CYCLE-2 Programs: -

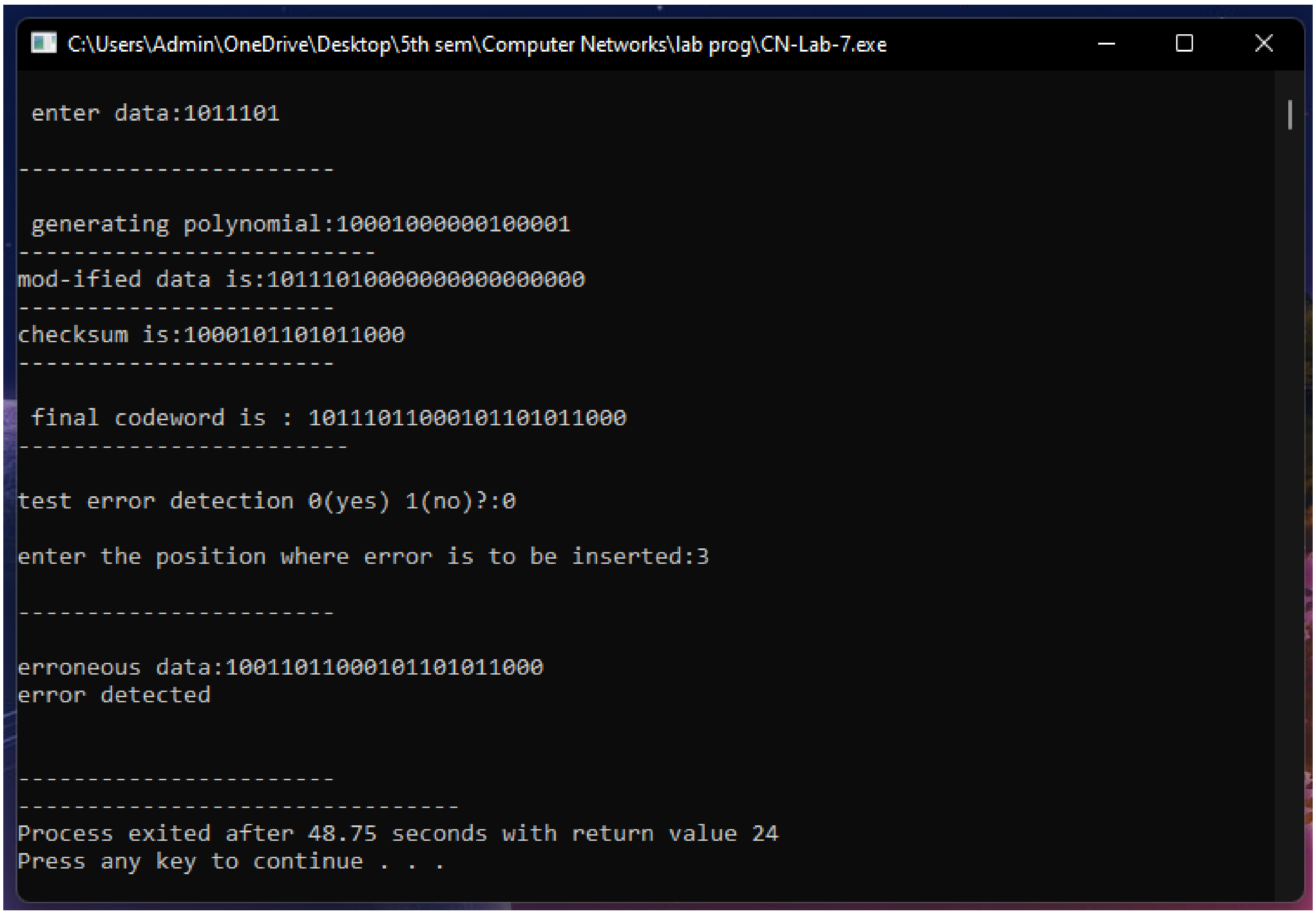
1. Write a program for error detecting code using CRC-CCITT (16-bits).

Code:-

```
#include <stdio.h>
#include <string.h>
#define N strlen(gen)
char modif[28],checksum[28],gen[28];
int a,e,c,b;
void xor()
{
for(c=1;c<N;c++)
checksum[c]=((checksum[c]==gen[c])?'0':'1');
}
void crc()
{
for(e=0;e<N;e++)
checksum[e]=modif[e];
do
{
if(checksum[0]=='1')
xor();
for(c=0;c<N-1;c++)
checksum[c]=checksum[c+1];
checksum[c]=modif[e++];
}while(e<=a+N-1);
}
int main()
```

```
{
int flag=0;
strcpy(gen,"10001000000100001");
printf("\n enter data:");
scanf("%s",modif);
printf("\n----------------------\n");
printf("\n generating polynomial:%s",gen);
a=strlen(modif);
for(e=a;e<a+N-1;e++)
modif[e]='0';
printf("\n-------------------------\n");
printf("mod-ified data is:%s",modif);
printf("\n----------------------\n");
crc();
printf("checksum is:%s",checksum);
for(e=a;e<a+N-1;e++)
modif[e]=checksum[e-a];
printf("\n----------------------\n");
printf("\n final codeword is : %s",modif);
printf("\n-----------------------\n");
printf("\ntest error detection 0(yes) 1(no)?:");
scanf("%d",&e);
if(e==0)
{
do{
printf("\nenter the position where error is to be inserted:");
scanf("%d",&e);
}
while(e==0||e>a+N-1);
modif[e-1]=(modif[e-1]=='0')?'1':'0';
printf("\n----------------------\n");
printf("\nerroneous data:%s\n",modif);
}
crc();
for(e=0;(e<N-1)&&(checksum[e]!='1');e++);
if(e<N-1)
printf("error detected\n\n");
else
printf("\n no error detected \n\n");
printf("\n----------------------");
}
```

Output:-



C:\Users\Admin\OneDrive\Desktop\5th sem\Computer Networks\lab prog\CN-Lab-7.exe

```
 enter data:1011101

-----------------------

 generating polynomial:10001000000100001
--------------------------
mod-ified data is:10111010000000000000000
-----------------------
checksum is:1000101101011000
-----------------------

 final codeword is : 10111011000101101011000
------------------------

test error detection 0(yes) 1(no)?:0

enter the position where error is to be inserted:3

-----------------------

erroneous data:10011011000101101011000
error detected


-----------------------
--------------------------------
Process exited after 48.75 seconds with return value 24
Press any key to continue . . .
```

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

Code:-

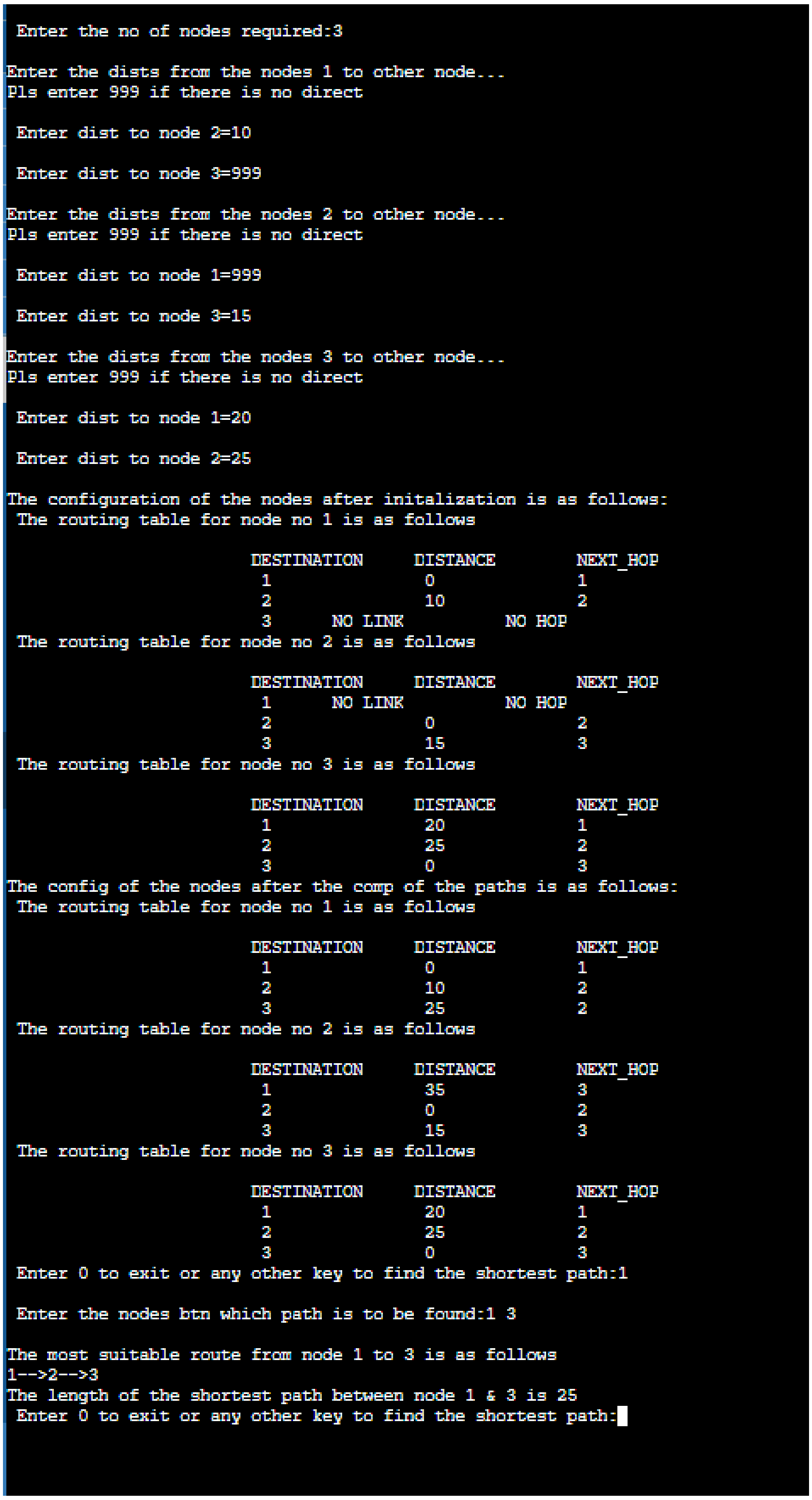
```
#include<stdlib.h>
#include<stdio.h>
#define NUL 1000
#define NODES 10
struct node
{
int t[NODES][3];
};
struct node n[NODES];
typedef struct node NOD;
int main()
{
void init(int,int);
void inp(int,int);
void caller(int,int);
void op1(int,int,int);
void find(int,int);
int i,j,x,y,no;
do{
printf("\n Enter the no of nodes required:");
scanf("%d",&no);
}while(no>10||no<0);
for(i=0;i<no;i++)
{
init(no,i);
inp(no,i);
}
printf("\nThe configuration of the nodes after initalization is as follows:");
for(i=0;i<no;i++)
op1(no,i,0);
for(j=0;j<no;j++)
{
for(i=0;i<no;i++)
caller(no,i);
}
printf("\nThe config of the nodes after the comp of the paths is as follows:");
```

```
for(i=0;i<no;i++)
op1(no,i,1);
while(1)
{
printf("\n Enter 0 to exit or any other key to find the shortest path:");
scanf("%d",&j);
if(!j)
break;
do{
printf("\n Enter the nodes btn which path is to be found:");
scanf("%d%d",&x,&y);
}while((x<0||x>no) && (y<0||y>no));
printf("\nThe most suitable route from node %d to %d is as follows\n",x,y);
find(x,y);
printf("%d",y);
printf("\nThe length of the shortest path between node %d & %d is %d",x,y,n[x-1].t[y-1][2]);
}
}
void init(int no,int x)
{
int i;
for(i=0;i<no;i++)
{
n[x].t[i][1]=i;
n[x].t[i][2]=999;
n[x].t[i][3]=NUL;
}
n[x].t[x][2]=0;
n[x].t[x][3]=x;
}
void inp(int no,int x)
{
int i;
printf("\nEnter the dists from the nodes %d to other node...",x+1);
printf("\nPls enter 999 if there is no direct \n");
for(i=0;i<no;i++)
{
if(i!=x)
{
do
{
```

```
printf("\n Enter dist to node %d=",i+1);
scanf("%d",&n[x].t[i][2]);
}while(n[x].t[i][2]<0|| n[x].t[i][2]>999);
if(n[x].t[i][2]!=999)
n[x].t[i][3]=i;
}}
}
void caller(int no,int x)
{
void compar(int,int,int);
int i;
for(i=0;i<no;i++)
{
if(n[x].t[i][2]!=999 && n[x].t[i][2]!=0)
{
compar(x,i,no);
}
}
}
void compar(int x,int y,int no)
{
int i,z;
for(i=0;i<no;i++)
{
z=n[x].t[y][2]+n[y].t[i][2];
if(n[x].t[i][2]>z)
{
n[x].t[i][2]=z;
n[x].t[i][3]=y;
}
}
}
void op1(int no,int x,int z)
{
int i,j;
printf("\n The routing table for node no %d is as follows",x+1);
printf("\n\n\t\t\tDESTINATION\tDISTANCE\tNEXT_HOP");
for(i=0;i<no;i++)
{
if((!z && n[x].t[i][2]>=999) ||(n[x].t[i][2]>=(999*no)))
printf("\n\t\t\t %d \tNO LINK \t NO HOP",n[x].t[i][1]+1);
```

```
else
if(n[x].t[i][3]==NUL)
printf("\n\t\t\t %d \t\t %d \t\t NO HOP",n[x].t[i][1]+1,n[x].t[i][2]);
else
printf("\n\t\t\t %d \t\t %d \t\t%d",n[x].t[i][1]+1,n[x].t[i][2],n[x].t[i][3]+1);
}
}
void find(int x,int y)

{
int i,j;
i=x-1;
j=y-1;
printf("%d-->",x);
if(n[i].t[j][3]!=j)
{
find(n[i].t[j][3]+1,y);
return;
}
}
```

Output:-



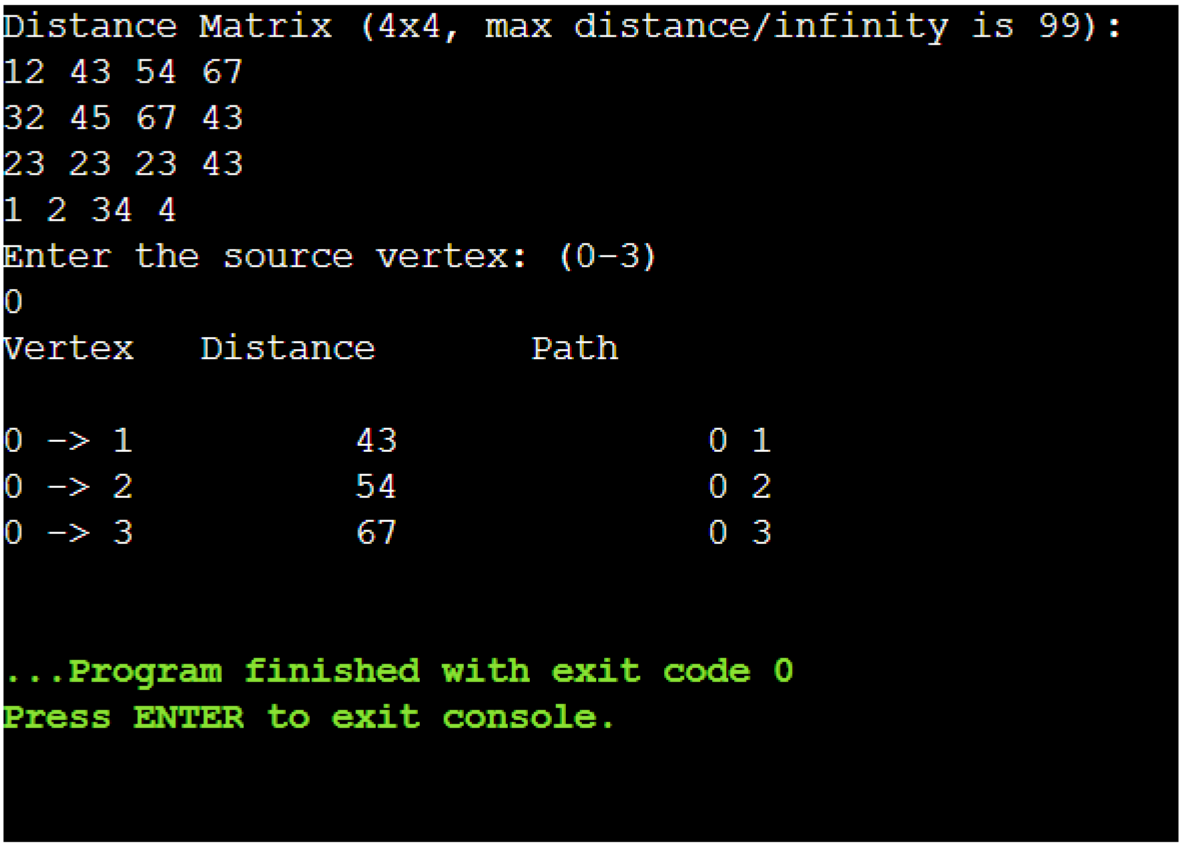
```
 Enter the no of nodes required:3

Enter the dists from the nodes 1 to other node...
Pls enter 999 if there is no direct

 Enter dist to node 2=10

 Enter dist to node 3=999

Enter the dists from the nodes 2 to other node...
Pls enter 999 if there is no direct

 Enter dist to node 1=999

 Enter dist to node 3=15

Enter the dists from the nodes 3 to other node...
Pls enter 999 if there is no direct

 Enter dist to node 1=20

 Enter dist to node 2=25

The configuration of the nodes after initalization is as follows:
 The routing table for node no 1 is as follows

                        DESTINATION     DISTANCE        NEXT_HOP
                         1               0               1
                         2               10              2
                         3      NO LINK          NO HOP
 The routing table for node no 2 is as follows

                        DESTINATION     DISTANCE        NEXT_HOP
                         1      NO LINK          NO HOP
                         2               0               2
                         3               15              3
 The routing table for node no 3 is as follows

                        DESTINATION     DISTANCE        NEXT_HOP
                         1               20              1
                         2               25              2
                         3               0               3
The config of the nodes after the comp of the paths is as follows:
 The routing table for node no 1 is as follows

                        DESTINATION     DISTANCE        NEXT_HOP
                         1               0               1
                         2               10              2
                         3               25              2
 The routing table for node no 2 is as follows

                        DESTINATION     DISTANCE        NEXT_HOP
                         1               35              3
                         2               0               2
                         3               15              3
 The routing table for node no 3 is as follows

                        DESTINATION     DISTANCE        NEXT_HOP
                         1               20              1
                         2               25              2
                         3               0               3
 Enter 0 to exit or any other key to find the shortest path:1

 Enter the nodes btn which path is to be found:1 3

The most suitable route from node 1 to 3 is as follows
1-->2-->3
The length of the shortest path between node 1 & 3 is 25
 Enter 0 to exit or any other key to find the shortest path:
```

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

Code:-

```
#include <bits/stdc++.h>

using namespace std;

#define V 4

int minDistance(int dist[], bool sptSet[]) {
   int min = 9999, min_index;

   for (int v = 0; v < V; v++)
      if (sptSet[v] == false && dist[v] <= min)
         min = dist[v], min_index = v;

   return min_index;
}

void printPath(int parent[], int j) {
   if (parent[j] == -1)
      return;

   printPath(parent, parent[j]);

   cout << j << " ";
}

void printSolution(int dist[], int n, int parent[]) {
   int src = 0;
   cout << "Vertex\t Distance\tPath" << endl;
   for (int i = 1; i < V; i++) {
      cout << "\n"
          << src << " -> " << i << " \t \t" << dist[i] << "\t\t" << src << " ";
      printPath(parent, i);
   }
}

void dijkstra(int graph[V][V], int src) {
    int dist[V];

    bool sptSet[V];

    int parent[V];

    for (int i = 0; i < V; i++) {
        parent[i] = -1;
        dist[i] = 9999;
        sptSet[i] = false;
    }

    dist[src] = 0;

    for (int count = 0; count < V - 1; count++) {
        int u = minDistance(dist, sptSet);

        sptSet[u] = true;

        for (int v = 0; v < V; v++)

            if (!sptSet[v] && graph[u][v] &&
                dist[u] + graph[u][v] < dist[v]) {
                parent[v] = u;
                dist[v] = dist[u] + graph[u][v];
            }
    }

    printSolution(dist, V, parent);
}

int main() {
    int graph[V][V];
    cout << "Distance Matrix (" << V << "x" << V << ", max distance/infinity is 99): " << endl;
    for (int i = 0; i < V; i++) {
        for (int j = 0; j < V; j++)
            cin >> graph[i][j];
    }
    cout << "Enter the source vertex: (0-" << V - 1 << ")" << endl;
    int src;
    cin >> src;
    dijkstra(graph, src);
    cout << endl;
    return 0;
}
```

Output:-



```
Distance Matrix (4x4, max distance/infinity is 99):
12 43 54 67
32 45 67 43
23 23 23 43
1 2 34 4
Enter the source vertex: (0-3)
0
Vertex   Distance       Path

0 -> 1          43              0 1
0 -> 2          54              0 2
0 -> 3          67              0 3


...Program finished with exit code 0
Press ENTER to exit console.
```

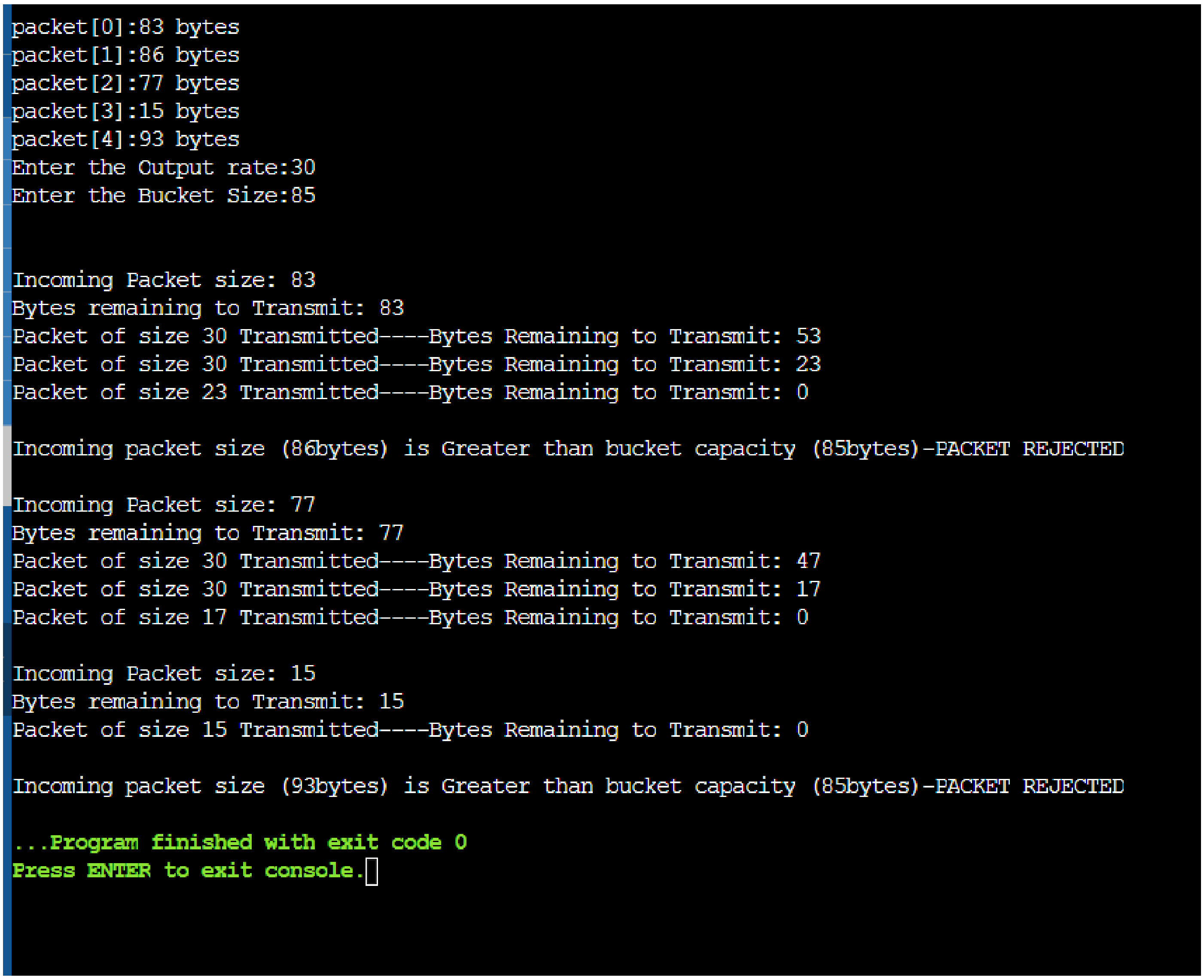
4. Write a program for congestion control using Leaky bucket algorithm.

Code:-

```
//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<stdlib.h>
long int random(void);


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("\nTime left for transmission: %d units", p_time);
//for(clk = 10; clk <= 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:30
Enter the Bucket Size:85


Incoming Packet size: 83
Bytes remaining to Transmit: 83
Packet of size 30 Transmitted----Bytes Remaining to Transmit: 53
Packet of size 30 Transmitted----Bytes Remaining to Transmit: 23
Packet of size 23 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 30 Transmitted----Bytes Remaining to Transmit: 47
Packet of size 30 Transmitted----Bytes Remaining to Transmit: 17
Packet of size 17 Transmitted----Bytes Remaining to Transmit: 0

Incoming Packet size: 15
Bytes remaining to Transmit: 15
Packet of size 15 Transmitted----Bytes Remaining to Transmit: 0

Incoming packet size (93bytes) is Greater than bucket capacity (85bytes)-PACKET REJECTED

...Program finished with exit code 0
Press ENTER to exit console.
```

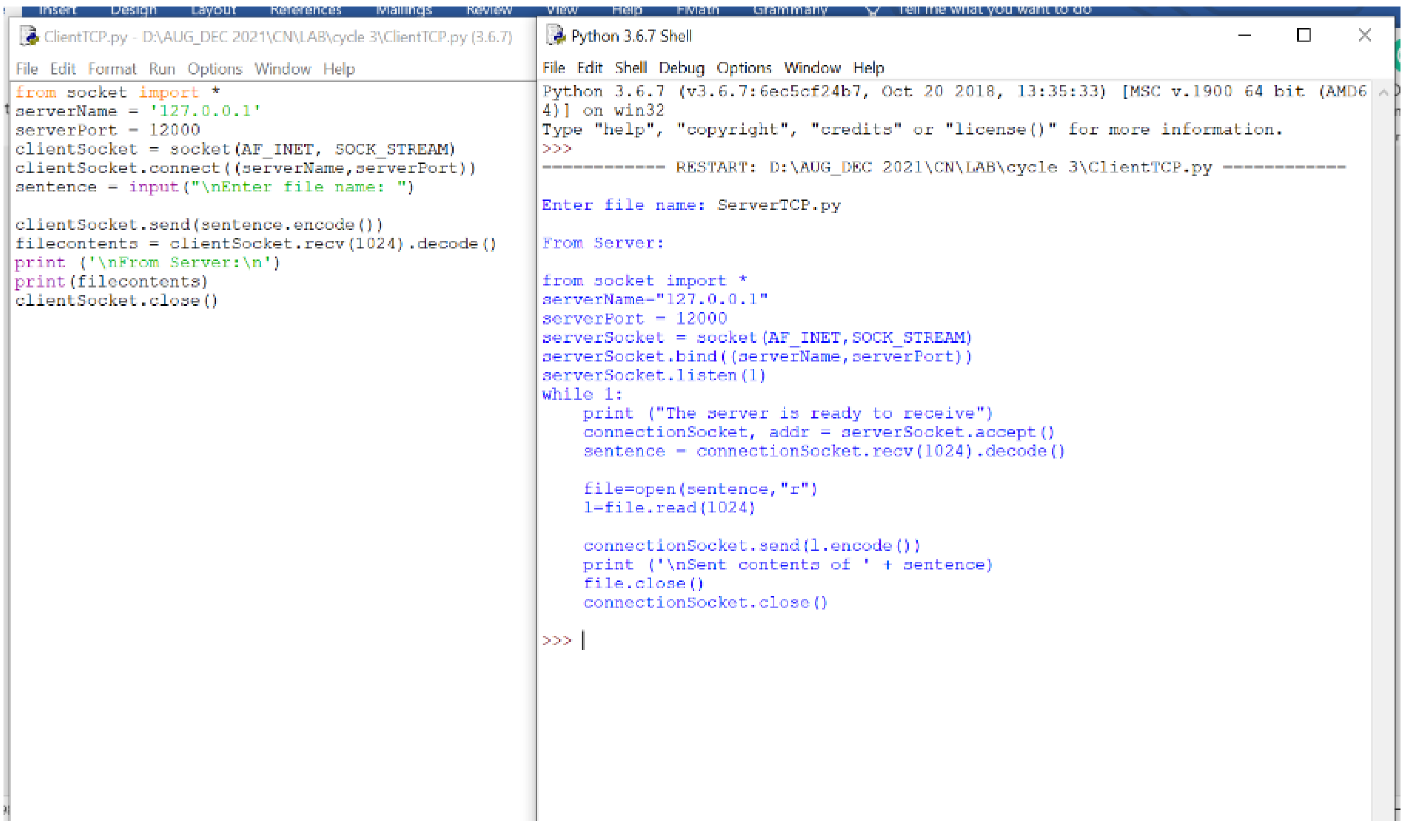
5. Using TCP/IP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.

Code:-

```
//ClientTCP.py
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()
print ("\nFrom Server:\n")
```

```
print(filecontents)
clientSocket.close()


//ServerTCP.py
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()
```

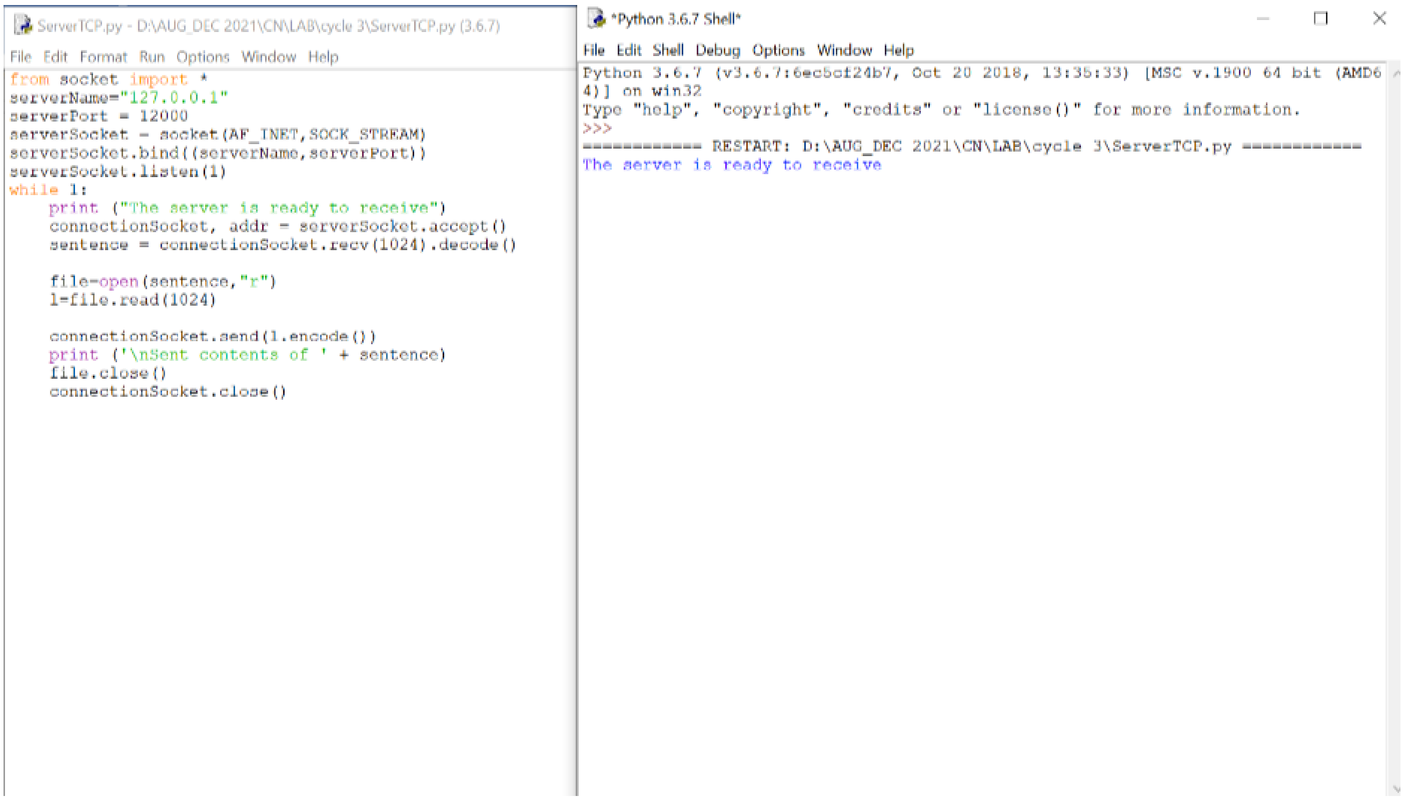
Output:-



ClientTCP.py - D:\AUG_DEC 2021\CN\LAB\cycle 3\ClientTCP.py (3.6.7)
File Edit Format Run Options Window Help
Python 3.6.7 Shell
File Edit Shell Debug Options Window Help

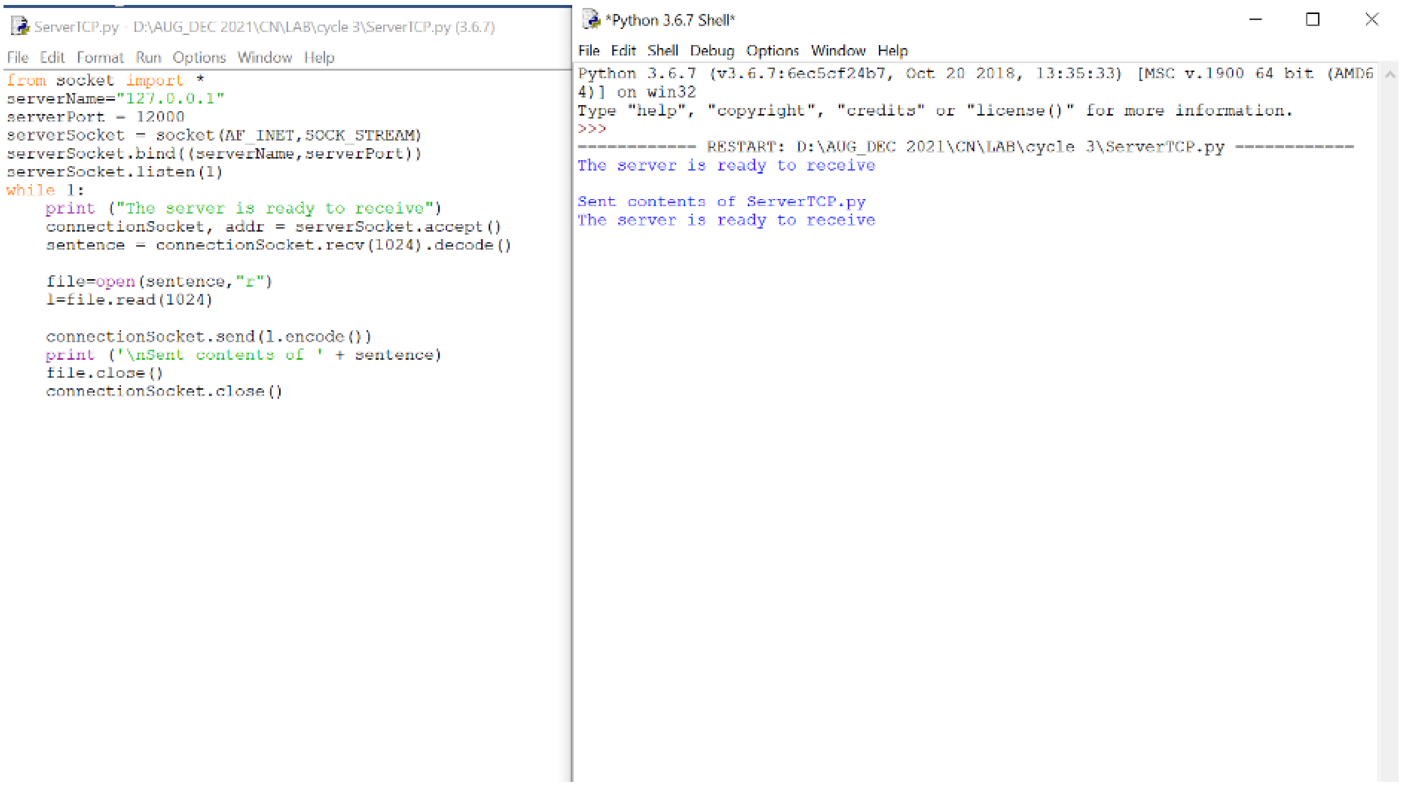
```
from socket import *
serverName = '127.0.0.1'
serverPort = 12000
clientSocket = socket(AF_INET, SOCK_STREAM)
clientSocket.connect((serverName,serverPort))
sentence = input("\nEnter file name: ")

clientSocket.send(sentence.encode())
filecontents = clientSocket.recv(1024).decode()
print ('\nFrom Server:\n')
print(filecontents)
clientSocket.close()
```

```
Python 3.6.7 (v3.6.7:6ec5cf24b7, Oct 20 2018, 13:35:33) [MSC v.1900 64 bit (AMD6
4)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
============ RESTART: D:\AUG_DEC 2021\CN\LAB\cycle 3\ClientTCP.py ============

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()

>>> |
```


ServerTCP.py - D:\AUG_DEC 2021\CN\LAB\cycle 3\ServerTCP.py (3.6.7)
File Edit Format Run Options Window Help
Python 3.6.7 Shell
File Edit Shell Debug Options Window Help

```
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()
```

```
Python 3.6.7 (v3.6.7:6ec5cf24b7, Oct 20 2018, 13:35:33) [MSC v.1900 64 bit (AMD6
4)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
============ RESTART: D:\AUG_DEC 2021\CN\LAB\cycle 3\ServerTCP.py ============
The server is ready to receive
```


ServerTCP.py - D:\AUG_DEC 2021\CN\LAB\cycle 3\ServerTCP.py (3.6.7)
File Edit Format Run Options Window Help
Python 3.6.7 Shell
File Edit Shell Debug Options Window Help

```
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()
```

```
Python 3.6.7 (v3.6.7:6ec5cf24b7, Oct 20 2018, 13:35:33) [MSC v.1900 64 bit (AMD6
4)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
============ RESTART: D:\AUG_DEC 2021\CN\LAB\cycle 3\ServerTCP.py ============
The server is ready to receive

Sent contents of ServerTCP.py
The server is ready to receive
```

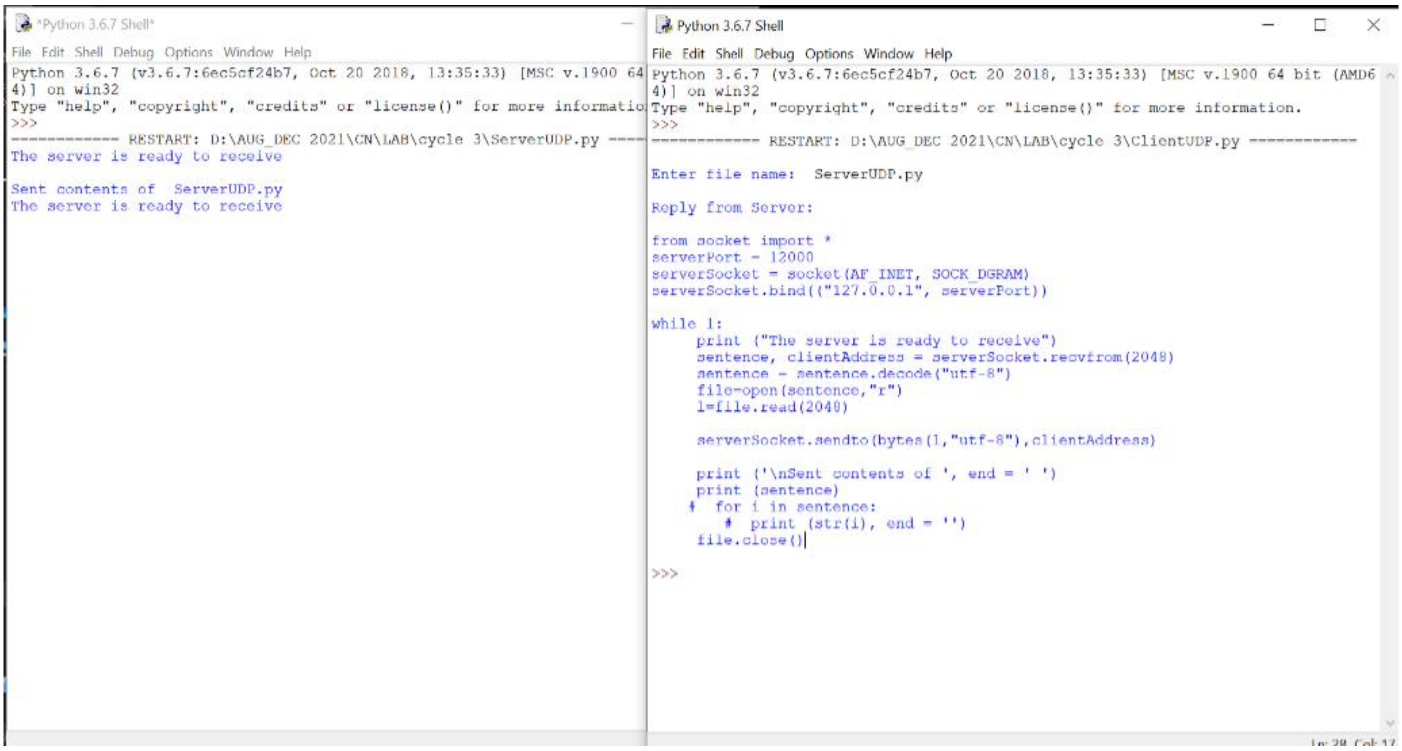
6. Using UDP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.

Code:-

```
//ClientUDP.py
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()
```

```
//ServerUDP.py
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 3.6.7 Shell
File Edit Shell Debug Options Window Help

```
Python 3.6.7 (v3.6.7:6ec5cf24b7, Oct 20 2018, 13:35:33) [MSC v.1900 64
4)] on win32
Type "help", "copyright", "credits" or "license()" for more informatio
>>>
============ RESTART: D:\AUG_DEC 2021\CN\LAB\cycle 3\ServerUDP.py ====
The server is ready to receive

Sent contents of  ServerUDP.py
The server is ready to receive
```

Python 3.6.7 Shell
File Edit Shell Debug Options Window Help
Ln: 28 Col: 17

```
Python 3.6.7 (v3.6.7:6ec5cf24b7, Oct 20 2018, 13:35:33) [MSC v.1900 64 bit (AMD6
4)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
============ RESTART: D:\AUG_DEC 2021\CN\LAB\cycle 3\ClientUDP.py ============

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))

while 1:
     print ("The server is ready to receive")
     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()

>>>
```