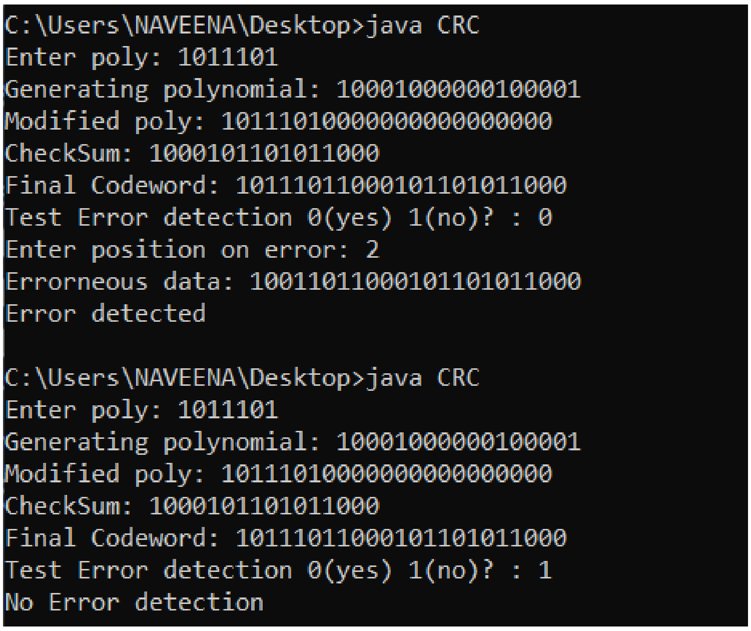
CN LAB CYCLE 2 PROGRAMS

1) Write a program for error detecting code using CRC-CCITT (16-bits).

```
import java.util.*;
public class CRC{
public static int n;
 public static void main(String[] args){
  Scanner in=new Scanner(System.in);
  CRC ob=new CRC();
 String code, copy, rec,zero="0000000000000000";
 System.out.print("Enter poly: ");
 code=in.nextLine();
 System.out.println("Generating polynomial: 10001000000100001");
 n=code.length()
 copy=code;
 code+=zero;
System.out.println("Modified poly: "+code);
code=ob.divide(code);
System.out.println("CheckSum: "+code.substring(n));
copy=copy.substring(0,n)+code.substring(n);
System.out.println("Final Codeword: "+copy);
 // System.out.print("\nEnter recived data: ");
  // rec=in.nextLine();
 // if(zero.equals(ob.divide(rec).substring(n)))
  //     System.out.println("Correct bits recieved");
    // else
    //     System.out.println("Recieved frame contains one or more errors");
 System.out.print("Test Error detection 0(yes) 1(no)? : ");
  int choice = in.nextInt();
if(choice == 0){
 System.out.print("Enter position on error: ");
  int errorPos = in.nextInt();
 if(copy.charAt(errorPos) == '1')
   copy = copy.substring(0,errorPos) + "0" + copy.substring(errorPos+1);
    else
    copy = copy.substring(0,errorPos) + "1" + copy.substring(errorPos+1);
System.out.println("Errorneous data: "+copy);
System.out.println("Error detected");
        }
        else
System.out.println("No Error detection");
    }
  public String divide(String s){
        int i,j;
        char x;
        String div="10001000000100001";
   for(i=0;i<n;i++){
            x=s.charAt(i);
    for(j=0;j<17;j++){
      if(x=='1'){
       if(s.charAt(i+j)!=div.charAt(j))
       s=s.substring(0,i+j)+"1"+s.substring(i+j+1);
        else
      s=s.substring(0,i+j)+"0"+s.substring(i+j+1);
        }
        }
        }
 return s;
 }
}
```

OUTPUT:



```
C:\Users\NAVEENA\Desktop>java CRC
Enter poly: 1011101
Generating polynomial: 10001000000100001
Modified poly: 10111010000000000000000
CheckSum: 1000101101011000
Final Codeword: 10111011000101101011000
Test Error detection 0(yes) 1(no)? : 0
Enter position on error: 2
Errorneous data: 10011011000101101011000
Error detected

C:\Users\NAVEENA\Desktop>java CRC
Enter poly: 1011101
Generating polynomial: 10001000000100001
Modified poly: 10111010000000000000000
CheckSum: 1000101101011000
Final Codeword: 10111011000101101011000
Test Error detection 0(yes) 1(no)? : 1
No Error detection
```

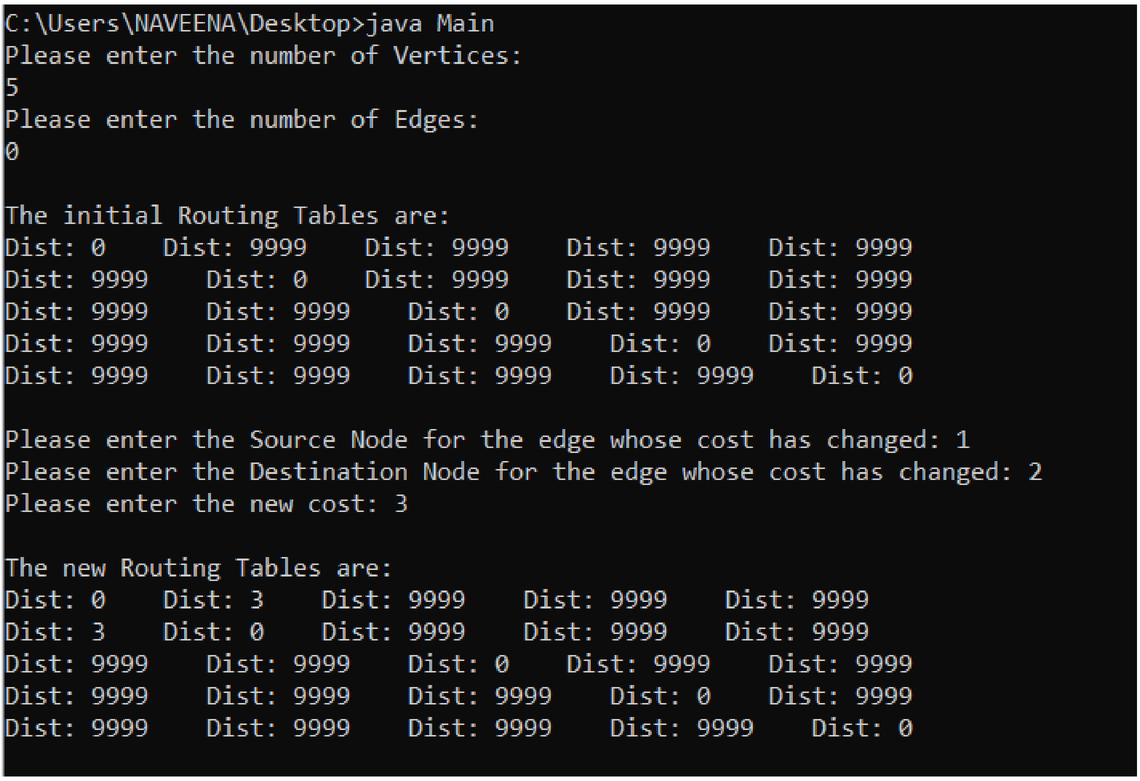
2) Write a program for distance vector algorithm to find suitable path for transmission.

```
import java.io.*;
public class Main
{
 static int graph[][];
 static int via[][];
 static int rt[][];
 static int v;
 static int e;

 public static void main(String args[]) throws IOException
 {
  BufferedReader br = new BufferedReader(new InputStreamReader(System.in));

  System.out.println("Please enter the number of Vertices: ");
  v = Integer.parseInt(br.readLine());

  System.out.println("Please enter the number of Edges: ");
  e = Integer.parseInt(br.readLine());

  graph = new int[v][v];
  via = new int[v][v];
  rt = new int[v][v];
  for(int i = 0; i < v; i++)
   for(int j = 0; j < v; j++)
   {
    if(i == j)
     graph[i][j] = 0;
    else
     graph[i][j] = 9999;
   }
 for(int i = 0; i < e; i++)
 {
  System.out.println("Please enter data for Edge " + (i + 1) + ":");
  System.out.print("Source: ");
  int s = Integer.parseInt(br.readLine());
  s--;
  System.out.print("Destination: ");
  int d = Integer.parseInt(br.readLine());
  d--;
  System.out.print("Cost: ");
  int c = Integer.parseInt(br.readLine());
  graph[s][d] = c;
  graph[d][s] = c;
 }

 dvr_calc_disp("The initial Routing Tables are: ");


 System.out.print("Please enter the Source Node for the edge whose cost has changed: ");
 int s = Integer.parseInt(br.readLine());
 s--;
 System.out.print("Please enter the Destination Node for the edge whose cost has changed: ");
 int d = Integer.parseInt(br.readLine());
 d--;
 System.out.print("Please enter the new cost: ");
 int c = Integer.parseInt(br.readLine());
 graph[s][d] = c;
 graph[d][s] = c;

 dvr_calc_disp("The new Routing Tables are: ");
}
```

```
 }
 static void dvr_calc_disp(String message)
 {
  System.out.println();
  init_tables();
  update_tables();
  System.out.println(message);
  print_tables();
  System.out.println();
 }
static void update_table(int source)
 {
  for(int i = 0; i < v; i++)
  {
   if(graph[source][i] != 9999)
  {
  int dist = graph[source][i];
    for(int j = 0; j < v; j++)
    {
     int inter_dist = rt[i][j];
     if(via[i][j] == source)
      inter_dist = 9999;
     if(dist + inter_dist < rt[source][j])
     {
      rt[source][j] = dist + inter_dist;
      via[source][j] = i;
     }
    }
    }
   }
 }
 static void update_tables()
 {
  int k = 0;
  for(int i = 0; i < 4*v; i++)
  {
   update_table(k);
   k++;
   if(k == v)
    k = 0;
  }
 }
static void init_tables()
 {
  for(int i = 0; i < v; i++)
  {
   for(int j = 0; j < v; j++)
   {
    if(i == j)
    {
     rt[i][j] = 0;
     via[i][j] = i;
    }
    else
    {
     rt[i][j] = 9999;
     via[i][j] = 100;
    }
   }
  }
 }

 static void print_tables()
```

```
{
 for(int i = 0; i < v; i++)
 {
  for(int j = 0; j < v; j++)
  {
   System.out.print("Dist: " + rt[i][j] + "    ");
  }
  System.out.println();
 }
}
}
```

OUTPUT:

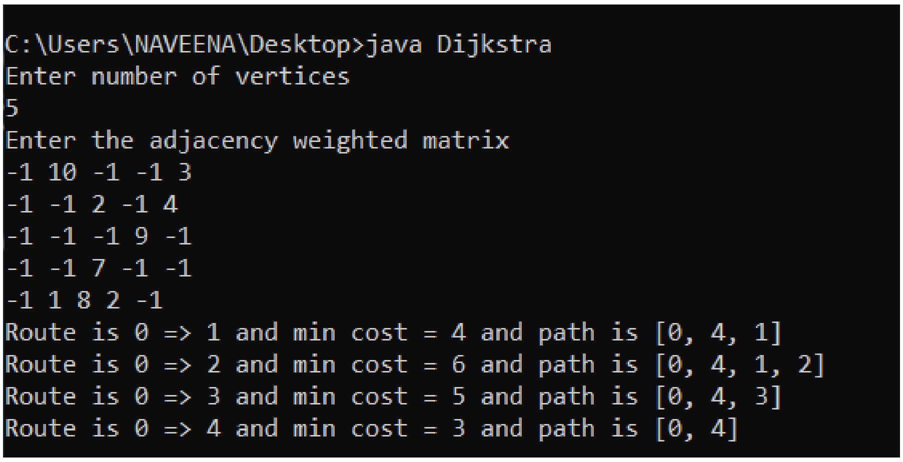


```
C:\Users\NAVEENA\Desktop>java Main
Please enter the number of Vertices:
5
Please enter the number of Edges:
0

The initial Routing Tables are:
Dist: 0    Dist: 9999    Dist: 9999    Dist: 9999    Dist: 9999
Dist: 9999    Dist: 0    Dist: 9999    Dist: 9999    Dist: 9999
Dist: 9999    Dist: 9999    Dist: 0    Dist: 9999    Dist: 9999
Dist: 9999    Dist: 9999    Dist: 9999    Dist: 0    Dist: 9999
Dist: 9999    Dist: 9999    Dist: 9999    Dist: 9999    Dist: 0

Please enter the Source Node for the edge whose cost has changed: 1
Please enter the Destination Node for the edge whose cost has changed: 2
Please enter the new cost: 3

The new Routing Tables are:
Dist: 0    Dist: 3    Dist: 9999    Dist: 9999    Dist: 9999
Dist: 3    Dist: 0    Dist: 9999    Dist: 9999    Dist: 9999
Dist: 9999    Dist: 9999    Dist: 0    Dist: 9999    Dist: 9999
Dist: 9999    Dist: 9999    Dist: 9999    Dist: 0    Dist: 9999
Dist: 9999    Dist: 9999    Dist: 9999    Dist: 9999    Dist: 0
```

3) Implement Dijkstra’s algorithm to compute the shortest path for a given topology.

```
import java.util.*;


class Edge{
    int src, dest, w;
    public Edge(int src, int dest, int w){
        this.src = src;
        this.dest = dest;
        this.w = w;
    }
}


class Node {
    int vertex, w;
    public Node(int vertex, int w) {
        this.vertex = vertex;
        this.w = w;
    }
}



class Graph{
    List<List<Edge>> edgeList = null;
    Graph(List<Edge> edges, int N){
        edgeList = new ArrayList<>();
        for (int i = 0; i < N; i++) {
            edgeList.add(new ArrayList<>());
        }
        for (Edge edge: edges){
            edgeList.get(edge.src).add(edge);
        }
    }
}

class Dijkstra{
    private static void getPath(int[] prev, int i, List<Integer> route){
        if (i >= 0){
            getPath(prev, prev[i], route);
            route.add(i);
        }
    }

    public static void getShortestPath(Graph graph, int src, int N){
        PriorityQueue<Node> minHeap;
        minHeap = new PriorityQueue<>(Comparator.comparingInt(node -> node.w));
        minHeap.add(new Node(src, 0));
        List<Integer> dist = new ArrayList<>(Collections.nCopies(N, Integer.MAX_VALUE));
        dist.set(src, 0);
        boolean[] done = new boolean[N];
        done[src] = true;
        int[] prev = new int[N];
        prev[src] = -1;
        List<Integer> route = new ArrayList<>();
        while (!minHeap.isEmpty()){
            Node node = minHeap.poll();
            int u = node.vertex;
            for (Edge edge: graph.edgeList.get(u)){
                int v = edge.dest;
                int w = edge.w;
                if (!done[v] && (dist.get(u) + w) < dist.get(v)){
                    dist.set(v, dist.get(u) + w);
                    prev[v] = u;
                    minHeap.add(new Node(v, dist.get(v)));
                }
            }
            done[u] = true;
        }

        for(int i = 1; i < N; ++i){
            if (i != src && dist.get(i) != Integer.MAX_VALUE) {
                getPath(prev, i, route);
                System.out.printf("Route is %d => %d and min cost = %d and path is %s\n",
                                src, i, dist.get(i), route);
                route.clear();
            }
        }
    }

    public static void main(String[] args){
        Scanner s = new Scanner(System.in);
        List<Edge> edges = new ArrayList<>();
        System.out.println("Enter number of vertices");
        int n = s.nextInt();
        System.out.println("Enter the adjacency weighted matrix");
        int[][] mat = new int[n][n];
        for(int i=0; i<n; i++){
            for(int j=0; j<n; j++){
                mat[i][j] = s.nextInt();
            }
        }

        for(int i=0; i<n; i++){
            for(int j=0; j<n; j++){
                if(i == j) continue;
                if(mat[i][j] != -1){
                    edges.add(new Edge(i, j, mat[i][j]));
                }
            }
        }
        Graph graph = new Graph(edges, n);
        int src = 0;
        getShortestPath(graph, src, n);
        s.close();
    }
}
```

OUTPUT:



```
C:\Users\NAVEENA\Desktop>java Dijkstra
Enter number of vertices
5
Enter the adjacency weighted matrix
-1 10 -1 -1 3
-1 -1 2 -1 4
-1 -1 -1 9 -1
-1 -1 7 -1 -1
-1 1 8 2 -1
Route is 0 => 1 and min cost = 4 and path is [0, 4, 1]
Route is 0 => 2 and min cost = 6 and path is [0, 4, 1, 2]
Route is 0 => 3 and min cost = 5 and path is [0, 4, 3]
Route is 0 => 4 and min cost = 3 and path is [0, 4]
```

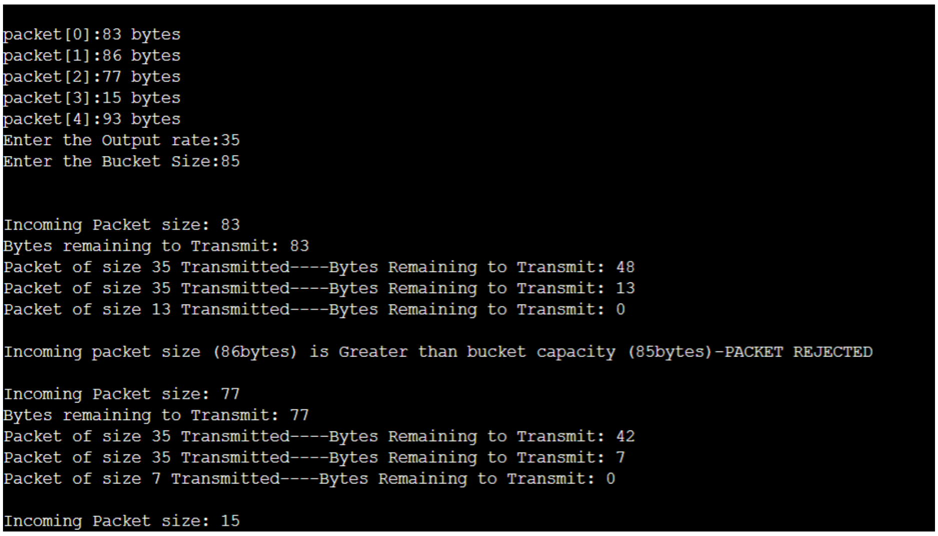
4) Write a program for congestion control using Leaky bucket algorithm.

```
#include<stdio.h>
        #include<stdlib.h>
        #include<unistd.h>
        #define NOF_PACKETS 5
        /*
        int rand (int a)
        {
        int rn = (random() % 10) % a;
        return rn == 0 ? 1 : rn;
        }
        */
        /*
        #include &lt;stdlib.h&gt;
        long int random(void);
        3
        The random() function uses a nonlinear additive feedback random number
        generator employing a default ta-
        ble of size 31 long integers to return successive pseudo-random numbers in the
        range from 0 to RAND_MAX.
        The period of this random number generator is very large, approximately 16 *
        ((2^31) - 1).
        */
        int main()
        {
        int packet_sz[NOF_PACKETS], i, clk, b_size, o_rate, p_sz_rm=0, p_sz, p_time, op;
        for(i = 0; i<NOF_PACKETS; ++i)
        packet_sz[i] = random() % 100;
        for(i = 0; i<NOF_PACKETS; ++i)
        printf("\npacket[%d]:%d bytes\t", i, packet_sz[i]);
        printf("\nEnter the Output rate:");
        scanf("%d", &o_rate);
```

```
printf("Enter the Bucket Size:");
scanf("%d", &b_size);
for(i = 0; i<NOF_PACKETS; ++i)
{
if( (packet_sz[i] + p_sz_rm) > b_size)
if(packet_sz[i] > b_size)/*compare the packet siz with bucket size*/
printf("\n\nIncoming packet size (%dbytes) is Greater than bucket capacity (%dbytes)-PACKET REJECTED", packet_sz[i], b_size);
else
printf("\n\nBucket capacity exceeded-PACKETS REJECTED!!");
else
{
p_sz_rm += packet_sz[i];
printf("\n\nIncoming Packet size: %d", packet_sz[i]);
printf("\nBytes remaining to Transmit: %d", p_sz_rm);
//p_time = random() * 10;
//printf(&quot;\nTime left for transmission: %d units&quot;, p_time);
//for(clk = 10; clk &lt;= p_time; clk += 10)
while(p_sz_rm>0)
{
sleep(1);
if(p_sz_rm)
{
if(p_sz_rm <= o_rate)/*packet size remaining comparing with output rate*/
op = p_sz_rm, p_sz_rm = 0;
else
op = o_rate, p_sz_rm -= o_rate;
printf("\nPacket of size %d Transmitted", op);
printf("----Bytes Remaining to Transmit: %d", p_sz_rm);
}
else
{
```

```
printf("\nNo packets to transmit!!");
}
}
}
}}
```

OUTPUT:



```
packet[0]:83 bytes
packet[1]:86 bytes
packet[2]:77 bytes
packet[3]:15 bytes
packet[4]:93 bytes
Enter the Output rate:35
Enter the Bucket Size:85


Incoming Packet size: 83
Bytes remaining to Transmit: 83
Packet of size 35 Transmitted----Bytes Remaining to Transmit: 48
Packet of size 35 Transmitted----Bytes Remaining to Transmit: 13
Packet of size 13 Transmitted----Bytes Remaining to Transmit: 0

Incoming packet size (86bytes) is Greater than bucket capacity (85bytes)-PACKET REJECTED

Incoming Packet size: 77
Bytes remaining to Transmit: 77
Packet of size 35 Transmitted----Bytes Remaining to Transmit: 42
Packet of size 35 Transmitted----Bytes Remaining to Transmit: 7
Packet of size 7 Transmitted----Bytes Remaining to Transmit: 0

Incoming Packet size: 15
```

5) Using TCP/IP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present

Client:

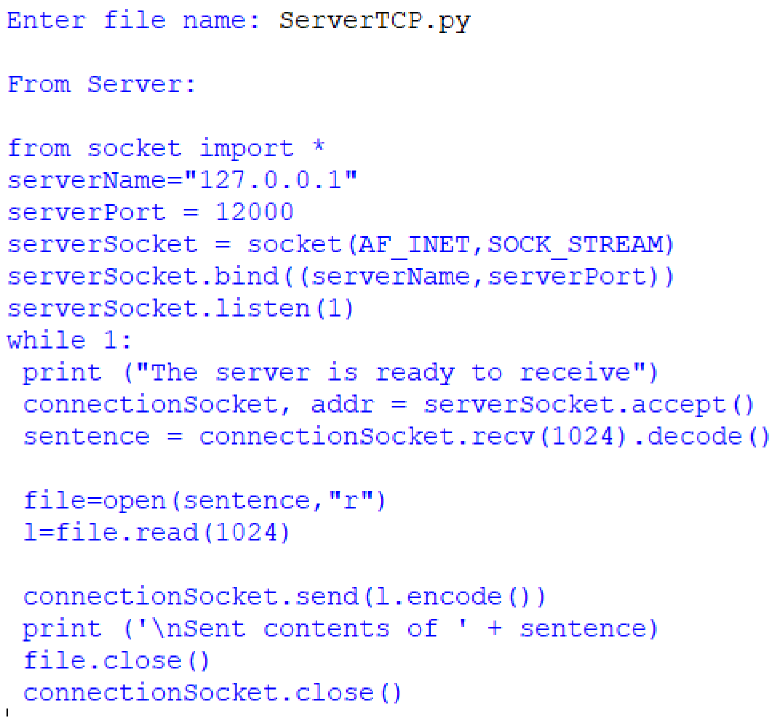
```
from socket import *
serverName = '127.0.0.1'
serverPort = 12000
clientSocket = socket(AF_INET, SOCK_STREAM)
clientSocket.connect((serverName,serverPort))
sentence = input("\nEnter file name: ")
clientSocket.send(sentence.encode())
filecontents = clientSocket.recv(1024).decode()
6
print ('\nFrom Server:\n')
print(filecontents)
clientSocket.close()
```

Server:

```
 from socket import *
serverName="127.0.0.1"
serverPort = 12000
serverSocket = socket(AF_INET,SOCK_STREAM)
serverSocket.bind((serverName,serverPort))
serverSocket.listen(1)
while 1:
 print ("The server is ready to receive")
 connectionSocket, addr = serverSocket.accept()
 sentence = connectionSocket.recv(1024).decode()

 file=open(sentence,"r")
 l=file.read(1024)
```

```
connectionSocket.send(l.encode())
print ('\nSent contents of ' + sentence)
file.close()
connectionSocket.close()
```

OUTPUT:



```
Enter file name: ServerTCP.py

From Server:

from socket import *
serverName="127.0.0.1"
serverPort = 12000
serverSocket = socket(AF_INET,SOCK_STREAM)
serverSocket.bind((serverName,serverPort))
serverSocket.listen(1)
while 1:
 print ("The server is ready to receive")
 connectionSocket, addr = serverSocket.accept()
 sentence = connectionSocket.recv(1024).decode()

 file=open(sentence,"r")
 l=file.read(1024)

 connectionSocket.send(l.encode())
 print ('\nSent contents of ' + sentence)
 file.close()
 connectionSocket.close()
```

6) Using UDP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.

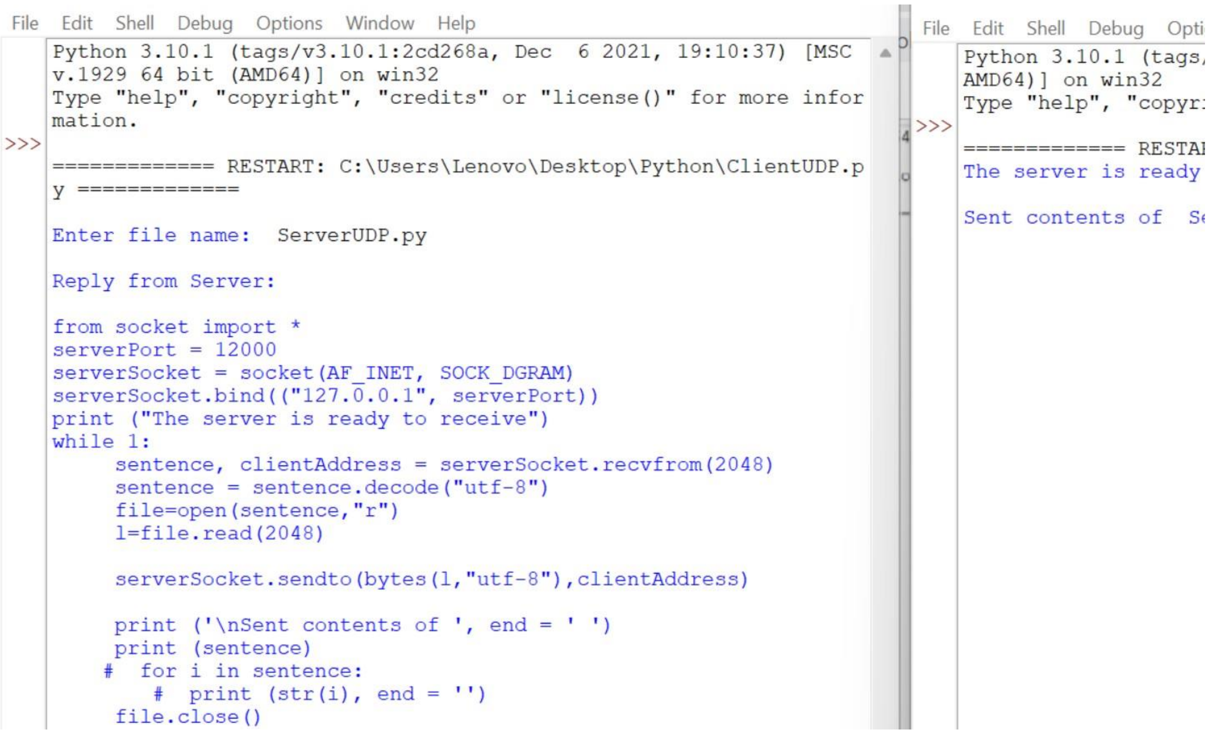
Client:

```
from socket import *
serverName = "127.0.0.1"
serverPort = 12000
clientSocket = socket(AF_INET, SOCK_DGRAM)
sentence = input("\nEnter file name: ")
clientSocket.sendto(bytes(sentence,"utf-8"),(serverName, serverPort))
filecontents,serverAddress = clientSocket.recvfrom(2048)
print ('\nReply from Server:\n')
print (filecontents.decode("utf-8"))
# for i in filecontents:
 # print(str(i), end = '')
clientSocket.close()
clientSocket.close()
```

Server:

```
from socket import *
serverPort = 12000
serverSocket = socket(AF_INET, SOCK_DGRAM)
serverSocket.bind(("127.0.0.1", serverPort))
print ("The server is ready to receive")
while 1:
 sentence, clientAddress = serverSocket.recvfrom(2048)
 sentence = sentence.decode("utf-8")
 file=open(sentence,"r")
 l=file.read(2048)

 serverSocket.sendto(bytes(l,"utf-8"),clientAddress)
 print ('\nSent contents of ', end = ' ')
print (sentence)
# for i in sentence:
# print (str(i), end = '')
file.close()
```

OUTPUT:



```
Python 3.10.1 (tags/v3.10.1:2cd268a, Dec  6 2021, 19:10:37) [MSC
v.1929 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more infor
mation.
>>>
============= RESTART: C:\Users\Lenovo\Desktop\Python\ClientUDP.p
y =============

Enter file name:  ServerUDP.py

Reply from Server:

from socket import *
serverPort = 12000
serverSocket = socket(AF_INET, SOCK_DGRAM)
serverSocket.bind(("127.0.0.1", serverPort))
print ("The server is ready to receive")
while 1:
     sentence, clientAddress = serverSocket.recvfrom(2048)
     sentence = sentence.decode("utf-8")
     file=open(sentence,"r")
     l=file.read(2048)

     serverSocket.sendto(bytes(l,"utf-8"),clientAddress)

     print ('\nSent contents of ', end = ' ')
     print (sentence)
    #  for i in sentence:
        #  print (str(i), end = '')
     file.close()
```

```
Python 3.10.1 (tags,
AMD64)] on win32
Type "help", "copyr:
>>>
============= RESTAI
The server is ready

Sent contents of  S
```