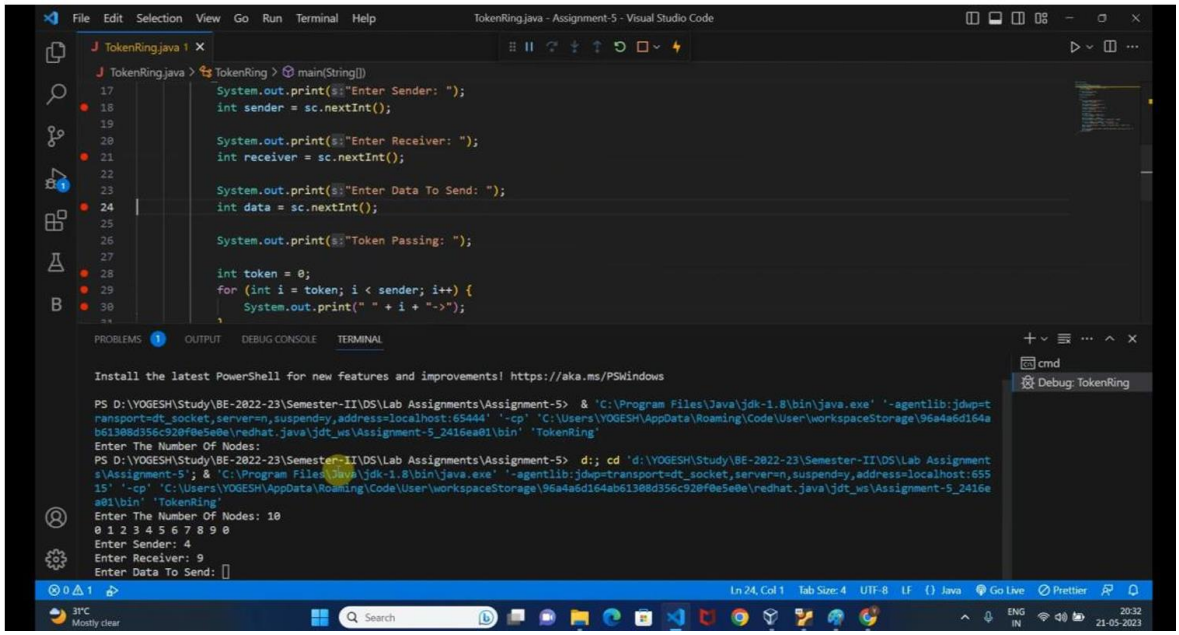
```
import java.util.*;

import java.util.concurrent.*;

class TokenRing {

static final int NUM_PROCESSES = 5; // Number of processes

static List<Process> processes = new ArrayList<>();

static Semaphore mutex = new Semaphore(1);

static boolean[] flags = new boolean[NUM_PROCESSES];

static int tokenHolder = 0;  // Initially, process 0 holds the token

static Random random = new Random();

public static void main(String[] args) throws InterruptedException {

for (int i = 0; i < NUM_PROCESSES; i++) {

Process p = new Process(i);

processes.add(p);

new Thread(p).start();

}

}

static class Process implements Runnable {

int id;

Process(int id) {

this.id = id;

}

public void run() {

while (true) {

try {

Thread.sleep(random.nextInt(1000)); // Simulate random wait

requestToken();

1 DS-5 code

enterCriticalSection();

releaseToken();

Thread.sleep(random.nextInt(1000)); // Simulate random wait before next

request

}

} catch (InterruptedException e) {

e.printStackTrace();

}

}

void requestToken() throws InterruptedException {

mutex.acquire();

while (tokenHolder != id) { // Wait for the token to be passed

System.out.println("Process " + id + " waiting for the token.");

mutex.release();

Thread.sleep(100); // Simulate waiting time

mutex.acquire();

}

System.out.println("Process " + id + " acquired the token.");

mutex.release();

}

void enterCriticalSection() throws InterruptedException {

System.out.println("Process " + id + " entering critical section.");

Thread.sleep(random.nextInt(500)); // Simulate critical section work
```

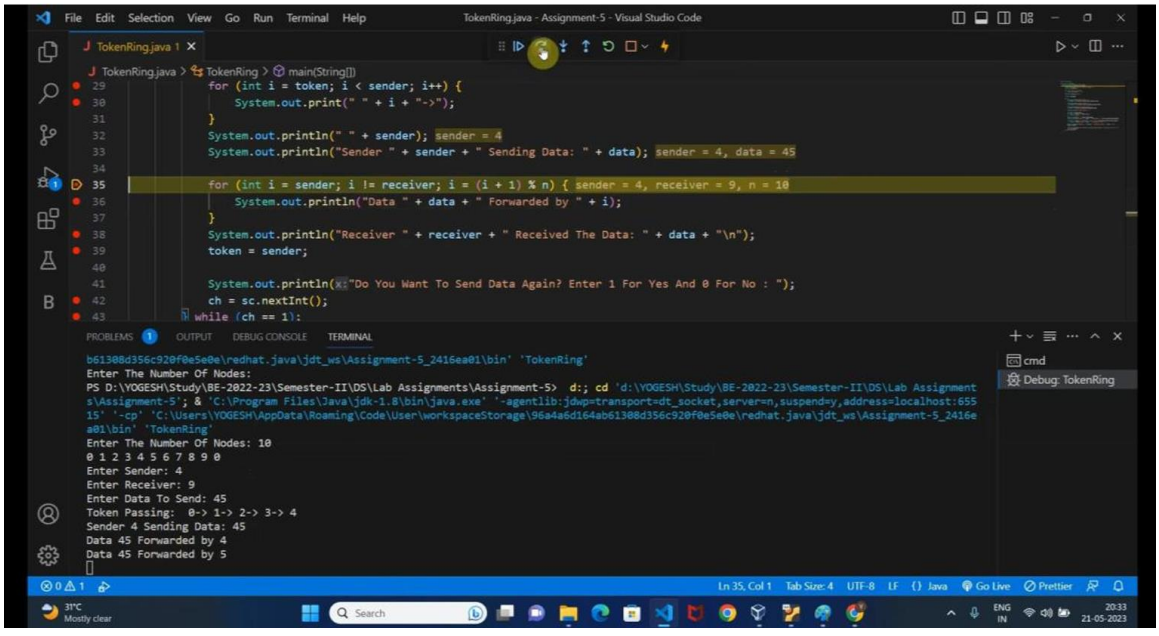
```
}
void releaseToken() throws InterruptedException {
mutex.acquire();
```

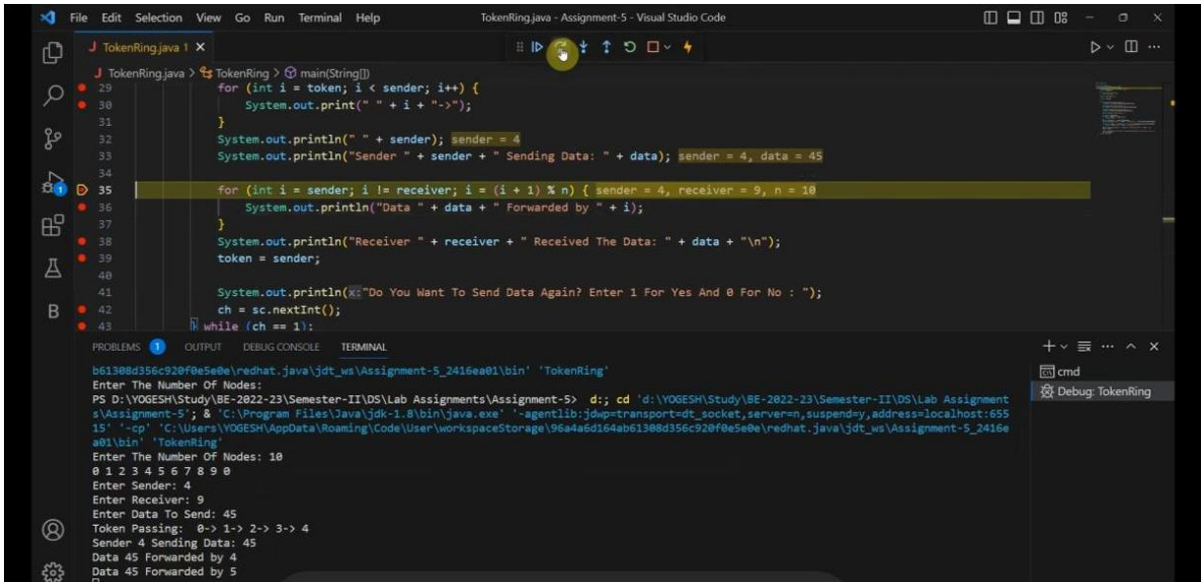
2 DS-5 code

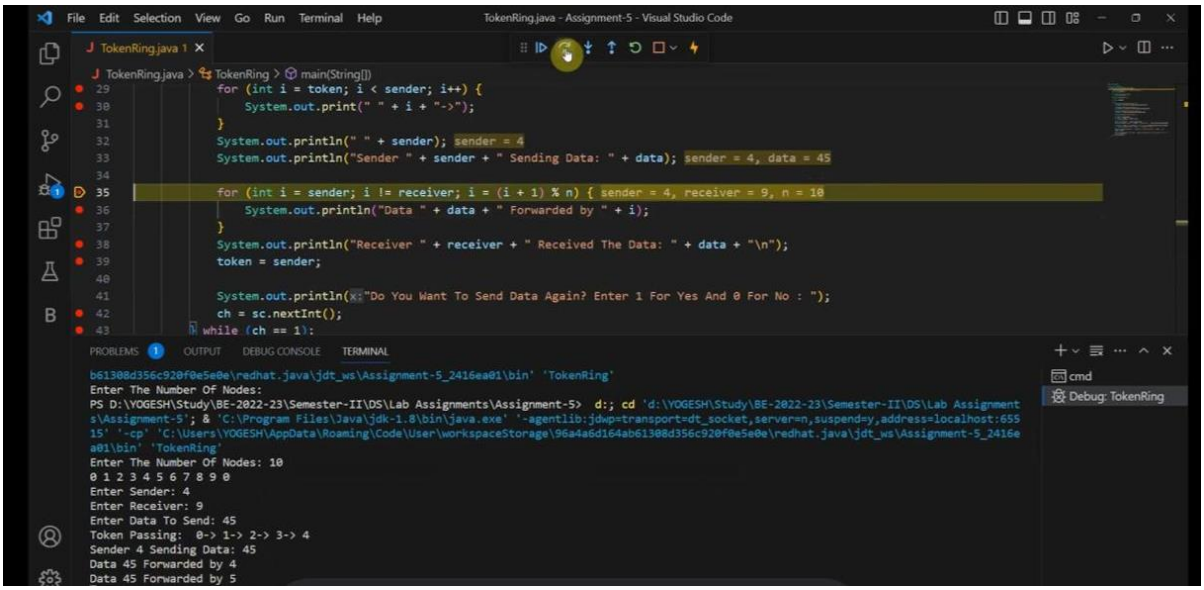
```
System.out.println("Process " + id + " exiting
critical section and passing token.");
tokenHolder = (tokenHolder + 1) %
NUM_PROCESSES; // Pass token to the next
process
}
}
}
mutex.release();
```

Output :






File Edit Selection View Go Run Terminal Help
TokenRing.java - Assignment-5 - Visual Studio Code
TokenRing.java 1
TokenRing.java > TokenRing > main(String[])
for (int i = token; i < sender; i++) {
System.out.print(" " + i + "->");
}
System.out.println(" " + sender); sender = 4
System.out.println("Sender " + sender + " Sending Data: " + data); sender = 4, data = 45
for (int i = sender; i != receiver; i = (i + 1) % n) { sender = 4, receiver = 9, n = 10
System.out.println("Data " + data + " Forwarded by " + i);
}
System.out.println("Receiver " + receiver + " Received The Data: " + data + "\n");
token = sender;
System.out.println("Do You Want To Send Data Again? Enter 1 For Yes And 0 For No : ");
ch = sc.nextInt();
} while (ch == 1);
PROBLEMS 1 OUTPUT DEBUG CONSOLE TERMINAL
b61308d356c920f0e5e0e\redhat.java\jdt_ws\Assignment-5_2416ea01\bin' 'TokenRing'
Enter The Number Of Nodes:
PS D:\YOGESH\Study\BE-2022-23\Semester-II\DS\Lab Assignments\Assignment-5> d:; cd 'd:\YOGESH\Study\BE-2022-23\Semester-II\DS\Lab Assignments\Assignment-5'; & 'C:\Program Files\Java\jdk-1.8\bin\java.exe' '-agentlib:jdwp=transport=dt_socket,server=n,suspend=y,address=localhost:65515' '-cp' 'C:\Users\YOGESH\AppData\Roaming\Code\User\workspaceStorage\96a4a6d164ab61308d356c920f0e5e0e\redhat.java\jdt_ws\Assignment-5_2416ea01\bin' 'TokenRing'
Enter The Number Of Nodes: 10
0 1 2 3 4 5 6 7 8 9 0
Enter Sender: 4
Enter Receiver: 9
Enter Data To Send: 45
Token Passing: 0-> 1-> 2-> 3-> 4
Sender 4 Sending Data: 45
Data 45 Forwarded by 4
Data 45 Forwarded by 5
cmd
Debug: TokenRing


File Edit Selection View Go Run Terminal Help
TokenRing.java - Assignment-5 - Visual Studio Code
TokenRing.java 1
TokenRing.java > TokenRing > main(String[])
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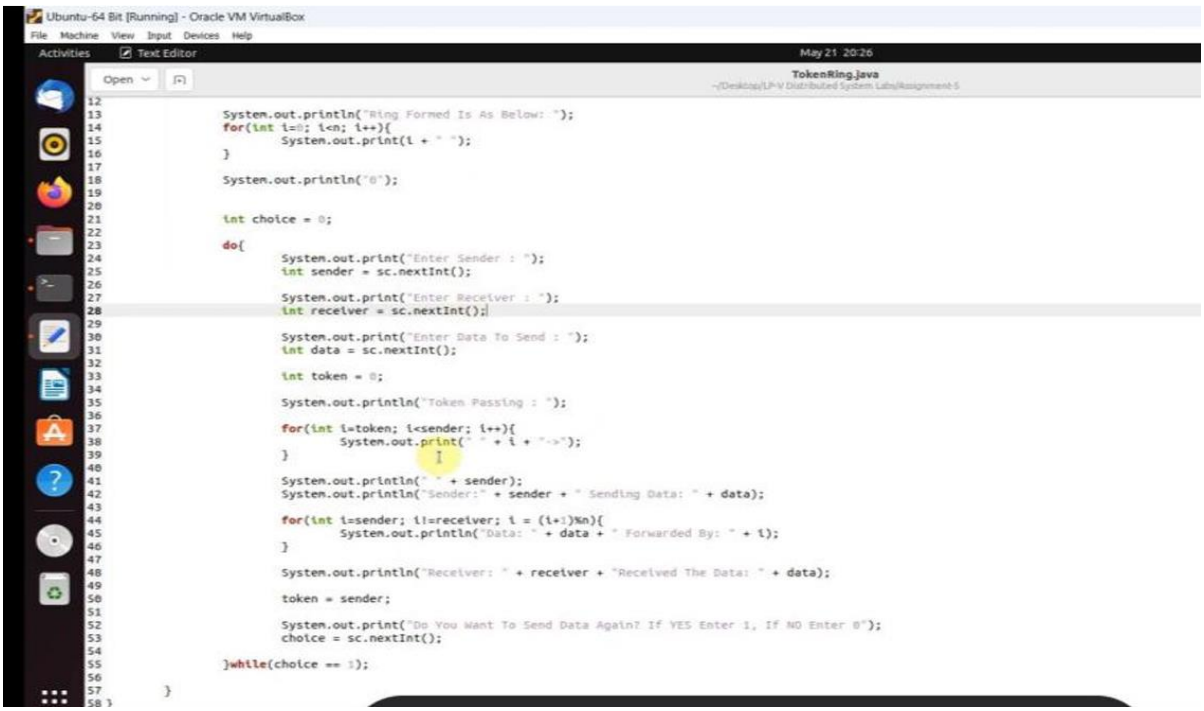
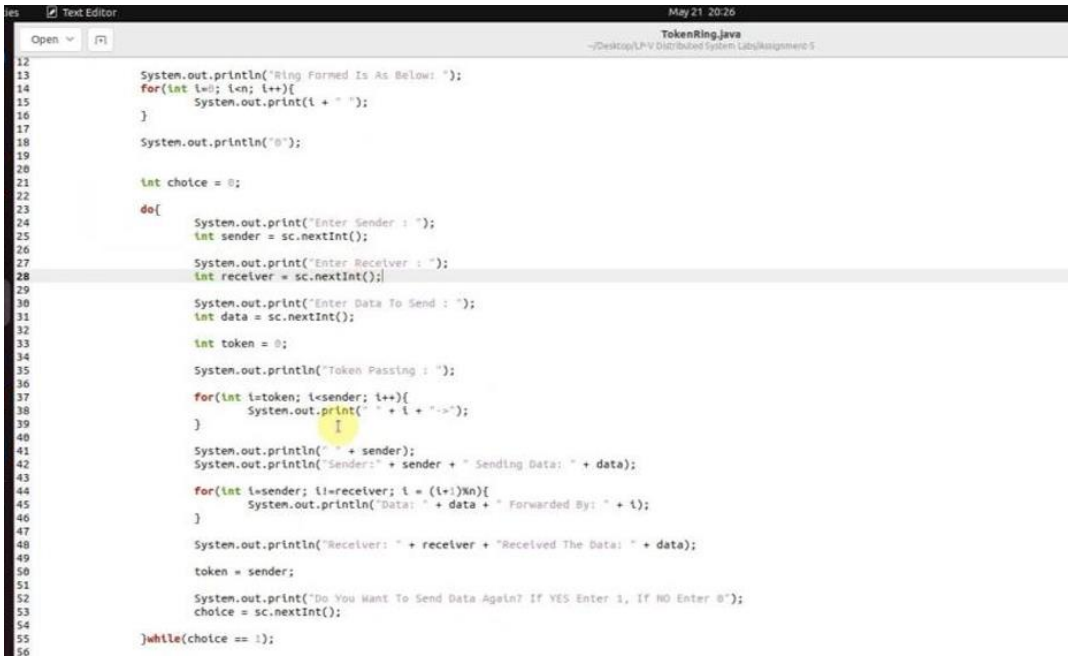
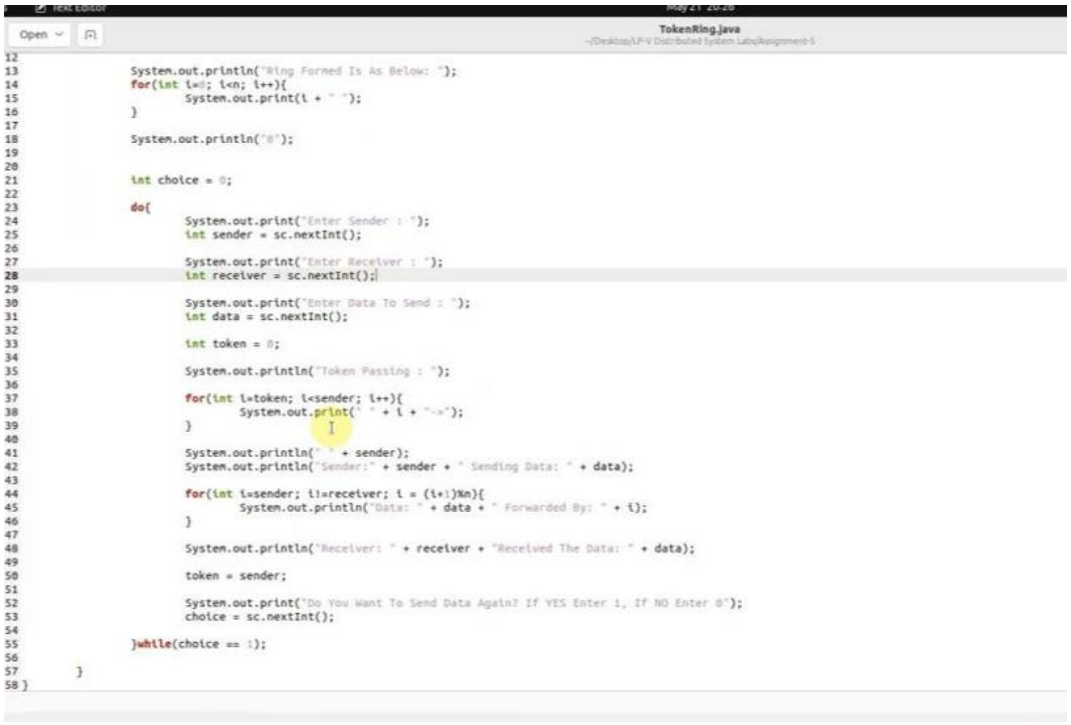
System.out.print(" " + i + "->");
}
System.out.println(" " + sender); sender = 4
System.out.println("Sender " + sender + " Sending Data: " + data); sender = 4, data = 45
for (int i = sender; i != receiver; i = (i + 1) % n) { sender = 4, receiver = 9, n = 10
System.out.println("Data " + data + " Forwarded by " + i);
}
System.out.println("Receiver " + receiver + " Received The Data: " + data + "\n");
token = sender;
System.out.println("Do You Want To Send Data Again? Enter 1 For Yes And 0 For No : ");
ch = sc.nextInt();
} while (ch == 1);
PROBLEMS 1 OUTPUT DEBUG CONSOLE TERMINAL
b61308d356c920f0e5e0e\redhat.java\jdt_ws\Assignment-5_2416ea01\bin' 'TokenRing'
Enter The Number Of Nodes:
PS D:\YOGESH\Study\BE-2022-23\Semester-II\DS\Lab Assignments\Assignment-5> d:; cd 'd:\YOGESH\Study\BE-2022-23\Semester-II\DS\Lab Assignments\Assignment-5'; & 'C:\Program Files\Java\jdk-1.8\bin\java.exe' '-agentlib:jdwp=transport=dt_socket,server=n,suspend=y,address=localhost:65515' '-cp' 'C:\Users\YOGESH\AppData\Roaming\Code\User\workspaceStorage\96a4a6d164ab61308d356c920f0e5e0e\redhat.java\jdt_ws\Assignment-5_2416ea01\bin' 'TokenRing'
Enter The Number Of Nodes: 10
0 1 2 3 4 5 6 7 8 9 0
Enter Sender: 4
Enter Receiver: 9
Enter Data To Send: 45
Token Passing: 0-> 1-> 2-> 3-> 4
Sender 4 Sending Data: 45
Data 45 Forwarded by 4
Data 45 Forwarded by 5
cmd
Debug: TokenRing

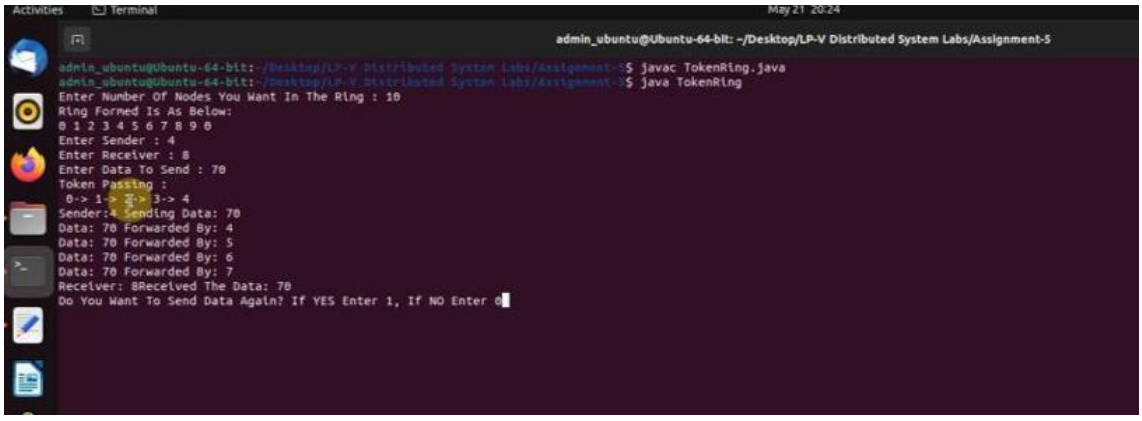

Ubuntu-64 Bit [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities
Text Editor
May 21 20:26
Open
TokenRing.java
System.out.println("Ring Formed Is As Below: ");
for(int i=0; i<n; i++){
System.out.print(i + " ");
}
System.out.println("0");
int choice = 0;
do{
System.out.print("Enter Sender : ");
int sender = sc.nextInt();
System.out.print("Enter Receiver : ");
int receiver = sc.nextInt();
System.out.print("Enter Data To Send : ");
int data = sc.nextInt();
int token = 0;
System.out.println("Token Passing : ");
for(int i=token; i<sender; i++){
System.out.print(" " + i + "->");
}
System.out.println(" " + sender);
System.out.println("Sender:" + sender + " Sending Data: " + data);
for(int i=sender; i!=receiver; i = (i+1)%n){
System.out.println("Data: " + data + " Forwarded By: " + i);
}
System.out.println("Receiver: " + receiver + "Received The Data: " + data);
token = sender;
System.out.print("Do You Want To Send Data Again? If YES Enter 1, If NO Enter 0");
choice = sc.nextInt();
}while(choice == 1);
}




```
12
13              System.out.println("Ring Formed Is As Below: ");
14              for(int i=0; i<n; i++){
15                      System.out.print(i + " ");
16              }
17
18              System.out.println("0");
19
20
21              int choice = 0;
22
23              do{
24                      System.out.print("Enter Sender : ");
25                      int sender = sc.nextInt();
26
27                      System.out.print("Enter Receiver : ");
28                      int receiver = sc.nextInt();
29
30                      System.out.print("Enter Data To Send : ");
31                      int data = sc.nextInt();
32
33                      int token = 0;
34
35                      System.out.println("Token Passing : ");
36
37                      for(int i=token; i<sender; i++){
38                              System.out.print(" " + i + "->");
39                      }
40
41                      System.out.println(" " + sender);
42                      System.out.println("Sender:" + sender + " Sending Data: " + data);
43
44                      for(int i=sender; i!=receiver; i = (i+1)%n){
45                              System.out.println("Data: " + data + " Forwarded By: " + i);
46                      }
47
48                      System.out.println("Receiver: " + receiver + "Received The Data: " + data);
49
50                      token = sender;
51
52                      System.out.print("Do You Want To Send Data Again? If YES Enter 1, If NO Enter 0");
53                      choice = sc.nextInt();
54
55              }while(choice == 1);
56
```




```
12
13              System.out.println("Ring Formed Is As Below: ");
14              for(int i=0; i<n; i++){
15                      System.out.print(i + " ");
16              }
17
18              System.out.println("0");
19
20
21              int choice = 0;
22
23              do{
24                      System.out.print("Enter Sender : ");
25                      int sender = sc.nextInt();
26
27                      System.out.print("Enter Receiver : ");
28                      int receiver = sc.nextInt();
29
30                      System.out.print("Enter Data To Send : ");
31                      int data = sc.nextInt();
32
33                      int token = 0;
34
35                      System.out.println("Token Passing : ");
36
37                      for(int i=token; i<sender; i++){
38                              System.out.print(" " + i + "->");
39                      }
40
41                      System.out.println(" " + sender);
42                      System.out.println("Sender:" + sender + " Sending Data: " + data);
43
44                      for(int i=sender; i!=receiver; i = (i+1)%n){
45                              System.out.println("Data: " + data + " Forwarded By: " + i);
46                      }
47
48                      System.out.println("Receiver: " + receiver + "Received The Data: " + data);
49
50                      token = sender;
51
52                      System.out.print("Do You Want To Send Data Again? If YES Enter 1, If NO Enter 0");
53                      choice = sc.nextInt();
54
55              }while(choice == 1);
56
57      }
58 }
```




```
admin_ubuntu@Ubuntu-64-bit:~/Desktop/LP-V Distributed System Labs/Assignment-5$ javac TokenRing.java
admin_ubuntu@Ubuntu-64-bit:~/Desktop/LP-V Distributed System Labs/Assignment-5$ java TokenRing
Enter Number Of Nodes You Want In The Ring : 10
Ring Formed Is As Below:
0 1 2 3 4 5 6 7 8 9 0
Enter Sender : 4
Enter Receiver : 8
Enter Data To Send : 70
Token Passing :
 0-> 1-> 2-> 3-> 4
Sender:4 Sending Data: 70
Data: 70 Forwarded By: 4
Data: 70 Forwarded By: 5
Data: 70 Forwarded By: 6
Data: 70 Forwarded By: 7
Receiver: 8Received The Data: 70
Do You Want To Send Data Again? If YES Enter 1, If NO Enter 0
```