- | --- |
| Operation | Time Complexity | Space Complexity |
| Size | O(n) | O(2) |
| isEmpty | O(1) | O(1) |
| addNodeAtHead | O(1) | O(1) |
| addNodeAtTail | O(n) | O(2) |
| addNodeAt(Nth)Position | O(n) | O(3) |
| reverseALinkList | O(n) | O(n) |
| getHeadNode | O(1) | O(1) |
| getTailNode | O(n) | O(1) |
| deleteNodeAt(nth) position | O(n) | O(3) |

**Question2. Stack**

|  |  |  |
| --- | --- | --- |
| Operation | Time Complexity | Space Complexity |
| push | O(1) | O(1) |
| pop | O(n) | O(4) |
| peek | O(1) | O(1) |
| size | O(n) | O(2) |
| isEmpty | O(1) | O(1) |

**Question3. Queue**

|  |  |  |
| --- | --- | --- |
| Operation | Time Complexity | Space Complexity |
| enqueue | O(1) | O(3) |
| dequeue | O(n2) | O(6) |
| peek | O(1) | O(1) |
| size | O(1) | O(1) |
| isEmpty | O(1) | O(1) |

**Question4. Double-Linked List**

|  |  |  |
| --- | --- | --- |
| Operation | Time Complexity | Space Complexity |
| Size | O(1) | O(1) |
| isEmpty | O(1) | O(1) |
| addNodeAtHead | O(1) | O(2) |
| addNodeAtTail | O(1) | O(2) |
| addNodeAt(Nth)Position | O(n) | O(3) |
| reverseALinkList | O(n) | O(n) |
| getHeadNode | O(1) | O(1) |
| getTailNode | O(1) | O(1) |
| deleteNodeAt(nth) position | O(n) | O(3) |

**Question5.**

**Answer.** Yes, we can implement stack using arrays.

* Pros
  + Time complexity of accessing an element is constant. i.e. fast to access, irrespective of the size.
  + Easy to use and access. (index based access)
* Cons
  + Size of array is fixed, once initialized.
  + Position based insertion is very complex as it involves a shifting operation before inserting.
  + Shrinking & expansion of array is expensive operation.

**Question6.**

Code available with main class and test class file name

**Question7.**

**Answer.**

1. We can implement Queue using 2 stacks.
2. Two approaches to do this:
   * 1. Making either dequeue or enqueue operation very { O(n2)} expensive
     2. Making enqueue & dequeue both equally expensive. { O(n)}

**Question8.**

Code available with main class and test class file name

**Question9.**

Code available with main class and test class file name

**Question10.**

**Answer.** Stack is the ideal data structure for this purpose.

Code available with main class and test class file name