

B.M.S. COLLEGE OF ENGINEERING, BENGALURU

Autonomous Institute, Affiliated to VTU



Lab Record

Computer Networks

*Submitted in partial fulfillment for the 5th Semester
Laboratory*

Bachelor of Technology
in
Computer Science and Engineering

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B.M.S. COLLEGE OF ENGINEERING
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CERTIFICATE

This is to certify that the Computer Networks (20CS5PCCON) laboratory has been carried out by **Mahantesh Gattina (1BM19CS219)** during the 5th Semester October 2021 - January 2022.

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PROGRAM 1 : Write a program for error detecting code using CRC-CCITT (16-BITS)

```
#include <iostream>
#include <string.h>
using namespace std;
int crc(char *ip, char *op, char *poly, int mode)
{
    strcpy(op, ip);
    if (mode) {
        for (int i = 1; i < strlen(poly); i++)
            strcat(op, "0");
    }
    for (int i = 0; i < strlen(ip); i++) {
        if (op[i] == '1') {
            for (int j = 0; j < strlen(poly); j++) {
                if (op[i + j] == poly[j])
                    op[i + j] = '0';
                else
                    op[i + j] = '1';
            }
        }
    }
    for (int i = 0; i < strlen(op); i++)
        if (op[i] == '1')
            return 0;
    return 1;
}

int main()
{
    char ip[50], op[50], recv[50];
    char poly[] = "10001000000100001";

    cout << "Enter the input message in
    binary : " << endl; cin >> ip;
    crc(ip, op, poly, 1);
    cout << "The transmitted message is : " << ip << op + strlen(ip) << endl;
    cout << "Enter the received message in
    binary : " << endl; cin >> recv;
    if (crc(recv, op, poly, 0))
        cout << "No error in data" << endl;
    else
        cout << "Error in data transmission has occurred" << endl;

    return 0;
}
```

```
Enter the input message in binary
1011
The transmitted message is: 10111011000101101011
Enter the received message in binary
10111011000101101011
No error in data
```

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

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

```
#include<stdio.h>
struct node
{
    unsigned dist[20];
    unsigned from[20];
}rt[10];
int main()
{
    int dmat[20][20];
    int n,i,j,k,count=0;
    printf("\nEnter the number of nodes : ");
    scanf("%d",&n);
    printf("\nEnter the cost matrix :\n");
    for(i=0;i<n;i++)
        for(j=0;j<n;j++){
            scanf("%d",&dmat[i][j]);
            dmat[i][i]=0;
            rt[i].dist[j]=dmat[i][j];
            rt[i].from[j]=j;
        }
    do{
        count=0;
        for(i=0;i<n;i++)
            for(j=0;j<n;j++)
                for(k=0;k<n;k++){
                    if(rt[i].dist[j]>dmat[i][k]+rt[k].dist[j]){
                        rt[i].dist[j]=rt[i].dist[k]+rt[k].dist[j];
                        rt[i].from[j]=k;
                        count++;
                    }
                }
    }while(count!=0);
    for(i=0;i<n;i++)
    {
        printf("\n\nState value for router %d is \n",i+1);
        for(j=0;j<n;j++){
            printf(" \t\nnode %d via %d\n",j+1,rt[i].from[j]);
            printf("Distance : %d",j+1,rt[i].from[j]+1,rt[i].dist[j]);
        }
    }
}
```

Enter the number of nodes : 4

Enter the cost matrix :

```
0 5 99 99
5 0 3 99
99 3 0 1
99 99 1 0
```

State value for router 1 is

```
node 1 via 1 Distance : 0
node 2 via 2 Distance : 5
node 3 via 2 Distance : 8
node 4 via 2 Distance : 9
```

State value for router 2 is

```
node 1 via 1 Distance : 5
node 2 via 2 Distance : 0
node 3 via 3 Distance : 3
node 4 via 3 Distance : 4
```

State value for router 3 is

```
node 1 via 2 Distance : 8
node 2 via 2 Distance : 3
node 3 via 3 Distance : 0
node 4 via 4 Distance : 1
```

State value for router 4 is

```
node 1 via 3 Distance : 9
node 2 via 3 Distance : 4
node 3 via 3 Distance : 1
node 4 via 4 Distance : 0
```

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

PROGRAM 3 : Implement Dijkstra's algorithm to compute the shortest path for a given topology.

```
#include<bits/stdc++.h>
#include <limits.h>
#include <stdio.h>
using namespace std;
#define V 9
int minDistance(int dist[], bool sptSet[])
{
    int min = INT_MAX, 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 printSolution(int dist[])
{
    printf("Vertex \t\t Distance from Source\n");
    for (int i = 0; i < V; i++)
        printf("%d \t\t %d\n", i, dist[i]);
}
void dijkstra(int graph[V][V], int src)
{
    int dist[V];
    bool sptSet[V];
    for (int i = 0; i < V; i++)
        dist[i] = INT_MAX, 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] != INT_MAX && dist[u] +
                graph[u][v] < dist[v]) dist[v] = dist[u] + graph[u][v];
    }
    printSolution(dist);
}
int main()
{
    int graph[V][V] ;
    cout<<"Enter the graph "<<endl;
    for(int i = 0; i<V; i++)
        for(int j = 0; j<V; j++)
            cin>>graph[i][j];
    dijkstra(graph, 0);
    return 0;
}
```

Enter the graph

```
0 4 0 0 0 0 0 8 0
4 0 8 0 0 0 0 11 0
0 8 0 7 0 4 0 0 2
0 0 7 0 9 14 0 0 0
0 0 0 9 0 10 0 0 0
0 0 4 14 10 0 2 0 0
0 0 0 0 0 2 0 1 6
8 11 0 0 0 0 1 0 7
0 0 2 0 0 0 6 7 0
```

Vertex	Distance from Source
0	0
1	4
2	12
3	19
4	21
5	11
6	9
7	8
8	14

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

PROGRAM 4 : Write a program for congestion control using leaky bucket algorithm.

```
#include<stdio.h>
#include<stdlib.h>
#include<unistd.h>

#define NOF_PACKETS 10

int rando(int a)
{
    int rn = (random() % 10) % a;
    return rn == 0 ? 1 : rn;
}

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] = rando(6) * 10;
    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)
                    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 = rando(4)
                * 10;
                printf("\nTime left for transmission: %d
                units", p_time); for(clk = 10; clk <= p_time;
                clk += 10) {

                    sleep(1);
                    if(p_sz_rm)
                    {
                        if(p_sz_rm <= o_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("\nTime left for transmission: %d units",  
p_time-clk); printf("\nNo packets to transmit!!");
```

```
    }  
    }  
    }  
}
```

```
packet[0]:30 bytes  
packet[1]:10 bytes  
packet[2]:10 bytes  
packet[3]:50 bytes  
packet[4]:30 bytes  
packet[5]:50 bytes  
packet[6]:10 bytes  
packet[7]:20 bytes  
packet[8]:30 bytes  
packet[9]:10 bytes  
Enter the Output rate:10  
Enter the Bucket Size:25
```

```
Incoming packet size (30bytes) is Greater than bucket capacity (25bytes)-PACKET REJECTED
```

```
Incoming Packet size: 10  
Bytes remaining to Transmit: 10  
Time left for transmission: 20 units  
Packet of size 10 Transmitted----Bytes Remaining to Transmit: 0  
Time left for transmission: 0 units  
No packets to transmit!!
```

```
Incoming Packet size: 10  
Bytes remaining to Transmit: 10  
Time left for transmission: 30 units  
Packet of size 10 Transmitted----Bytes Remaining to Transmit: 0  
Time left for transmission: 10 units  
No packets to transmit!!  
Time left for transmission: 0 units  
No packets to transmit!!
```

```
Incoming packet size (50bytes) is Greater than bucket capacity (25bytes)-PACKET REJECTED
```

```
Incoming packet size (30bytes) is Greater than bucket capacity (25bytes)-PACKET REJECTED
```

```
Incoming packet size (50bytes) is Greater than bucket capacity (25bytes)-PACKET REJECTED
```

```
Incoming Packet size: 10  
Bytes remaining to Transmit: 10  
Time left for transmission: 10 units  
Packet of size 10 Transmitted----Bytes Remaining to Transmit: 0
```

```
Incoming Packet size: 20  
Bytes remaining to Transmit: 20  
Time left for transmission: 10 units  
Packet of size 10 Transmitted----Bytes Remaining to Transmit: 10
```

```
Incoming packet size (30bytes) is Greater than bucket capacity (25bytes)-PACKET REJECTED
```

```
Incoming Packet size: 10  
Bytes remaining to Transmit: 20  
Time left for transmission: 30 units  
Packet of size 10 Transmitted----Bytes Remaining to Transmit: 10  
Packet of size 10 Transmitted----Bytes Remaining to Transmit: 0  
Time left for transmission: 0 units  
No packets to transmit!!
```

```
...Program finished with exit code 0
```

PROGRAM 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.

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()
```

```
prot_896@LAPTOP-PKD3U47M:~$ python3 tcps.py
```

Enter file name: tcps.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()
```

```
prot_896@LAPTOP-PKD3U47M:~$
```

```
prot_896@LAPTOP-PKD3U47M:~$ python3 tcps.py
```

The server is ready to receive

Sent contents of tcps.py

The server is ready to receive

PROGRAM 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.

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"))
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)
    file.close()
```

```
trot_896@LAPTOP-PKD1U47M:~$ python3 udpc.py
```

Enter file name: udpc.py

Reply from Server:

```
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"))
clientSocket.close()
clientSocket.close()
```

```
trot_896@LAPTOP-PKD1U47M:~$
```

```
trot_896@LAPTOP-PKD1U47M:~$ python3 udps.py
```

The server is ready to receive

Sent contents of udpc.py