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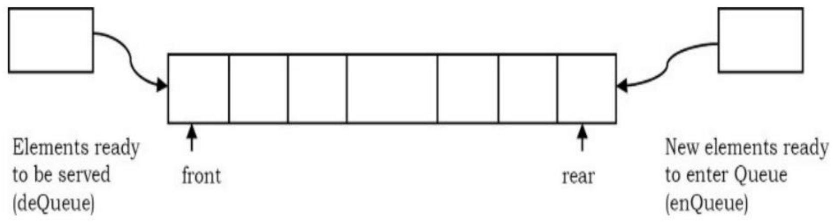
Experiment No.	**2**

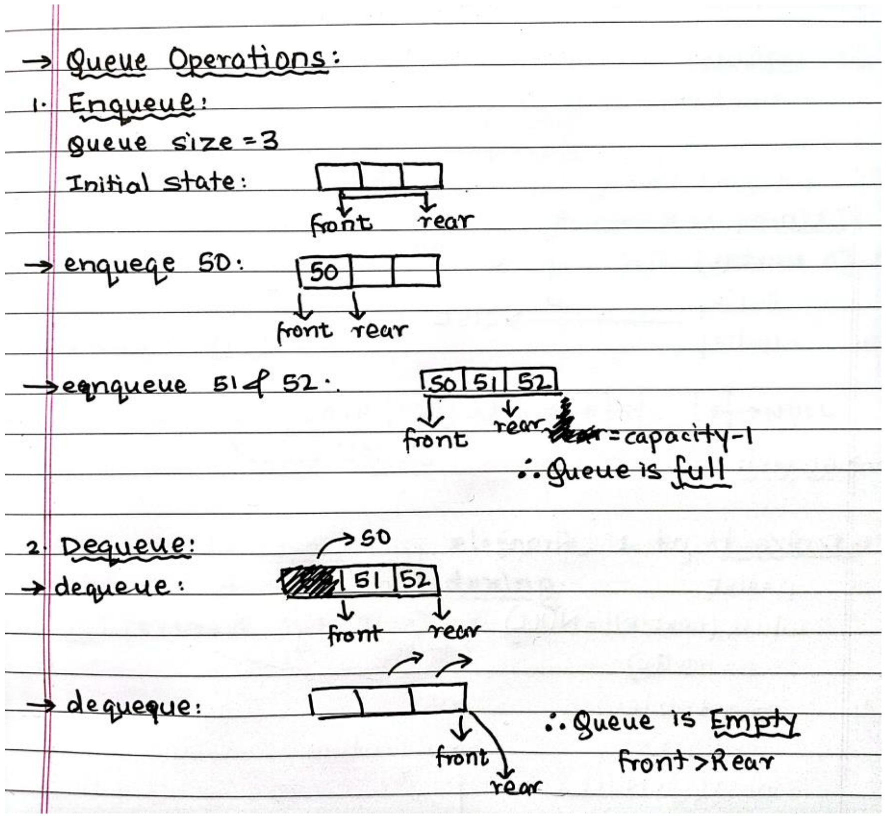
AIM:	**Queue Operations Menu-driven program**
Program 1	
PROBLEM STATEMENT:	Write a program to make a linear Queue and perform all queue operations on it
THEORY:	**What is a Queue?** A queue is an ordered list in which insertions are done at one end (rear) and deletions are done at the other end (front). The first element to be inserted is the first one to be deleted. Hence, it is called First in First out (FIFO). When an element is inserted in a queue, the concept is called EnQueue, and when an element is removed from the queue, the concept is called DeQueue. DeQueueing an empty queue is called underflow and EnQueuing an element in a full queue is called overflow. **Diagram of Queue:**  Elements ready to be served (deQueue) front rear New elements ready to enter Queue (enQueue) **Main Queue Operations:** **enQueue(int data):** Inserts an element at the end of the queue **int deQueue():** Removes the element at the front of the queue **Auxiliary Queue Operations**: **int Front():** Returns the element at the front without removing it **int QueueSize():** Returns the no. of elements stored in the queue **int IsEmptyQueue():** Indicates whether the queue is empty or not

ALGORITHM:

```
Class QueueCheck
  Main Method:
  1. Input size 'n' of queue from user
  2. Create an IntQueue object with size 'n'
  3. While true:
     a. Select an Operation from user and store in choice
     b. Switch(choice) with cases and default
     c. Input whether the user wants to continue
     d. If the flag is false then break

Class IntQueue
  Members:
  1. Int[] queue
  2. Int front,rear,capacity
  Constructor:
  1. Queue = new int[size]
  2. Capacity = size
  3. front = 0, rear = -1
  Enqueue Method:
  1. if Queue is not full
  2. queue[++rear] = e
  Dequeue Method:
  1. if Queue is not empty
  2. return queue[front++]
  isEmptyQueue Method:
  1. return front>rear
  isFullQueue Method:
  1. return rear == capacity-1
  front Method:
  1. return queue[front]
  rear Method:
  1. return queue[rear]
```

PROBLEM SOLVING:



PROGRAM:

QueueCheck.java:

```
import java.util.Scanner;
import queueds.IntQueue;
public class QueueCheck {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.print("Enter the size of the queue: ");
        int n = sc.nextInt();
        IntQueue queue = new IntQueue(n);
        int flag,choice;
        while(true) {
            System.out.println("Select an Operation:\n1. Enqueue\t2.
Dequeue\n3. Front\t4. Rear\n5. Size");
            choice = sc.nextInt();
            switch(choice) {
                case 1:
                    System.out.print("Enter the element to be enqueued: ");
                    int e = sc.nextInt();
                    try {
                        queue.enqueue(e);
                        System.out.println("Queue: " + queue.printQueue());
                    } catch(Exception ex) {
                        System.out.println(ex.getMessage());
                    }
                    break;
                case 2:
                    try {
                        System.out.println("Dequeued element: " +
queue.dequeue());
                        System.out.println("Queue: " + queue.printQueue());
                    } catch(Exception ex) {
                        System.out.println(ex.getMessage());
                    }
                    break;
                case 3:
                    try {
                        System.out.println("Front element: " + queue.front());
                    } catch(Exception ex) {
                        System.out.println(ex.getMessage());
                    }
                    break;
                case 4:
                    try {
                        System.out.println("Rear element: " + queue.rear());
                    } catch(Exception ex) {
                        System.out.println(ex.getMessage());
                    }
                    break;
                case 5:
                    System.out.println("Size: " + queue.size());
                    System.out.println("Queue: " + queue.printQueue());
                    break;
                default:
                    System.out.println("Invalid choice!");
```

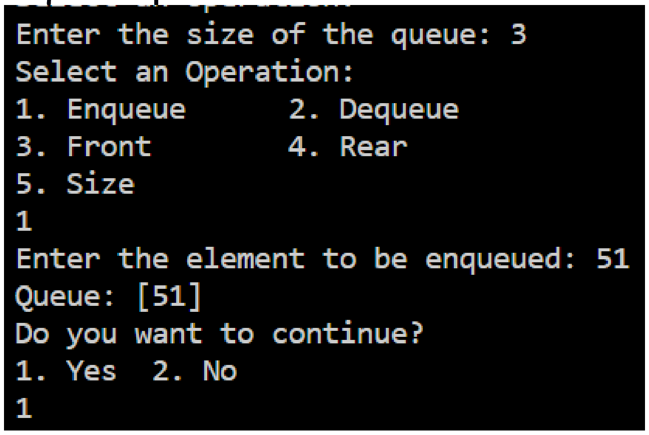
```
            }
            System.out.println("Do you want to continue?\n1. Yes\t2. No");
            flag = sc.nextInt();
            if (flag == 2) {
                break;
            }
        }
        sc.close();
    }
}
```

IntQueue.java:

```
package queueds;
public class IntQueue {
    int[] queue;
    int front;
    int rear;
    int capacity;
    public IntQueue(int size) {
        queue = new int[size];
        capacity = size;
        front = 0;
        rear = -1;
    }
    public void enqueue(int e) throws Exception {
        if(isFullQueue()) {
            throw new Exception("Queue is full!");
        }
        queue[++rear] = e;
    }
    public int dequeue() throws Exception {
        if(isEmptyQueue()) {
            throw new Exception("Queue is empty!");
        }
        return queue[front++];
    }
    public int front() throws Exception {
        if(isEmptyQueue()) {
            throw new Exception("Queue is empty!");
        }
        return queue[front];
    }
    public int rear() throws Exception {
        if(isEmptyQueue()) {
            throw new Exception("Queue is empty!");
        }
        return queue[rear];
    }
    public String printQueue() {
        String s = "[";
        for(int i=front;i<rear+1;i++) {
            s += queue[i]+(i!=rear?",":"");
        }
        return s += "]";
    }
    public boolean isEmptyQueue() {
        return front>rear;
    }
    public boolean isFullQueue() {
        return rear == capacity - 1;
    }
    public int size() {
        return rear+1-front;
    }
}
```

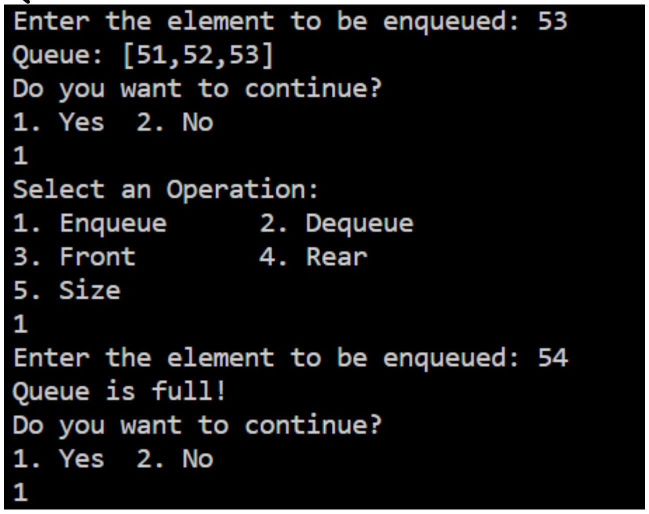
OUTPUT:

Enqueue Operation:



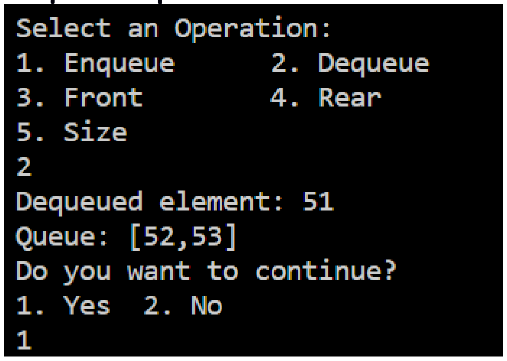
```
Enter the size of the queue: 3
Select an Operation:
1. Enqueue      2. Dequeue
3. Front        4. Rear
5. Size
1
Enter the element to be enqueued: 51
Queue: [51]
Do you want to continue?
1. Yes  2. No
1
```

QueueFull Check:



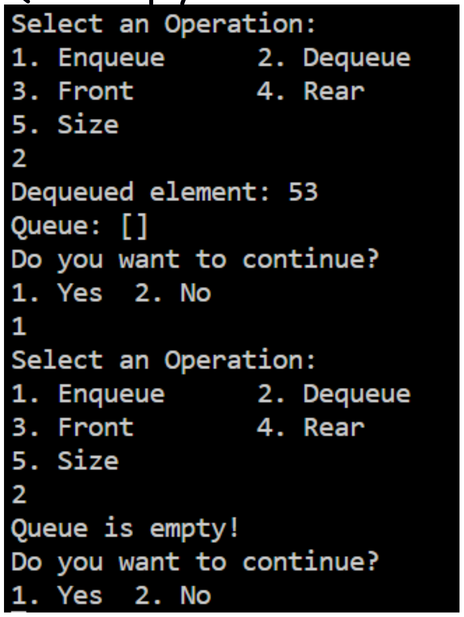
```
Enter the element to be enqueued: 53
Queue: [51,52,53]
Do you want to continue?
1. Yes  2. No
1
Select an Operation:
1. Enqueue      2. Dequeue
3. Front        4. Rear
5. Size
1
Enter the element to be enqueued: 54
Queue is full!
Do you want to continue?
1. Yes  2. No
1
```

Dequeue Operation:



```
Select an Operation:
1. Enqueue      2. Dequeue
3. Front        4. Rear
5. Size
2
Dequeued element: 51
Queue: [52,53]
Do you want to continue?
1. Yes  2. No
1
```

Queue Empty Check:



```
Select an Operation:
1. Enqueue      2. Dequeue
3. Front        4. Rear
5. Size
2
Dequeued element: 53
Queue: []
Do you want to continue?
1. Yes  2. No
1
Select an Operation:
1. Enqueue      2. Dequeue
3. Front        4. Rear
5. Size
2
Queue is empty!
Do you want to continue?
1. Yes  2. No
```

CONCLUSION:	In this experiment, we learned how to implement a linear Queue using an array in java and implement the basic operations of a queue data structure.