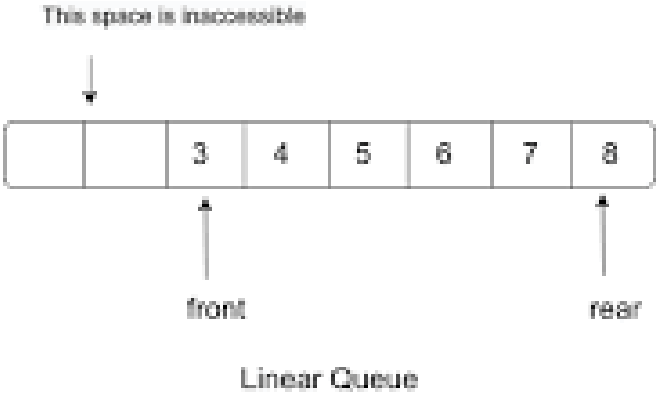
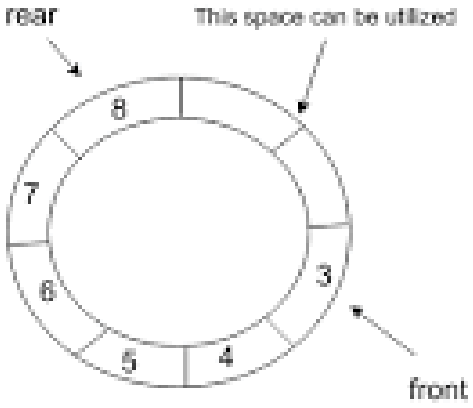
Circular Array Queue

A Circular Array Queue represents an array implementation of a queue in which we use indexes of the array to represent the front and end of the queue. When we are at the end of the array we circle back to zero. When there is no more room in the array we double the size and rearrange the elements from front to rear.



Linear Queue



Circular queue

Here is a sample simulation of how the CircularArrayQueue works. I print the contents of the array to demonstrate how the front and end indexes change and wrap around the array. Notice at the end where the size of the array doubles.

```
CircularArrayQueue<Integer> a = new CircularArrayQueue<Integer>(10);
a.offer(1);
a.offer(2);
a.offer(3);
a.offer(4);
a.offer(5);
a.offer(6);
a.offer(7);
a.offer(8);
a.offer(9);
System.out.println(a);
```

```
[1, 2, 3, 4, 5, 6, 7, 8, 9, null]
FrontIndex: 0   EndIndex: 9
```

```
System.out.println("NEXT: "+a.poll());
System.out.println("NEXT: "+a.poll());
System.out.println("NEXT: "+a.poll());
```

```
NEXT: 1
NEXT: 2
NEXT: 3
[null, null, null, 4, 5, 6, 7, 8, 9, null]
FrontIndex: 3   EndIndex: 9
```

```
a.offer(10);
System.out.println(a);
```

```
[null, null, null, 4, 5, 6, 7, 8, 9, 10]
FrontIndex: 3   EndIndex: 0
```

```
a.offer(11);
System.out.println(a);
```

```
[11, null, null, 4, 5, 6, 7, 8, 9, 10]
FrontIndex: 3   EndIndex: 1
```

```
a.offer(12);
System.out.println(a);
```

```
[11, 12, null, 4, 5, 6, 7, 8, 9, 10]
FrontIndex: 3   EndIndex: 2
```

```
System.out.println("NEXT: "+a.poll());
System.out.println(a);
```

```
NEXT: 4
[11, 12, null, null, 5, 6, 7, 8, 9, 10]
FrontIndex: 4   EndIndex: 2
```

```
a.offer(13);
System.out.println(a);
```

```
[11, 12, 13, null, 5, 6, 7, 8, 9, 10]
FrontIndex: 4   EndIndex: 3
```

```
a.offer(14);
System.out.println(a);
```

```
[11, 12, 13, 14, 5, 6, 7, 8, 9, 10]
FrontIndex: 4   EndIndex: 4
```

```
a.offer(15); // The array is full. Time to resize and rearrange. Change front and end.
System.out.println(a);
```

```
[5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, null, null, null, null, null, null, null, null, null, null]
FrontIndex: 0   EndIndex: 11
```

```
System.out.println("NEXT: "+a.poll());
System.out.println(a);
```

```
NEXT: 5
[null, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, null, null, null, null, null, null, null, null, null,
null]
FrontIndex: 1   EndIndex: 11
```

Directions: Use the attached files to complete your implementation of a circular array queue