Assignment 3

CS221: Data Structures and Algorithms

Usman Institute of Technology

Fall 2018

Release Date: 14 November, 2019

Submission Mode: Soft-copy

- How to submit:
    - Create an account on http://www.turnitin.com/ as a Student
    - Use following information at time of sign-up
        - Class ID: 19412335
        - Enrollment Key: CS211FALL18
    - You can submit your assignment by **18 November 2019 06:00 am.**

- Make sure that function names must be similar as asked in the assignment.
- YOU HAVE TO SUBMIT ONLY ONE .PY FILE
- YOUR FILE NAME MUST BE IN THE FORMAT OF <YOUR ROLL NUMBER>.py
    - **For example, if you Roll Number is 18B-121-CS then your file name must be 18B-121-CS.py**
- You must read Academic Integrity at the end of this document.

Double Ended Queue (or Deque)

Deque or Double Ended Queue is a generalized version of Queue data structure that allows insert and delete at both ends.

Operations on Dequeue:

Mainly the following four basic operations are performed on queue:

InsertFront(): Adds an item at the front of Deque.
InsertLast(): Adds an item at the rear of Deque.
DeleteFront(): Deletes an item from front of Deque and <u>returns</u> the value.
DeleteLast(): Deletes an item from rear of Deque and <u>returns</u> the value.

In addition to above operations, following operations are also supported

GetFront(): <u>Returns</u> the front item from queue.
GetRear(): <u>Returns</u> the last item from queue.
IsEmpty(): <u>Returns</u> whether Deque is empty or not.
IsFull(): <u>Returns</u> whether Deque is full or not.
Count(): <u>Returns</u> the number of element in the queue.

You have to perform following tasks for your assignment.

1. **[40 Marks]** Create a class ArrayDeque and implement the operations discussed above. You have to create following functions for your class:

```python
def InsertFront(value):
    // your code goes here


def InsertLast(value):
    // your code goes here
```

```
    def DeleteFront():
        // your code goes here

    def DeleteLast():
        // your code goes here

    def GetFront():
        // your code goes here

    def GetRear():
        // your code goes here

    def IsFull():
        // your code goes here

    def Count():
        // your code goes here
```

2. **[20 Marks]** Create a function **Add(i,x)** to insert an element x at i^{th} position of the queue. We check if i < n/2, we shift the element a[0] , …, a[i-1] left by one position. Otherwise, we shift the elements a[i], … , a[i-1] right by one position. The running time of add(i,x) operation should not exceed O(1+min{i, n-i}). (Hint: see the book "Open Data Structure")

```
    def Add(i, x):
        // your code goes here
```

3. **[20 Marks]** Create a function **Remove()** in order to remove an element from the ith location of the queue. It either shifts elements a[0], …, a[i-1] right by one position or shifts the elements a[i + 1], …, a[n-1] left by one position depending on whether i < n=2. Again, this means that remove(i) never spends more than O(1+min{i, n-i}) time to shift elements. (Hint: see the book "Open Data Structure")

```
    def Remove(i, x):
        // your code goes here
```

4. **[20 Marks]** Implement a method rotate(r) that "rotates" a List so that list item i becomes list item (i + r) mod n.

```
    def Rotate(r):
        // your code goes here
```

Academic Integrity

Each student in this course is expected to make sure that any work submitted by a student in this course for academic credit will be the **student's own work**. Scholastic dishonesty shall be considered a serious violation of these rules and regulations and is subject to strict disciplinary action. Scholastic dishonesty includes, but is not limited to, cheating on exams, plagiarism on assignments, and collusion.

PLAGIARISM: Plagiarism is the act of taking the work created by another person or entity and presenting it as one's own for the purpose of personal gain or of obtaining academic credit. Plagiarism includes the submission of or incorporation of the work of others without acknowledging its provenance or giving due credit according to established academic practices. This includes the submission of material that has been appropriated, bought, received as a gift, downloaded, or obtained by any other means. Students must not, unless they have been granted permission from all faculty members concerned, submit the same assignment or project for academic credit for different courses.

CHEATING: The term cheating shall refer to the use of or obtaining of unauthorized information in order to obtain personal benefit or academic credit.

COLLUSION: Collusion is the act of providing unauthorized assistance to one or more person or of not taking the appropriate precautions against doing so. Any student caught violating academic integrity will suffer an academic penalty. All violations of academic integrity will also be immediately reported to the Disciplinary Committee. Any student violating academic integrity a second time in this course will receive a failing grade for the course, and additional disciplinary sanctions may be administered through the Disciplinary Committee.

Conclusively, each student need to be take care of:

1. You must not share your solutions with other students. You are encouraged to discuss the problems but each student is supposed to take care of his or her own solution.
2. You must not submit solution of other students as yours.
3. You must duly cite all resources you used in development of your solution.