



# University of Dhaka

## Department of Computer Science and Engineering

CSE 3111 – Computer Networking Laboratory Credits: 1.5 Batch: 26/3<sup>rd</sup> Year 1<sup>st</sup> Sem 2022

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### Lab Experiment # 2

#### **Name of the Experiment:**

#### **Introduction to Socket Programming — Exercises on Simple Client-Server Communication**

##### Creating TCP Connections using Socket Programming

- a) Establish a TCP connection in between a server process, running on host A and a client process, running on host B and then perform some operation by the server process requested by the client and send responses from the server.
  - i. Small letter to capital conversion for a line of text
  - ii. Checking whether a number is prime or not
- b) Using the above connection, design and implement a non-idempotent operation using exactly-once semantics that can handle failure of request messages, failure of response messages and process execution failures.
  - i. Design and describe an application-level protocol to be used between an automatic teller machine and a bank's centralized server. Your protocol should allow a user's card and password to be verified, the account balance (which is maintained at the centralized computer) to be queried, and an account withdrawal to be made (that is, money disbursed to the user). Your protocol entities should be able to handle the all-too-common cases in which there is not enough money in the account to cover the withdrawal. Specify your protocol by listing the messages exchanged and the action taken by the automatic teller machine or the bank's centralized computer on transmission and receipt of messages. Sketch the operation of your protocol for the case of a simple withdrawal with no errors.
  - ii. HOME WORK – Enhance the above protocol so that it can handle errors related to both request and response messages to and from the server.

Resource Link: <https://www.geeksforgeeks.org/socket-programming-in-java/>

#### **What is an idempotent operation?**

In computing, an idempotent operation is one that has no additional effect if it is called more than once with the same input parameters. For example, removing an item from a set can be considered an idempotent operation on the set.

#### **What is an exactly-once semantics?**

As its name suggests, exactly-once semantics means that each message is delivered precisely once. The message can neither be lost nor delivered twice (or more times). Exactly-once is by far the most dependable message delivery guarantee.

### **// A Java program for a Client**

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

public class Client
{
    // initialize socket and input output streams
    private Socket socket      = null;
    private DataInputStream input = null;
    private DataOutputStream out      = null;

    // constructor to put ip address and port
    public Client(String address, int port)
    {
        // establish a connection
        try
        {
            socket = new Socket(address, port);
            System.out.println("Connected");

            // takes input from terminal
            input = new DataInputStream(System.in);

            // sends output to the socket
            out = new DataOutputStream(socket.getOutputStream());
        }
        catch(UnknownHostException u)
        {
            System.out.println(u);
        }
        catch(IOException i)
        {
            System.out.println(i);
        }

        // string to read message from input
        String line = "";

        // keep reading until "Over" is input
        while (!line.equals("Over"))
        {
            try
            {
                line = input.readLine();
                out.writeUTF(line);
            }
            catch(IOException i)
```

```

        {
            System.out.println(i);
        }
    }

    // close the connection
    try
    {
        input.close();
        out.close();
        socket.close();
    }
    catch(IOException i)
    {
        System.out.println(i);
    }
}

public static void main(String args[])
{
    Client client = new Client("IP Address of Server machine", 5000);
}
}

```

### **// A Java program for a Server**

```

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

public class Server
{
    //initialize socket and input stream
    private Socket      socket = null;
    private ServerSocket server = null;
    private DataInputStream in  = null;

    // constructor with port
    public Server(int port)
    {
        // starts server and waits for a connection
        try
        {
            server = new ServerSocket(port);
            System.out.println("Server started");

            System.out.println("Waiting for a client ...");

```

```

        socket = server.accept();
        System.out.println("Client accepted");

        // takes input from the client socket
        in = new DataInputStream(
            new BufferedInputStream(socket.getInputStream()));

        String line = "";

        // reads message from client until "Over" is sent
        while (!line.equals("Over"))
        {
            try
            {
                line = in.readUTF();
                System.out.println(line);
            }
            catch(IOException i)
            {
                System.out.println(i);
            }
        }
        System.out.println("Closing connection");

        // close connection
        socket.close();
        in.close();
    }
    catch(IOException i)
    {
        System.out.println(i);
    }
}

public static void main(String args[])
{
    Server server = new Server(5000);
}
}

```