

Data Structures

Queue Homework 1

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Problem #1: Deque

- Deque is a **Double ended queue** where you can add/remove from either rear or front. It is not FIFO anymore, but provides great flexibility
- Change the **circular queue** to include
 - `void enqueue_rear(int value)` [same old code]
 - **`void enqueue_front(int value)`**
 - `int dequeue_front()` [same old code]
 - **`int dequeue_rear()`**
- Front/Rear meanings shouldn't change.
- $O(1)$ time complexity for all methods

```

dq = Deque(6)
dq.enqueue_front(3)
dq.display()
dq.enqueue_front(2)
dq.enqueue_rear(4)
dq.enqueue_front(1)
dq.enqueue_front(5)
dq.enqueue_front(6)

dq.display() # 1 2 3 4
print(dq.dequeue_rear()) # 4
dq.display() # 1 2 3
print(dq.dequeue_front()) # 1
dq.display() # 2 3

print(dq.dequeue_rear()) # 3
print(dq.dequeue_front()) # 2

while not dq.empty():
    dq.dequeue_rear()

dq.display()
for i in range(0, 6):
    dq.enqueue_rear(i + 10)
dq.display()

```

```

Front 5 - rear 0
3
Front 1 - rear 1    FULL
6 5 1 2 3 4
4
Front 1 - rear 0
6 5 1 2 3
6
Front 2 - rear 0
5 1 2 3
3
5
Front 3 - rear 3    EMPTY

Front 3 - rear 3    FULL
10 11 12 13 14 15

```

Problem #2: Implement a stack using a single queue

- Let's practice aggregations
- Using Linked-list queue, implement stack functionalities
 - You may add a few extra functionalities to the queue code to make your stack code proper
- What is the time complexity of your push/pop?
- Don't implement display

```
class Stack:  
    def __init__(self):  
        self.queue = Queue()
```

```
stk = Stack()  
stk.push(10)  
stk.push(20)  
stk.push(30)  
print(stk.peak())    # 30  
stk.push(40)  
print(stk.peak())    # 40
```

```
while not stk.empty():  
    print(stk.pop(), end=' ')  
# 40 30 20 10
```

“Acquire knowledge and impart it to the people.”

“Seek knowledge from the Cradle to the Grave.”