LPV Practical Code and Outputs

Assignment No 1

Servant.java

```
import java.rmi.RemoteException;
import java.rmi.server.UnicastRemoteObject;
import java.rmi.*;
import java.rmi.server.*;

public class Servant extends UnicastRemoteObject implements ServerInterface {
   protected Servant() throws RemoteException {
      super();
   }

   @Override
   public String concat(String a, String b) throws RemoteException {
      return a + b;
   }
}
```

ServerInterface.java

```
import java.rmi.*;

public interface ServerInterface extends Remote {
   String concat(String a, String b) throws RemoteException;
}
```

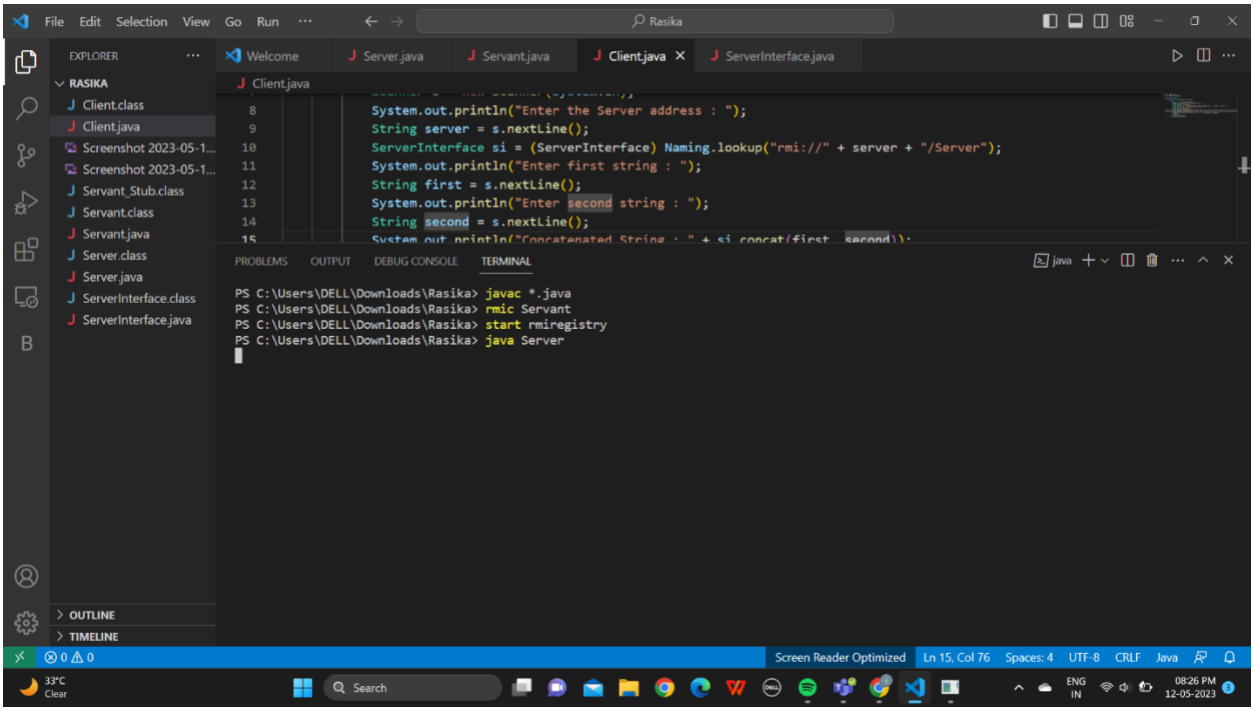
Server.java

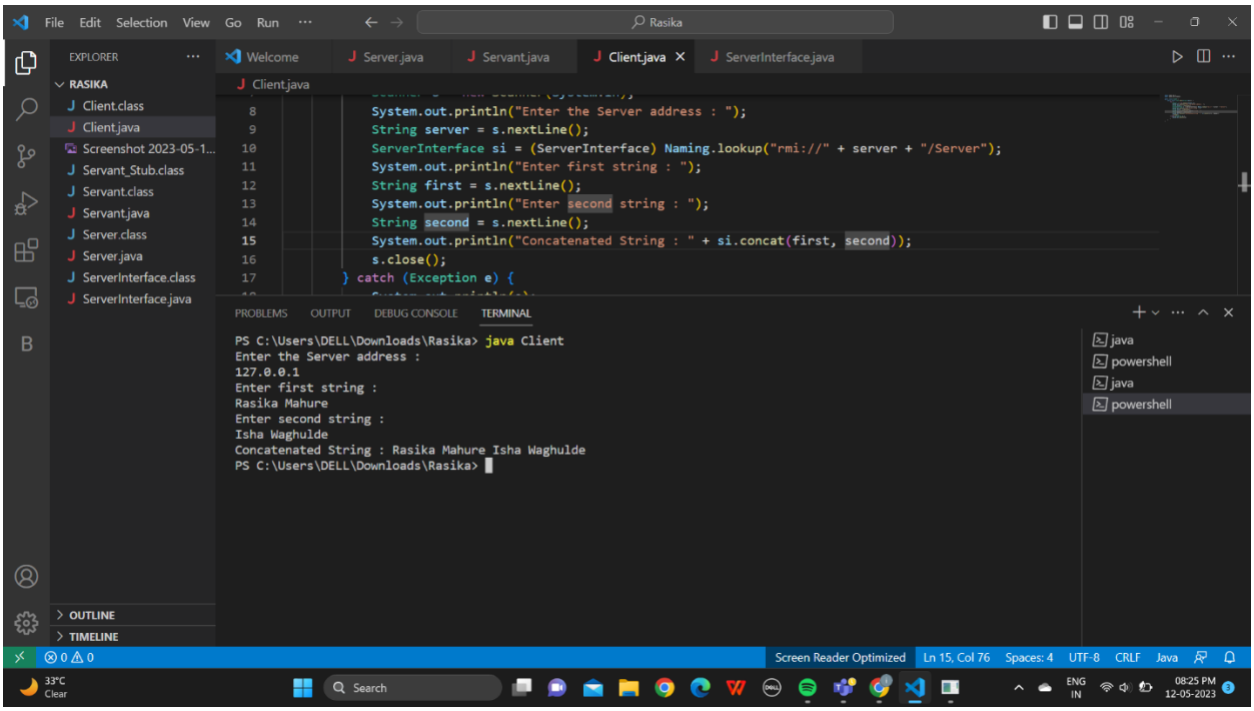
```
import java.rmi.*;
import java.net.*;

public class Server {
   public static void main(String[] args) {
      try {
         Servant s = new Servant();
         Naming.rebind("Server", s);
      } catch (Exception e) {
         System.out.println(e);
      }
   }
}
```

Client.java

```
import java.rmi.*;
import java.util.Scanner;
```

```java
public class Client {
   public static void main(String args[]) {
      try {
         Scanner s = new Scanner(System.in);
         System.out.println("Enter the Server address : ");
         String server = s.nextLine();
         ServerInterface si = (ServerInterface) Naming.lookup("rmi://" + server + "/Server");
         System.out.println("Enter first string : ");
         String first = s.nextLine();
         System.out.println("Enter second string : ");
         String second = s.nextLine();
         System.out.println("Concatenated String : " + si.concat(first, second));
         s.close();
      } catch (Exception e) {
         System.out.println(e);
      }
   }
}
```




File Edit Selection View Go Run
Rasika
EXPLORER
RASIKA
Client.class
Client.java
Screenshot 2023-05-1...
Servant_Stub.class
Servant.class
Servant.java
Server.class
Server.java
ServerInterface.class
ServerInterface.java
OUTLINE
TIMELINE
Welcome
Server.java
Servant.java
Client.java
ServerInterface.java
Client.java
8 System.out.println("Enter the Server address : ");
9 String server = s.nextLine();
10 ServerInterface si = (ServerInterface) Naming.lookup("rmi://" + server + "/Server");
11 System.out.println("Enter first string : ");
12 String first = s.nextLine();
13 System.out.println("Enter second string : ");
14 String second = s.nextLine();
15 System.out.println("Concatenated String : " + si.concat(first, second));
16 s.close();
17 } catch (Exception e) {
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
PS C:\Users\DELL\Downloads\Rasika> java Client
Enter the Server address :
127.0.0.1
Enter first string :
Rasika Mahure
Enter second string :
Isha Waghulde
Concatenated String : Rasika Mahure Isha Waghulde
PS C:\Users\DELL\Downloads\Rasika>
java
powershell
java
powershell
0 0
Screen Reader Optimized
Ln 15, Col 76
Spaces: 4
UTF-8
CRLF
Java
33°C
Clear
Search
ENG
IN
08:25 PM
12-05-2023

Assignment No 2

a) For example Calc.idl
Include the following code in the idl file

```
module CalcApp
{
    interface Calc
    {
            exception DivisionByZero {};

            float sum(in float a, in float b);
            float div(in float a, in float b) raises (DivisionByZero);
            float mul(in float a, in float b);
            float sub(in float a, in float b);
    };
};
```

b) CalcClient.java

```
import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;

import CalcApp.*;
import CalcApp.CalcPackage.DivisionByZero;

import org.omg.CosNaming.*;
import org.omg.CosNaming.NamingContextPackage.*;
import org.omg.CORBA.*;
import static java.lang.System.out;

public class CalcClient {

    static Calc calcImpl;
    static BufferedReader br = new BufferedReader(new
InputStreamReader(System.in));

    public static void main(String args[]) {
```

```
        try {
            // create and initialize the ORB
            ORB orb = ORB.init(args, null);

            // get the root naming context
            org.omg.CORBA.Object objRef =
orb.resolve_initial_references("NameService");
            // Use NamingContextExt instead of NamingContext. This is
            // part of the Interoperable naming Service.
            NamingContextExt ncRef = NamingContextExtHelper.narrow(objRef);

            // resolve the Object Reference in Naming
            String name = "Calc";
            calcImpl = CalcHelper.narrow(ncRef.resolve_str(name));
            System.out.println("Hello From the server");


            while (true) {
                out.println("1. Sum");
                out.println("2. Sub");
                out.println("3. Mul");
                out.println("4. Div");
                out.println("5. exit");
                out.println("--");
                out.println("choice: ");

                try {
                    String opt = br.readLine();
                    if (opt.equals("5")) {
                        break;
                    } else if (opt.equals("1")) {
                        out.println("a+b= " + calcImpl.sum(getFloat("a"),
getFloat("b")));
                    } else if (opt.equals("2")) {
                        out.println("a-b= " + calcImpl.sub(getFloat("a"),
getFloat("b")));
                    } else if (opt.equals("3")) {
                        out.println("a*b= " + calcImpl.mul(getFloat("a"),
getFloat("b")));
                    } else if (opt.equals("4")) {
                        try {
                            out.println("a/b= " + calcImpl.div(getFloat("a"),
getFloat("b")));
                        } catch (DivisionByZero de) {
```

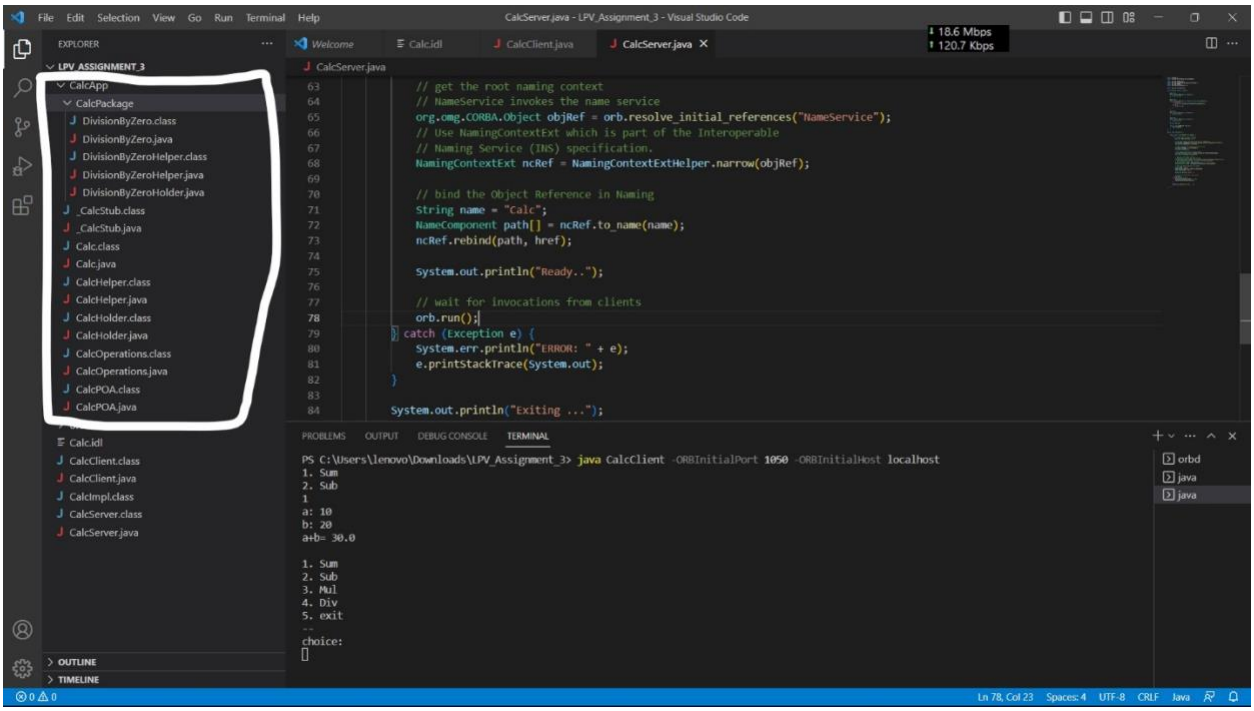
```
                            out.println("Division by zero!!!");
                        }
                    }
                } catch (Exception e) {
                    out.println("===");
                    out.println("Error with numbers");
                    out.println("===");
                }
                out.println("");

            }
            //calcImpl.shutdown();
        } catch (Exception e) {
            System.out.println("ERROR : " + e);
            e.printStackTrace(System.out);
        }
    }

    static float getFloat(String number) throws Exception {
        out.print(number + ": ");
        return Float.parseFloat(br.readLine());
    }
}
```

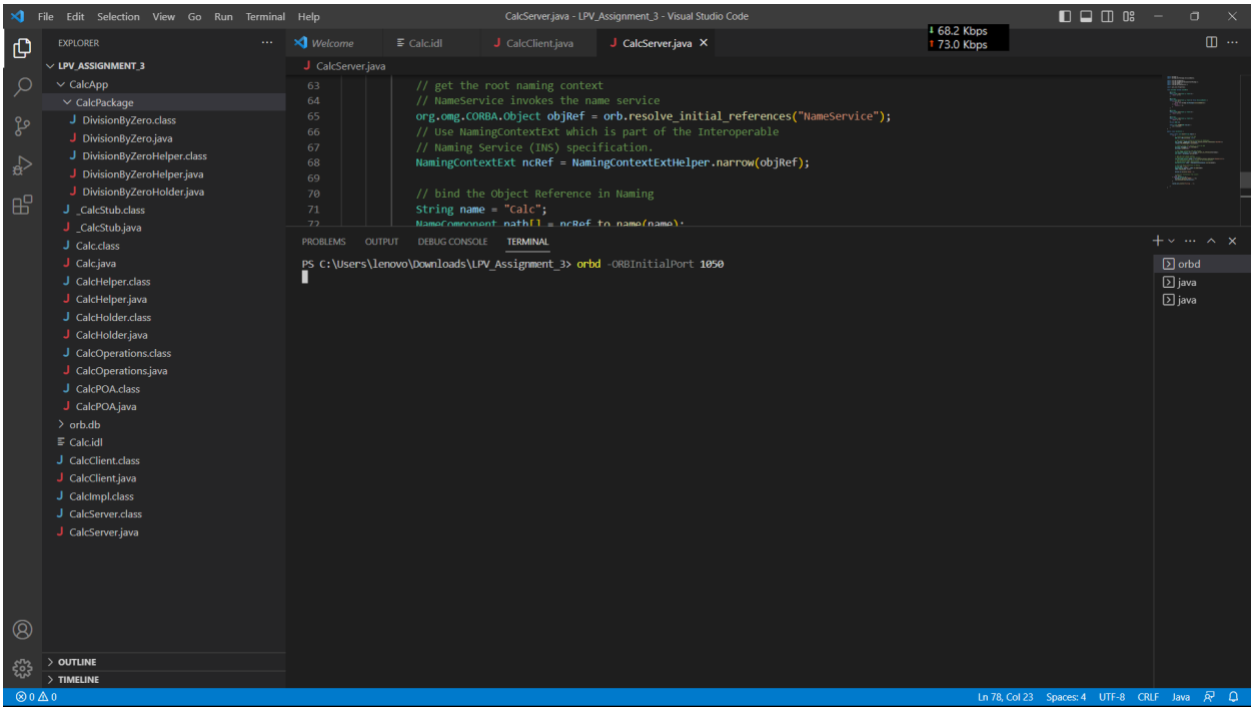
c) CalcServer.java

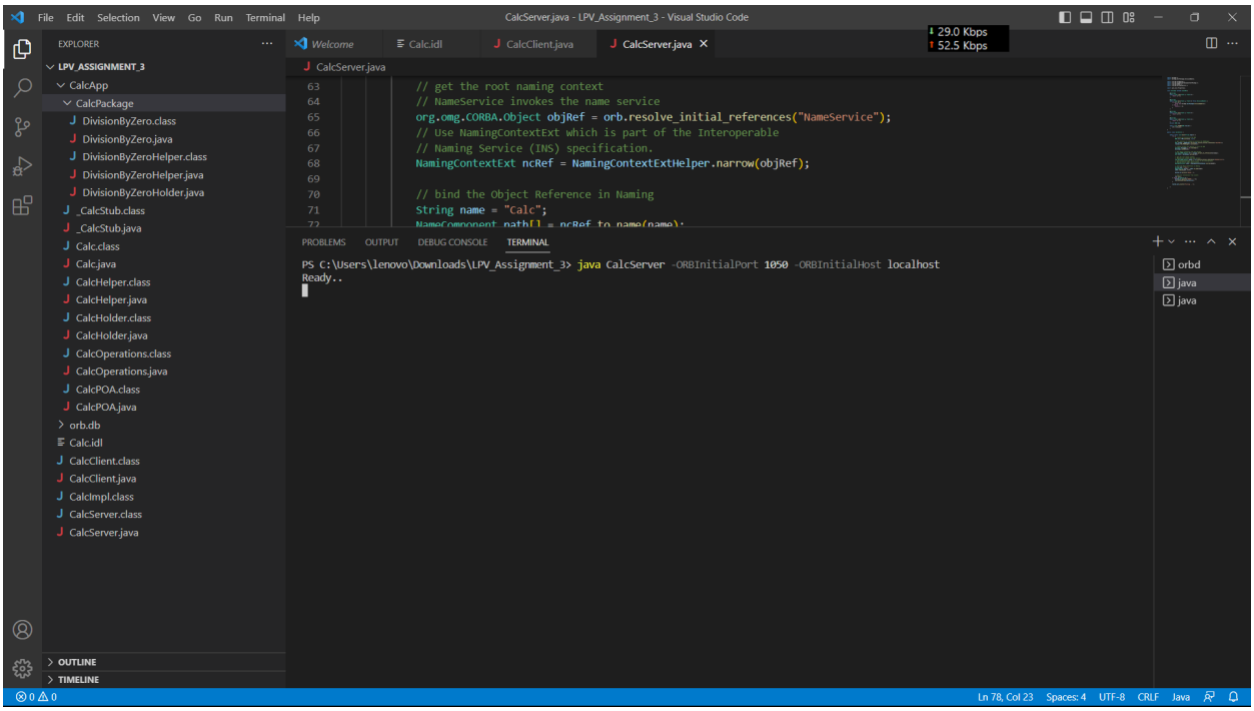
```
import CalcApp.*;
import CalcApp.CalcPackage.DivisionByZero;

import org.omg.CosNaming.*;
import org.omg.CosNaming.NamingContextPackage.*;
import org.omg.CORBA.*;
import org.omg.PortableServer.*;

import java.util.Properties;

class CalcImpl extends CalcPOA {

    @Override
    public float sum(float a, float b) {
        return a + b;
    }
```

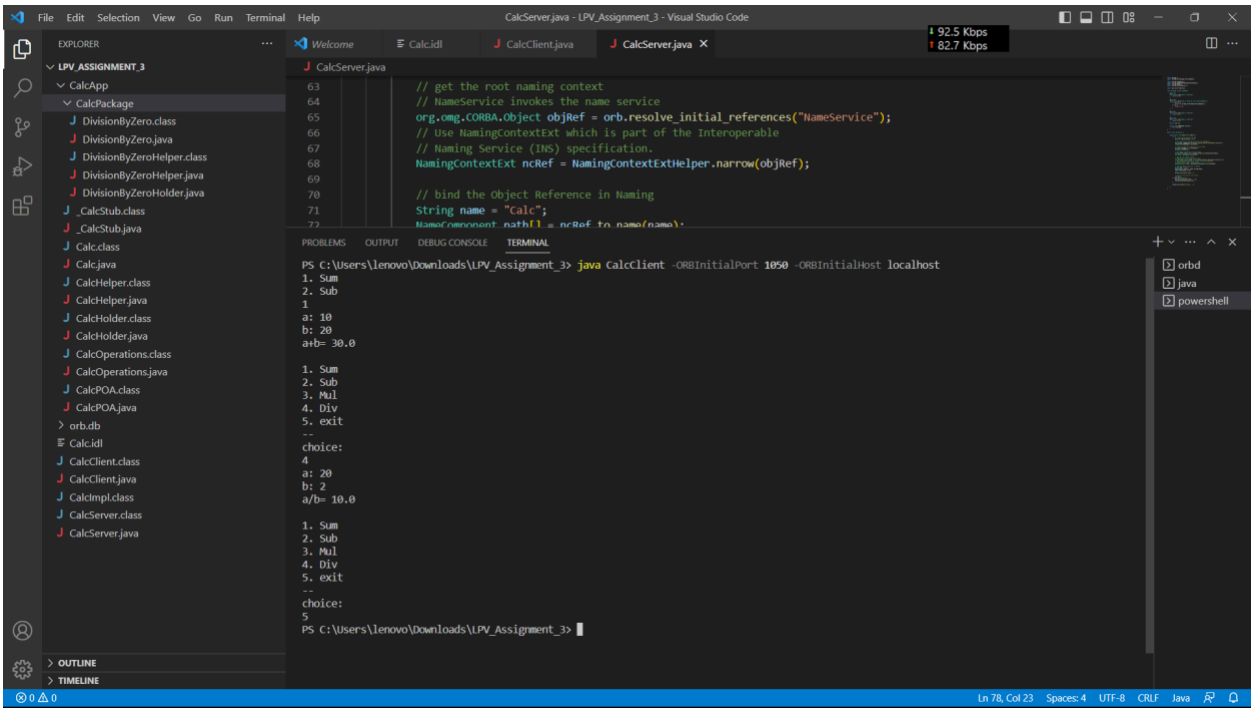
```
    @Override
    public float div(float a, float b) throws DivisionByZero {
        if (b == 0) {
            throw new CalcApp.CalcPackage.DivisionByZero();
        } else {
            return a / b;
        }
    }

    @Override
    public float mul(float a, float b) {
        return a * b;
    }

    @Override
    public float sub(float a, float b) {
        return a - b;
    }
    private ORB orb;

    public void setORB(ORB orb_val) {
        orb = orb_val;
    }
}

public class CalcServer {

    public static void main(String args[]) {
        try {
            // create and initialize the ORB
            ORB orb = ORB.init(args, null);

            // get reference to rootpoa & activate the POAManager
            POA rootpoa =
POAHelper.narrow(orb.resolve_initial_references("RootPOA"));
            rootpoa.the_POAManager().activate();

            // create servant and register it with the ORB
            CalcImpl helloImpl = new CalcImpl();
            helloImpl.setORB(orb);

            // get object reference from the servant
            org.omg.CORBA.Object ref = rootpoa.servant_to_reference(helloImpl);
            Calc href = CalcHelper.narrow(ref);
```

```
            // get the root naming context
            // NameService invokes the name service
            org.omg.CORBA.Object objRef =
orb.resolve_initial_references("NameService");
            // Use NamingContextExt which is part of the Interoperable
            // Naming Service (INS) specification.
            NamingContextExt ncRef = NamingContextExtHelper.narrow(objRef);

            // bind the Object Reference in Naming
            String name = "Calc";
            NameComponent path[] = ncRef.to_name(name);
            ncRef.rebind(path, href);

            System.out.println("Ready..");

            // wait for invocations from clients
            orb.run();
        } catch (Exception e) {
            System.err.println("ERROR: " + e);
            e.printStackTrace(System.out);
        }

        System.out.println("Exiting ...");

    }
}
```


File Edit Selection View Go Run Terminal Help
CalcServer.java - LPV_Assignment_3 - Visual Studio Code
18.6 Mbps
120.7 Kbps
EXPLORER
LPV_ASSIGNMENT_3
CalcApp
CalcPackage
DivisionByZero.class
DivisionByZero.java
DivisionByZeroHelper.class
DivisionByZeroHelper.java
DivisionByZeroHolder.java
_CalcStub.class
_CalcStub.java
Calc.class
Calc.java
CalcHelper.class
CalcHelper.java
CalcHolder.class
CalcHolder.java
CalcOperations.class
CalcOperations.java
CalcPOA.class
CalcPOA.java
Calc.idl
CalcClient.class
CalcClient.java
CalcImpl.class
CalcServer.class
CalcServer.java
Welcome
Calc.idl
CalcClient.java
CalcServer.java
// get the root naming context
// NameService invokes the name service
org.omg.CORBA.Object objRef = orb.resolve_initial_references("NameService");
// Use NamingContextExt which is part of the Interoperable
// Naming Service (INS) specification.
NamingContextExt ncRef = NamingContextExtHelper.narrow(objRef);
// bind the Object Reference in Naming
String name = "Calc";
NameComponent path[] = ncRef.to_name(name);
ncRef.rebind(path, href);
System.out.println("Ready..");
// wait for invocations from clients
orb.run();
} catch (Exception e) {
System.err.println("ERROR: " + e);
e.printStackTrace(System.out);
}
System.out.println("Exiting ...");
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
PS C:\Users\lenovo\Downloads\LPV_Assignment_3> java CalcClient -ORBInitialPort 1050 -ORBInitialHost localhost
1. Sum
2. Sub
1
a: 10
b: 20
a+b= 30.0
1. Sum
2. Sub
3. Mul
4. Div
5. exit
choice:
orbd
java
java
OUTLINE
TIMELINE
Ln 78, Col 23 Spaces: 4 UTF-8 CRLF Java


File Edit Selection View Go Run Terminal Help
CalcServer.java - LPV_Assignment_3 - Visual Studio Code
68.2 Kbps
73.0 Kbps
EXPLORER
LPV_ASSIGNMENT_3
CalcApp
CalcPackage
DivisionByZero.class
DivisionByZero.java
DivisionByZeroHelper.class
DivisionByZeroHelper.java
DivisionByZeroHolder.java
_CalcStub.class
_CalcStub.java
Calc.class
Calc.java
CalcHelper.class
CalcHelper.java
CalcHolder.class
CalcHolder.java
CalcOperations.class
CalcOperations.java
CalcPOA.class
CalcPOA.java
orb.db
Calc.idl
CalcClient.class
CalcClient.java
CalcImpl.class
CalcServer.class
CalcServer.java
Welcome
Calc.idl
CalcClient.java
CalcServer.java
// get the root naming context
// NameService invokes the name service
org.omg.CORBA.Object objRef = orb.resolve_initial_references("NameService");
// Use NamingContextExt which is part of the Interoperable
// Naming Service (INS) specification.
NamingContextExt ncRef = NamingContextExtHelper.narrow(objRef);
// bind the Object Reference in Naming
String name = "Calc";
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
PS C:\Users\lenovo\Downloads\LPV_Assignment_3> orbd -ORBInitialPort 1050
orbd
java
java
OUTLINE
TIMELINE
Ln 78, Col 23 Spaces: 4 UTF-8 CRLF Java


File Edit Selection View Go Run Terminal Help
CalcServer.java - LPV_Assignment_3 - Visual Studio Code
29.0 Kbps
52.5 Kbps
EXPLORER
LPV_ASSIGNMENT_3
CalcApp
CalcPackage
DivisionByZero.class
DivisionByZero.java
DivisionByZeroHelper.class
DivisionByZeroHelper.java
DivisionByZeroHolder.java
_CalcStub.class
_CalcStub.java
Calc.class
Calc.java
CalcHelper.class
CalcHelper.java
CalcHolder.class
CalcHolder.java
CalcOperations.class
CalcOperations.java
CalcPOA.class
CalcPOA.java
orb.db
Calc.idl
CalcClient.class
CalcClient.java
CalcImpl.class
CalcServer.class
CalcServer.java
Welcome
Calc.idl
CalcClient.java
CalcServer.java
// get the root naming context
// NameService invokes the name service
org.omg.CORBA.Object objRef = orb.resolve_initial_references("NameService");
// Use NamingContextExt which is part of the Interoperable
// Naming Service (INS) specification.
NamingContextExt ncRef = NamingContextExtHelper.narrow(objRef);
// bind the Object Reference in Naming
String name = "Calc";
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
PS C:\Users\lenovo\Downloads\LPV_Assignment_3> java CalcServer -ORBInitialPort 1050 -ORBInitialHost localhost
Ready..
orbd
java
java
OUTLINE
TIMELINE
Ln 78, Col 23 Spaces: 4 UTF-8 CRLF Java

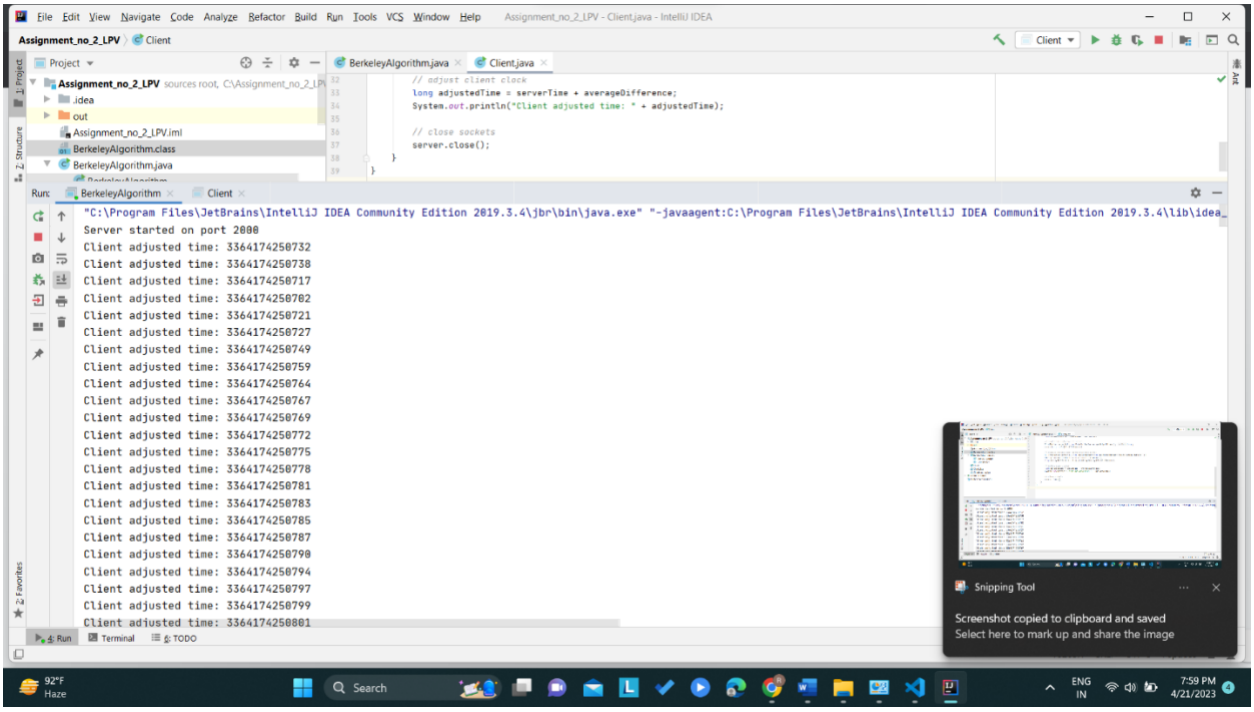

File Edit Selection View Go Run Terminal Help
CalcServer.java - LPV_Assignment_3 - Visual Studio Code
92.5 Kbps
82.7 Kbps
EXPLORER
LPV_ASSIGNMENT_3
CalcApp
CalcPackage
DivisionByZero.class
DivisionByZero.java
DivisionByZeroHelper.class
DivisionByZeroHelper.java
DivisionByZeroHolder.java
_CalcStub.class
_CalcStub.java
Calc.class
Calc.java
CalcHelper.class
CalcHelper.java
CalcHolder.class
CalcHolder.java
CalcOperations.class
CalcOperations.java
CalcPOA.class
CalcPOA.java
orb.db
Calc.idl
CalcClient.class
CalcClient.java
CalcImpl.class
CalcServer.class
CalcServer.java
Welcome
Calc.idl
CalcClient.java
CalcServer.java
// get the root naming context
// NameService invokes the name service
org.omg.CORBA.Object objRef = orb.resolve_initial_references("NameService");
// Use NamingContextExt which is part of the Interoperable
// Naming Service (INS) specification.
NamingContextExt ncRef = NamingContextExtHelper.narrow(objRef);
// bind the Object Reference in Naming
String name = "Calc";
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
PS C:\Users\lenovo\Downloads\LPV_Assignment_3> java CalcClient -ORBInitialPort 1050 -ORBInitialHost localhost
1. Sum
2. Sub
1
a: 10
b: 20
a+b= 30.0
1. Sum
2. Sub
3. Mul
4. Div
5. exit
--
choice:
4
a: 20
b: 2
a/b= 10.0
1. Sum
2. Sub
3. Mul
4. Div
5. exit
--
choice:
5
PS C:\Users\lenovo\Downloads\LPV_Assignment_3>
orbd
java
powershell
OUTLINE
TIMELINE
Ln 78, Col 23 Spaces: 4 UTF-8 CRLF Java

Assignment No 4

Code

```
import java.net.*;
import java.io.*;

public class BerkeleyAlgorithm {
  public static void main(String[] args) throws Exception {
    int port = 2000; // port number
    ServerSocket server = new ServerSocket(port);
    System.out.println("Server started on port " + port);

    while (true) {
      Socket client = server.accept();
      new Thread(new ClientHandler(client)).start();
    }
  }
}

class ClientHandler implements Runnable {
  private Socket client;

  public ClientHandler(Socket client) {
    this.client = client;
  }

  public void run() {
    try {
      // receive time request from client
      BufferedReader in = new BufferedReader(new InputStreamReader(client.getInputStream()));
      String request = in.readLine();
      long requestTime = Long.parseLong(request);

      // send current time to client
      long currentTime = System.currentTimeMillis();
      PrintWriter out = new PrintWriter(client.getOutputStream(), true);
      out.println(currentTime);

      // calculate clock difference
      long clockDifference = currentTime - requestTime;

      // send clock difference to server
      Socket server = new Socket("localhost", 2000);
      PrintWriter serverOut = new PrintWriter(server.getOutputStream(), true);
      serverOut.println(clockDifference);

      // receive average clock difference from server
      BufferedReader serverIn = new BufferedReader(new InputStreamReader(server.getInputStream()));
      String averageClockDifference = serverIn.readLine();
      long averageDifference = Long.parseLong(averageClockDifference);

      // adjust client clock
```

```
        long adjustedTime = currentTime + averageDifference;
        System.out.println("Client adjusted time: " + adjustedTime);

        // close sockets
        server.close();
        client.close();
    } catch (Exception e) {
        e.printStackTrace();
    }
  }
}
```



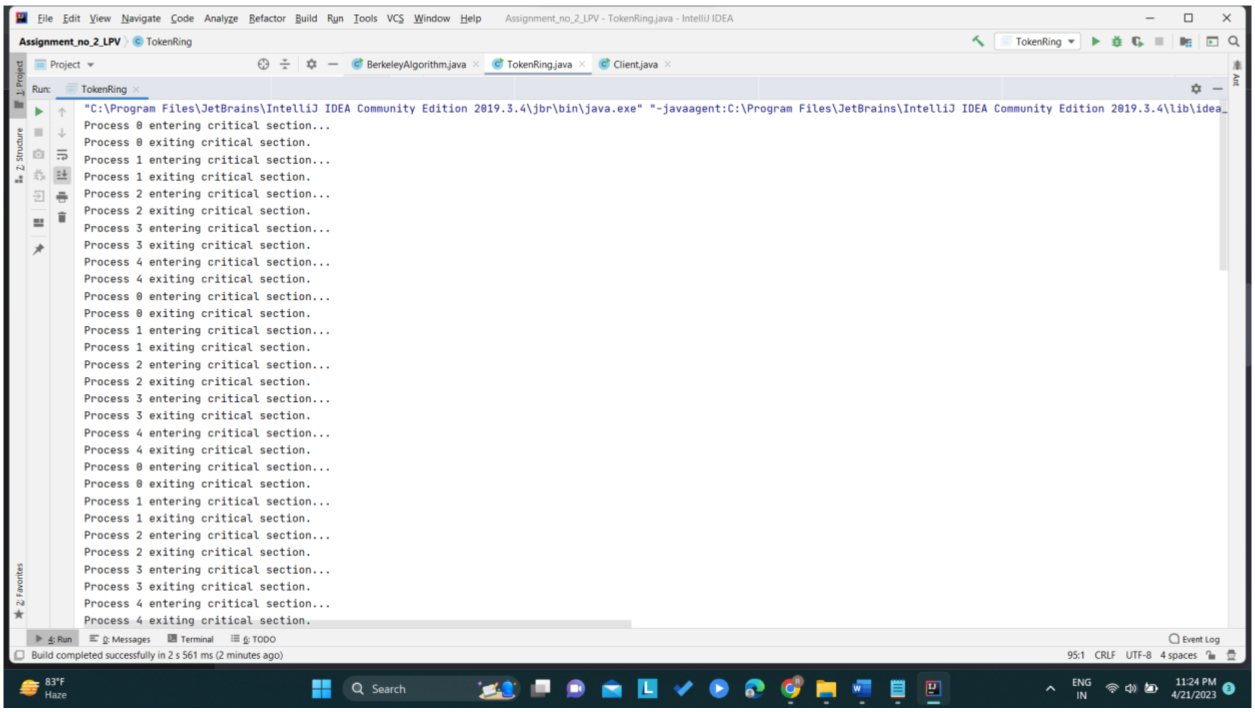
Assignment No 5

Code

```
import java.util.*;

public class TokenRing {
   private static final int N = 5; // Number of processes
   private static final int TOKEN = -1; // Token value
   private static final int CS_TIME = 1000; // Critical section time

   private static boolean[] hasToken = new boolean[N]; // Whether process i has the token
   private static boolean[] inCS = new boolean[N]; // Whether process i is in the critical section
   private static int tokenHolder = -1; // Current token holder

   private static void process(int id) throws InterruptedException {
      while (true) {
         if (hasToken[id]) {
            // Enter critical section
            inCS[id] = true;
            System.out.println("Process " + id + " entering critical section...");
            Thread.sleep(CS_TIME);
            System.out.println("Process " + id + " exiting critical section.");

            // Release token
            hasToken[id] = false;
            int nextId = (id + 1) % N;
            hasToken[nextId] = true;
            tokenHolder = nextId;
         } else {
            // Wait for token
            Thread.sleep(100);
         }
      }
   }

   public static void main(String[] args) throws InterruptedException {
      // Initialize token holder
      hasToken[0] = true;
      tokenHolder = 0;

      // Start processes
      List<Thread> threads = new ArrayList<>();
      for (int i = 0; i < N; i++) {
         int id = i;
         Thread thread = new Thread(() -> {
            try {
               process(id);
            } catch (InterruptedException e) {
               e.printStackTrace();
            }
         });
         threads.add(thread);
```

```
            thread.start();
        }

        // Wait for processes to finish
        for (Thread thread : threads) {
            thread.join();
        }
    }
}
```

Output



Assignment No 6

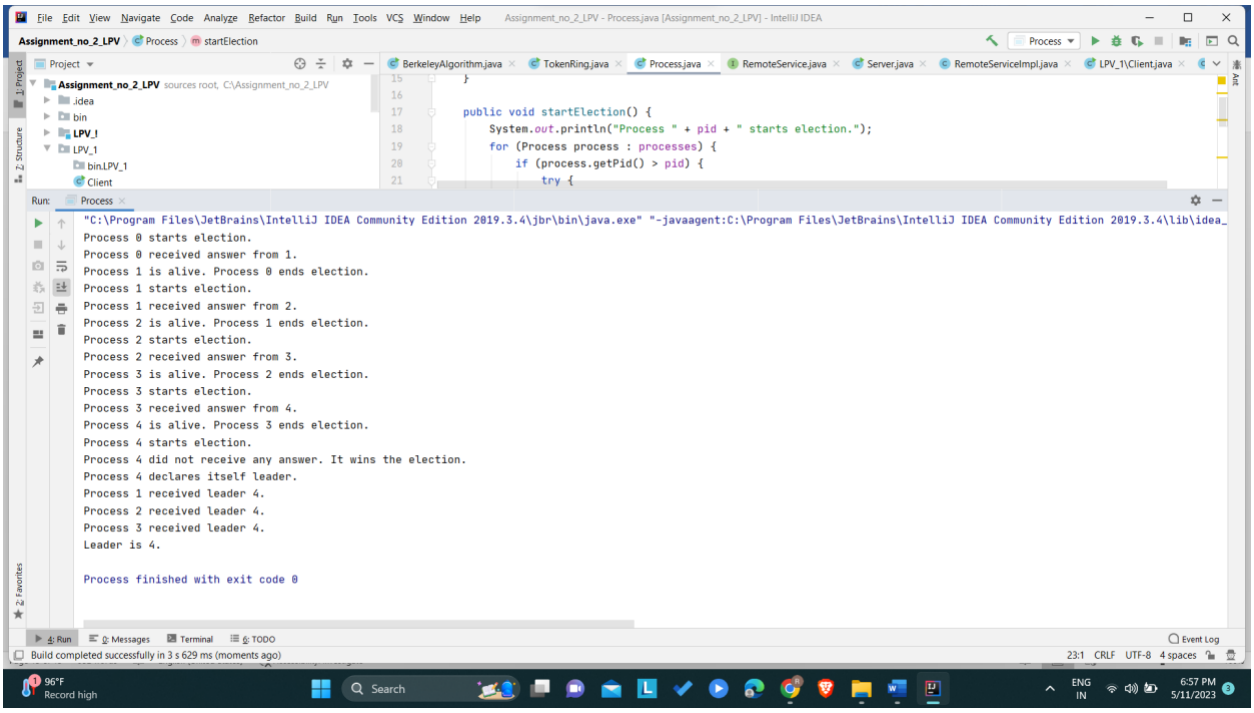
Code

```
import java.util.ArrayList;
import java.util.List;
import java.util.Random;

public class Process {
   private int pid;
   private List<Process> processes;
   private int leader;
   private boolean isRunning;

   public Process(int pid, List<Process> processes) {
      this.pid = pid;
      this.processes = processes;
      this.isRunning = true;
   }

   public void startElection() {
      System.out.println("Process " + pid + " starts election.");
      for (Process process : processes) {
         if (process.getPid() > pid) {
            try {
               if (process.ping()) {
                  System.out.println("Process " + pid + " received answer from " + process.getPid() + ".");
                  System.out.println("Process " + process.getPid() + " is alive. Process " + pid + " ends election.");
                  return;
               }
            } catch (Exception e) {
               System.out.println("Process " + process.getPid() + " is down.");
            }
         }
      }
      System.out.println("Process " + pid + " did not receive any answer. It wins the election.");
      declareLeader();
   }

   public boolean ping() {
      if (!isRunning) {
         return false;
      }
      return true;
   }

   public void declareLeader() {
      System.out.println("Process " + pid + " declares itself leader.");
      leader = pid;
      for (Process process : processes) {
         if (process.getPid() != pid) {
```

```
            try {
                process.notifyLeader(pid);
            } catch (Exception e) {
                // do nothing
            }
        }
    }
}

public void notifyLeader(int leader) {
    if (!isRunning) {
        return;
    }
    System.out.println("Process " + pid + " received leader " + leader + ".");
    this.leader = leader;
}

public void stop() {
    isRunning = false;
}

public int getPid() {
    return pid;
}

public int getLeader() {
    return leader;
}

public static void main(String[] args) {
    List<Process> processes = new ArrayList<>();
    for (int i = 0; i < 5; i++) {
        processes.add(new Process(i, new ArrayList<Process>()));
    }
    for (int i = 0; i < 5; i++) {
        Process process = processes.get(i);
        process.setProcesses(new ArrayList<>(processes.subList(0, i)));
        process.getProcesses().addAll(processes.subList(i + 1, 5));
    }
    // randomly choose a process to fail
    Process failedProcess = processes.get(new Random().nextInt(5));
    failedProcess.stop();
    // start the election
    for (Process process : processes) {
        process.startElection();
    }
    // print the result
    int maxLeader = -1;
    for (Process process : processes) {
        maxLeader = Math.max(maxLeader, process.getLeader());
    }
    System.out.println("Leader is " + maxLeader + ".");
}

public List<Process> getProcesses() {
```

```
        return processes;
    }

    public void setProcesses(List<Process> processes) {
        this.processes = processes;
    }
}
```

Output



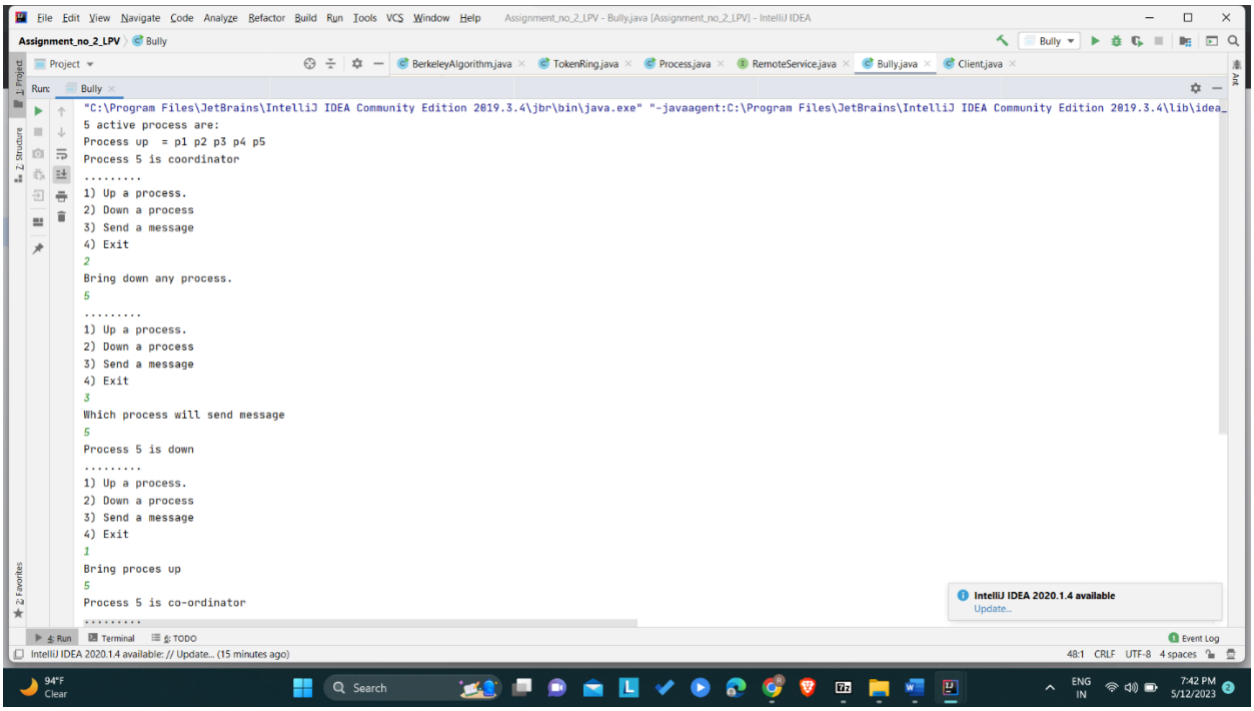
Assignment No 7

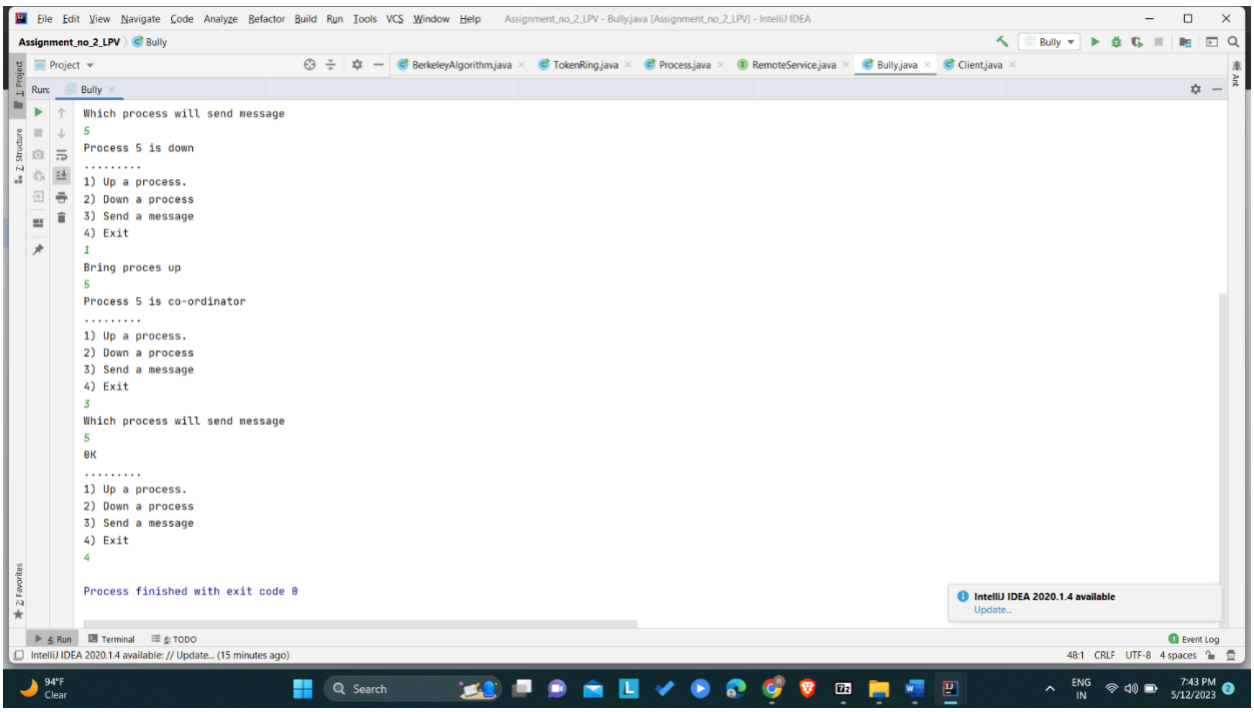
Code

A) Bully Algorithm

```
import java.io.InputStream;
    import java.io.PrintStream;
    import java.util.Scanner;

public class Bully {
  static boolean[] state = new boolean[5];
  int coordinator;

  public static void up(int up) {
    if (state[up - 1]) {
      System.out.println("Process " + up + " is already up");
    } else {
      int i;
      Bully.state[up - 1] = true;
      System.out.println("Process " + up + " held election");
      for (i = up; i < 5; ++i) {
        System.out.println("Election message sent from process " + up + " to process " + (i + 1));
      }
      for (i = up + 1; i <= 5; ++i) {
        if (!state[i - 1]) continue;
        System.out.println("Alive message send from process " + i + " to process " + up);
        break;
      }
    }
  }

  public static void down(int down) {
    if (!state[down - 1]) {
      System.out.println("Process " + down + " is already dowm.");
    } else {
      Bully.state[down - 1] = false;
    }
  }

  public static void mess(int mess) {
    if (state[mess - 1]) {
      if (state[4]) {
        System.out.println("0K");
      } else if (!state[4]) {
        int i;
        System.out.println("Process " + mess + " election");
        for (i = mess; i < 5; ++i) {
          System.out.println("Election send from process " + mess + " to process " + (i + 1));
        }
        for (i = 5; i >= mess; --i) {
          if (!state[i - 1]) continue;
```

```
                System.out.println("Coordinator message send from process " + i + " to all");
                break;
            }
          }
        } else {
          System.out.println("Process " + mess + " is down");
        }
    }

    public static void main(String[] args) {
        int choice;
        Scanner sc = new Scanner(System.in);
        for (int i = 0; i < 5; ++i) {
          Bully.state[i] = true;
        }
        System.out.println("5 active process are:");
        System.out.println("Process up  = p1 p2 p3 p4 p5");
        System.out.println("Process 5 is coordinator");
        do {
          System.out.println(".....");
          System.out.println("1) Up a process.");
          System.out.println("2) Down a process");
          System.out.println("3) Send a message");
          System.out.println("4) Exit");
          choice = sc.nextInt();
          switch (choice) {
            case 1: {
              System.out.println("Bring proces up");
              int up = sc.nextInt();
              if (up == 5) {
                System.out.println("Process 5 is co-ordinator");
                Bully.state[4] = true;
                break;
              }
              Bully.up(up);
              break;
            }
            case 2: {
              System.out.println("Bring down any process.");
              int down = sc.nextInt();
              Bully.down(down);
              break;
            }
            case 3: {
              System.out.println("Which process will send message");
              int mess = sc.nextInt();
              Bully.mess(mess);
            }
          }
        } while (choice != 4);
        sc.close();

    }
}
```


"C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2019.3.4\jbr\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2019.3.4\lib\idea_
5 active process are:
Process up = p1 p2 p3 p4 p5
Process 5 is coordinator
....
1) Up a process.
2) Down a process
3) Send a message
4) Exit
2
Bring down any process.
5
....
1) Up a process.
2) Down a process
3) Send a message
4) Exit
3
Which process will send message
5
Process 5 is down
....
1) Up a process.
2) Down a process
3) Send a message
4) Exit
1
Bring proces up
5
Process 5 is co-ordinator
....
IntelliJ IDEA 2020.1.4 available
Update...

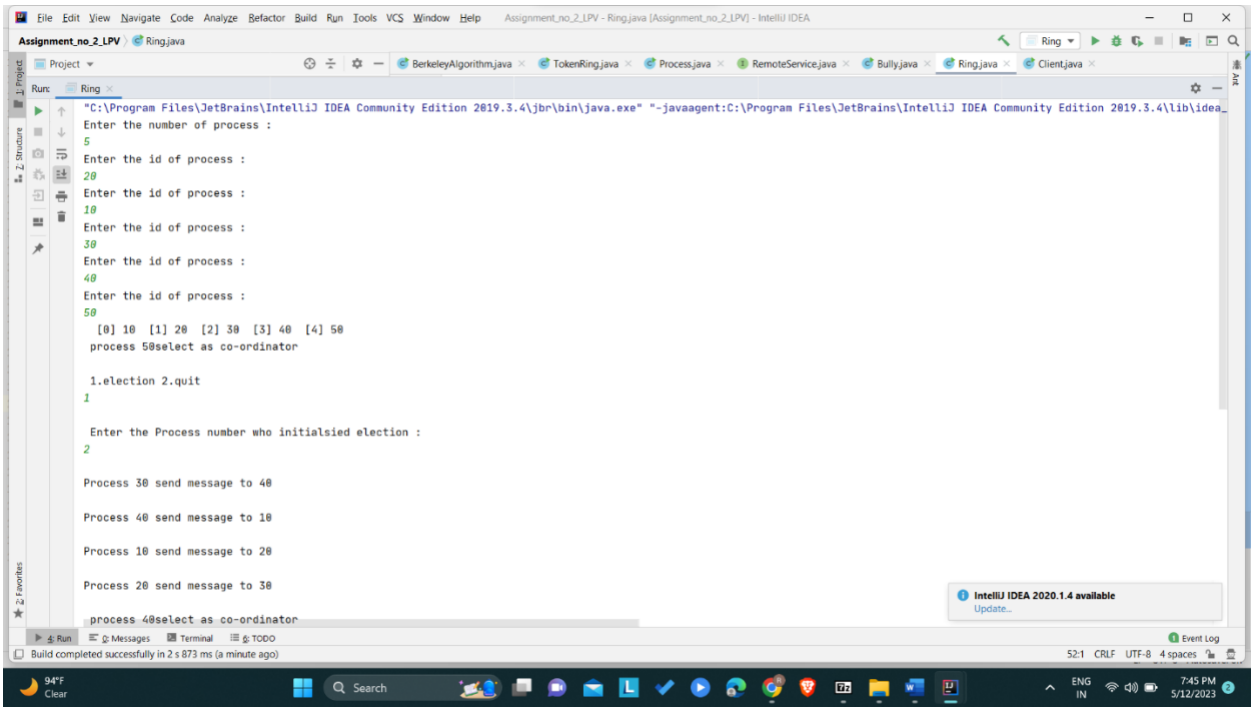

Which process will send message
5
Process 5 is down
....
1) Up a process.
2) Down a process
3) Send a message
4) Exit
1
Bring proces up
5
Process 5 is co-ordinator
....
1) Up a process.
2) Down a process
3) Send a message
4) Exit
3
Which process will send message
5
0K
....
1) Up a process.
2) Down a process
3) Send a message
4) Exit
4
Process finished with exit code 0
IntelliJ IDEA 2020.1.4 available
Update...

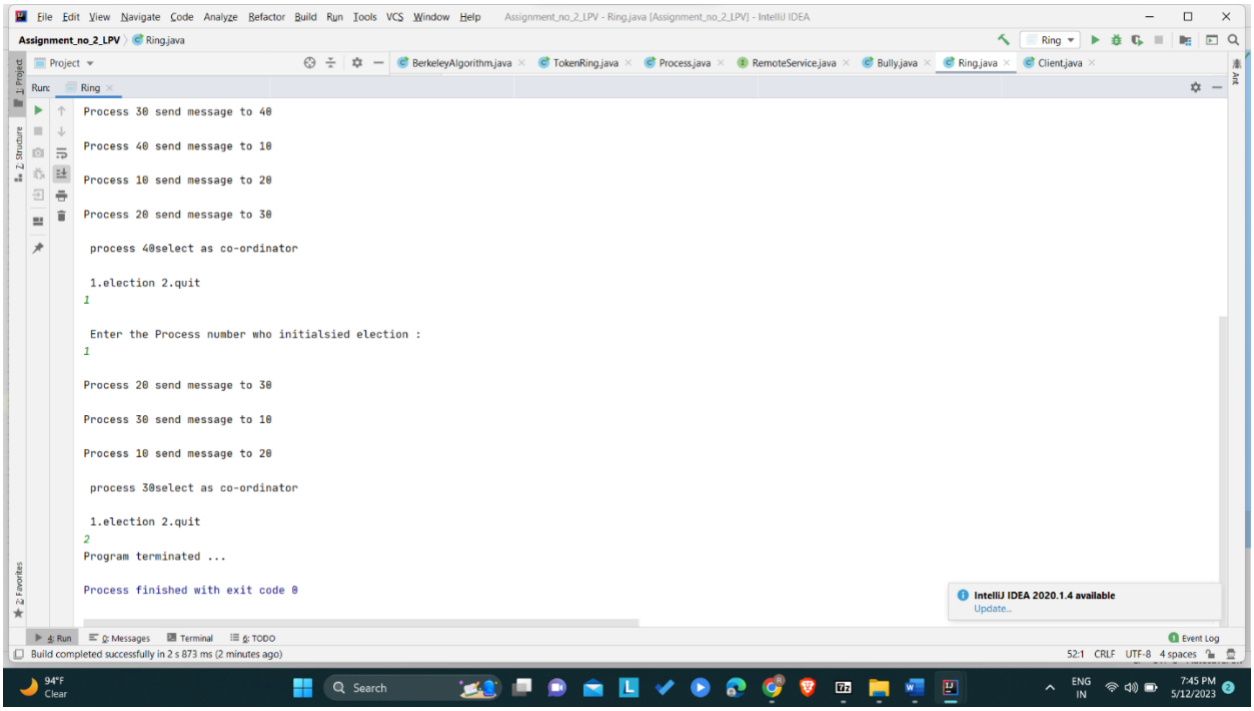
B) Ring Algorithm

C)
```
import java.util.Scanner;

public class Ring {

  public static void main(String[] args) {

    // TODO Auto-generated method stub

    int temp, i, j;
    char str[] = new char[10];
    Rr proc[] = new Rr[10];

// object initialisation
    for (i = 0; i < proc.length; i++)
      proc[i] = new Rr();

// scanner used for getting input from console
    Scanner in = new Scanner(System.in);
    System.out.println("Enter the number of process : ");
    int num = in.nextInt();

// getting input from users
    for (i = 0; i < num; i++) {
      proc[i].index = i;
      System.out.println("Enter the id of process : ");
      proc[i].id = in.nextInt();
      proc[i].state = "active";
      proc[i].f = 0;
    }


// sorting the processes from on the basis of id
    for (i = 0; i < num - 1; i++) {
      for (j = 0; j < num - 1; j++) {
        if (proc[j].id > proc[j + 1].id) {
          temp = proc[j].id;
          proc[j].id = proc[j + 1].id;
          proc[j + 1].id = temp;
        }
      }
    }


    for (i = 0; i < num; i++) {
      System.out.print("  [" + i + "]" + " " + proc[i].id);
    }



    int init;
    int ch;
    int temp1;
```

```
    int temp2;
    int ch1;
    int arr[] = new int[10];

    proc[num - 1].state = "inactive";

    System.out.println("\n process " + proc[num - 1].id + "select as co-ordinator");

    while (true) {
      System.out.println("\n 1.election 2.quit ");
      ch = in.nextInt();

      for (i = 0; i < num; i++) {
        proc[i].f = 0;
      }

      switch (ch) {
      case 1:
        System.out.println("\n Enter the Process number who initialsied election : ");
        init = in.nextInt();
        temp2 = init;
        temp1 = init + 1;

        i = 0;

        while (temp2 != temp1) {
          if ("active".equals(proc[temp1].state) && proc[temp1].f == 0) {

            System.out.println("\nProcess " + proc[init].id + " send message to " + proc[temp1].id);
            proc[temp1].f = 1;
            init = temp1;
            arr[i] = proc[temp1].id;
            i++;
          }
          if (temp1 == num) {
            temp1 = 0;
          } else {
            temp1++;
          }
        }

        System.out.println("\nProcess " + proc[init].id + " send message to " + proc[temp1].id);
        arr[i] = proc[temp1].id;
        i++;
        int max = -1;


// finding maximum for co-ordinator selection
        for (j = 0; j < i; j++) {
          if (max < arr[j]) {
            max = arr[j];
          }
        }

// co-ordinator is found then printing on console
```

```
        System.out.println("\n process " + max + "select as co-ordinator");


        for (i = 0; i < num; i++) {

          if (proc[i].id == max) {
            proc[i].state = "inactive";
          }
        }
        break;
      case 2:
        System.out.println("Program terminated ...");
        return ;
      default:
        System.out.println("\n invalid response \n");
        break;
      }


    }
  }

}

class Rr {

  public int index;   // to store the index of process
  public int id;     // to store id/name of process
  public int f;
  String state;      // indiactes whether active or inactive state of node

}
```


"C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2019.3.4\jbr\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2019.3.4\lib\idea_
Enter the number of process :
5
Enter the id of process :
20
Enter the id of process :
10
Enter the id of process :
30
Enter the id of process :
40
Enter the id of process :
50
[0] 10 [1] 20 [2] 30 [3] 40 [4] 50
process 50select as co-ordinator
1.election 2.quit
1
Enter the Process number who initialsied election :
2
Process 30 send message to 40
Process 40 send message to 10
Process 10 send message to 20
Process 20 send message to 30
process 40select as co-ordinator
IntelliJ IDEA 2020.1.4 available
Update...
Build completed successfully in 2 s 873 ms (a minute ago)


Process 30 send message to 40
Process 40 send message to 10
Process 10 send message to 20
Process 20 send message to 30
process 40select as co-ordinator
1.election 2.quit
1
Enter the Process number who initialsied election :
1
Process 20 send message to 30
Process 30 send message to 10
Process 10 send message to 20
process 30select as co-ordinator
1.election 2.quit
2
Program terminated ...
Process finished with exit code 0
IntelliJ IDEA 2020.1.4 available
Update...
Build completed successfully in 2 s 873 ms (2 minutes ago)