Lab Assignment 3

(Networking Lab)

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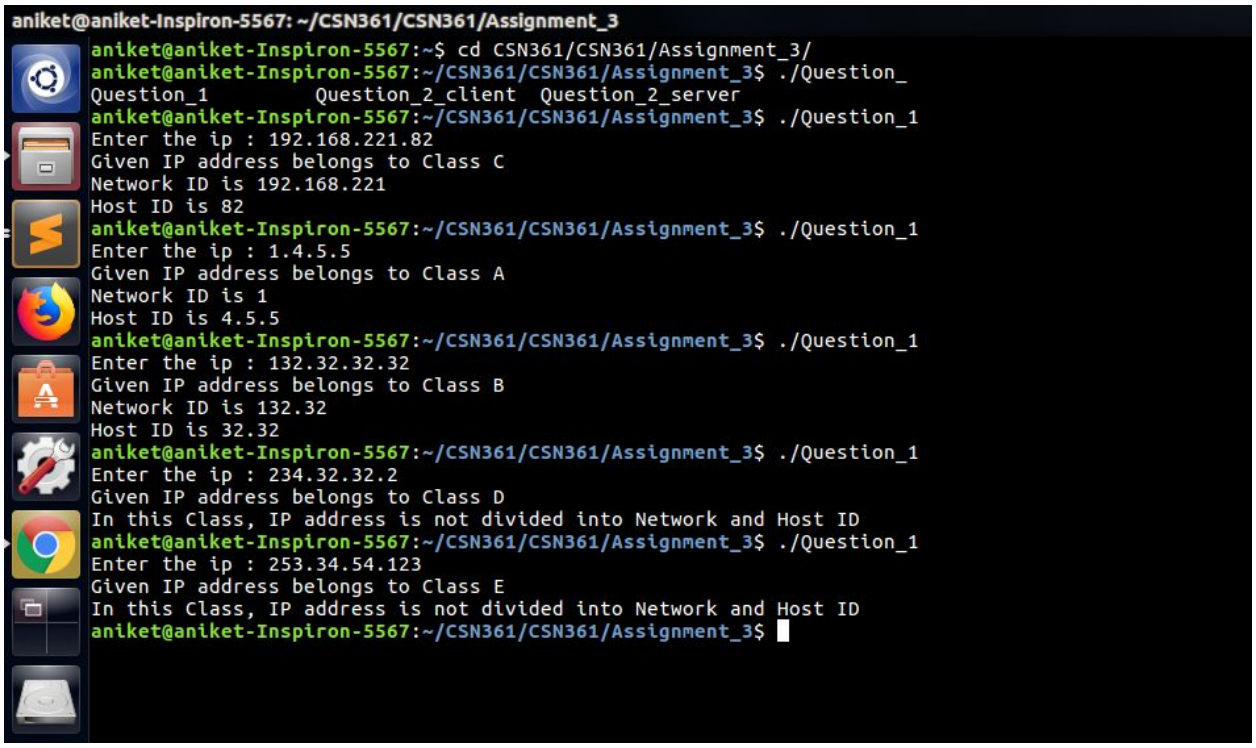
Problem Statements :

Q1 - Write a socket program in C++ to determine class, Network and Host ID of an IPv4 address.

Screenshot :



Source code :

```
#include<bits/stdc++.h>
using namespace std;
char findClass(string str)
{
    char arr[4];
    int i = 0;
    while (str[i] != '.')
    {
        arr[i] = str[i];
```

```
        i++;
    }
    i--;
    int ip = 0, j = 1;
    while (i >= 0)
    {
        ip = ip + (str[i] - '0') * j;
        j = j * 10;
        i--;
    }
    if (ip >=1 && ip <= 126)
        return 'A';
    if (ip >= 128 && ip <= 191)
        return 'B';
    if (ip >= 192 && ip <= 223)
        return 'C';
    if(ip >= 224 && ip <= 239)
        return 'D';
    return 'E';
}

void separate(string str, char ipClass)
{
    // Initializing network and host array to NULL
    char network[12], host[12];
    for (int k = 0; k < 12; k++)
        network[k] = host[k] = '\0';

    // for class A, only first octet is Network ID
    // and rest are Host ID
    if (ipClass == 'A')
    {
```

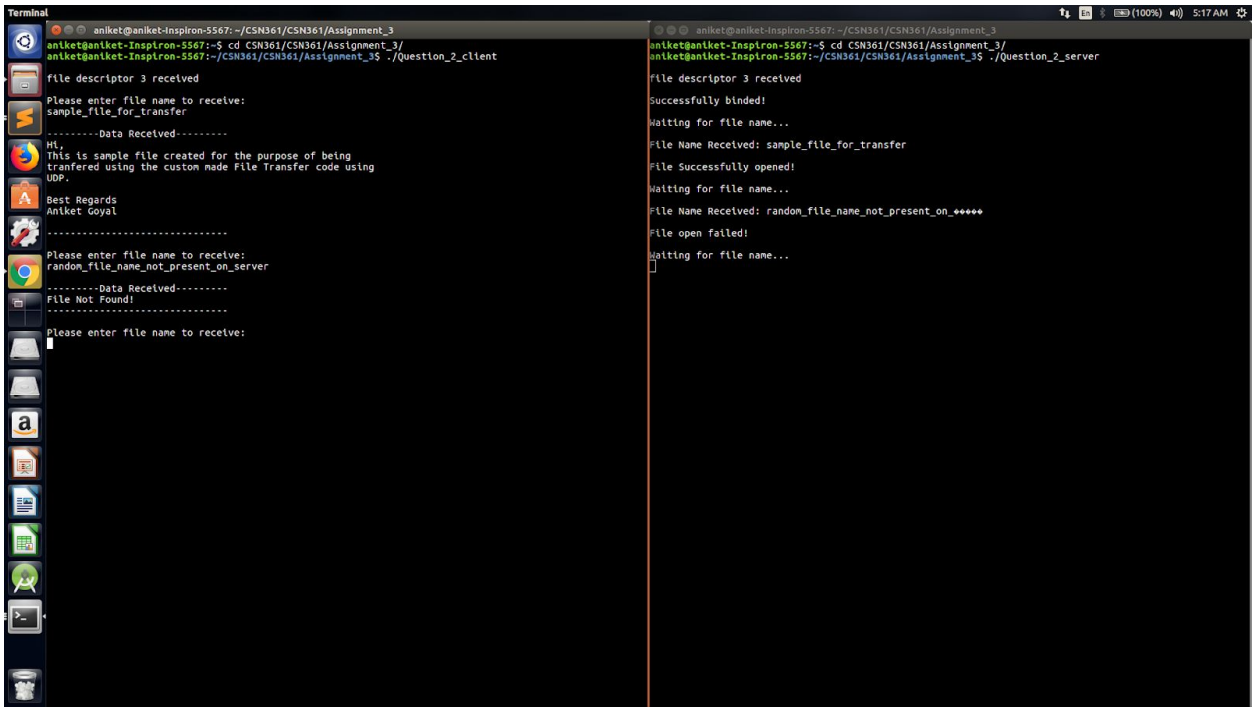
```
    int i = 0, j = 0;
    while (str[j] != '.')
        network[i++] = str[j++];
    i = 0;
    j++;
    while (str[j] != '\0')
        host[i++] = str[j++];
    printf("Network ID is %s\n", network);
    printf("Host ID is %s\n", host);
}

// for class B, first two octet are Network ID
// and rest are Host ID
else if (ipClass == 'B')
{
    int i = 0, j = 0, dotCount = 0;

    // storing in network[] up to 2nd dot
    // dotCount keeps track of number of
    // dots or octets passed
    while (dotCount < 2)
    {
        network[i++] = str[j++];
        if (str[j] == '.')
            dotCount++;
    }
    i = 0;
    j++;

    while (str[j] != '\0')
        host[i++] = str[j++];
```

```
    printf("Network ID is %s\n", network);
    printf("Host ID is %s\n", host);
}

// for class C, first three octet are Network ID
// and rest are Host ID
else if (ipClass == 'C')
{
    int i = 0, j = 0, dotCount = 0;

    // storing in network[] up to 3rd dot
    // dotCount keeps track of number of
    // dots or octets passed
    while (dotCount < 3)
    {
        network[i++] = str[j++];
        if (str[j] == '.')
            dotCount++;
    }

    i = 0;
    j++;

    while (str[j] != '\0')
        host[i++] = str[j++];

    printf("Network ID is %s\n", network);
    printf("Host ID is %s\n", host);
}

// Class D and E are not divided in Network
// and Host ID
```

```
    else
        printf("In this Class, IP address is not"
          " divided into Network and Host ID\n");
}

int main()
{
    string str;
    cout<<"Enter the ip : ";
    cin>>str;
    char ipClass = findClass(str);
    printf("Given IP address belongs to Class %c\n",ipClass);
    separate(str, ipClass);
    return 0;
}
```

Q2 - Write a C program to demonstrate File Transfer using UDP.

Screenshot :



Source code :

Client :

```
#include <arpa/inet.h>
#include <netinet/in.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <sys/socket.h>
#include <sys/types.h>
#include <unistd.h>

#define IP_PROTOCOL 0
#define IP_ADDRESS "127.0.0.1" // localhost
#define PORT_NO 15050
#define NET_BUF_SIZE 32
#define cipherKey 'S'
#define sendrecvflag 0
```

```
// function to clear buffer
void clearBuf(char* b)
{
    int i;
    for (i = 0; i < NET_BUF_SIZE; i++)
        b[i] = '\0';
}

// function for decryption
char Cipher(char ch)
{
    return ch ^ cipherKey;
}

// function to receive file
int recvFile(char* buf, int s)
{
    int i;
    char ch;
    for (i = 0; i < s; i++) {
        ch = buf[i];
        ch = Cipher(ch);
        if (ch == EOF)
            return 1;
        else
            printf("%c", ch);
    }
    return 0;
}

// driver code
```

```
int main()
{
    int sockfd, nBytes;
    struct sockaddr_in addr_con;
    unsigned int addrlen = sizeof(addr_con);
    addr_con.sin_family = AF_INET;
    addr_con.sin_port = htons(PORT_NO);
    addr_con.sin_addr.s_addr = inet_addr(IP_ADDRESS);
    char net_buf[NET_BUF_SIZE];
    FILE* fp;

    // socket()
    sockfd = socket(AF_INET, SOCK_DGRAM,
                    IP_PROTOCOL);

    if (sockfd < 0)
        printf("\nfile descriptor not received!!\n");
    else
        printf("\nfile descriptor %d received\n", sockfd);

    while (1) {
        printf("\nPlease enter file name to receive:\n");
        scanf("%s", net_buf);
        sendto(sockfd, net_buf, NET_BUF_SIZE,
               sendrecvflag, (struct sockaddr*)&addr_con,
               addrlen);

        printf("\n---------Data Received---------\n");

        while (1) {
            // receive
            clearBuf(net_buf);
```

```
        nBytes = recvfrom(sockfd, net_buf, NET_BUF_SIZE,
                    sendrecvflag, (struct sockaddr*)&addr_con,
                    &addrlen);

        // process
        if (recvFile(net_buf, NET_BUF_SIZE)) {
            break;
        }
    }
    printf("\n-------------------------------\n");
  }
  return 0;
}
```

Server :

```
#include <arpa/inet.h>
#include <netinet/in.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <sys/socket.h>
#include <sys/types.h>
#include <unistd.h>

#define IP_PROTOCOL 0
#define PORT_NO 15050
#define NET_BUF_SIZE 32
#define cipherKey 'S'
#define sendrecvflag 0
#define nofile "File Not Found!"

// function to clear buffer
```

```
void clearBuf(char* b)
{
    int i;
    for (i = 0; i < NET_BUF_SIZE; i++)
        b[i] = '\0';
}

// function to encrypt
char Cipher(char ch)
{
    return ch ^ cipherKey;
}

// function sending file
int sendFile(FILE* fp, char* buf, int s)
{
    int i, len;
    if (fp == NULL) {
        strcpy(buf, nofile);
        len = strlen(nofile);
        buf[len] = EOF;
        for (i = 0; i <= len; i++)
            buf[i] = Cipher(buf[i]);
        return 1;
    }

    char ch, ch2;
    for (i = 0; i < s; i++) {
        ch = fgetc(fp);
        ch2 = Cipher(ch);
        buf[i] = ch2;
        if (ch == EOF)
```

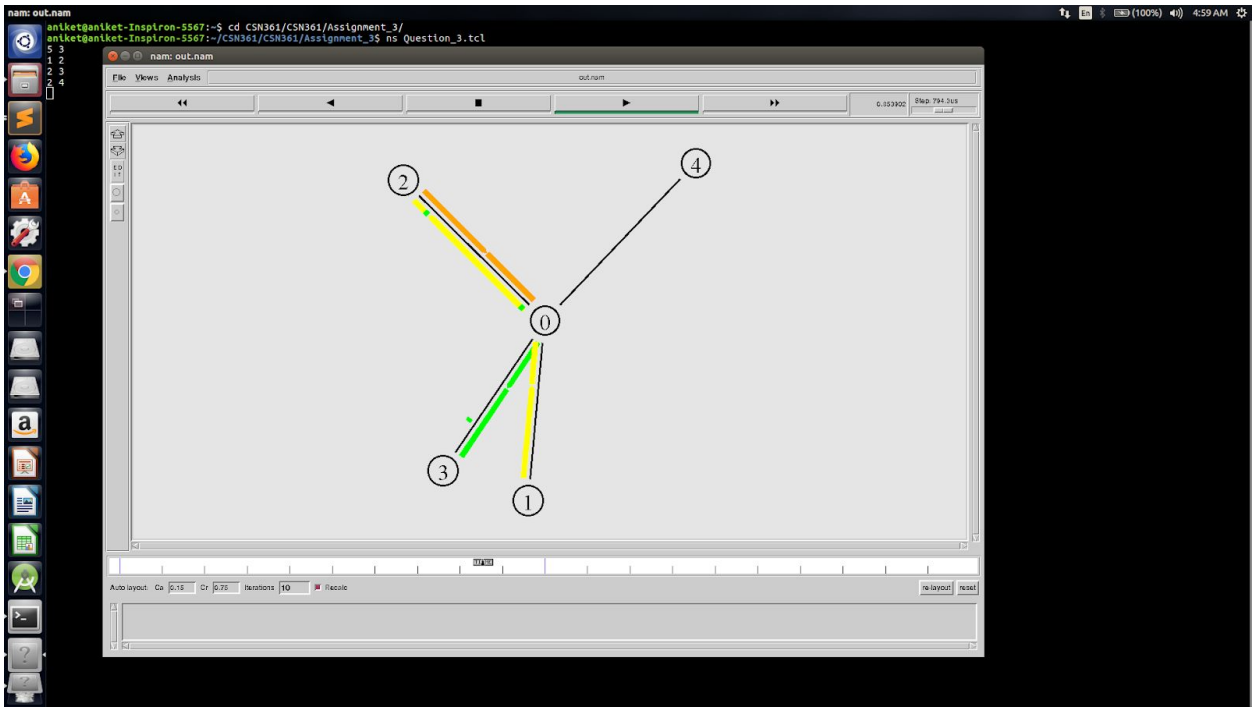
```
        return 1;
    }
    return 0;
}

// driver code
int main()
{
    int sockfd, nBytes;
    struct sockaddr_in addr_con;
    unsigned int addrlen = sizeof(addr_con);
    addr_con.sin_family = AF_INET;
    addr_con.sin_port = htons(PORT_NO);
    addr_con.sin_addr.s_addr = INADDR_ANY;
    char net_buf[NET_BUF_SIZE];
    FILE* fp;

    // socket()
    sockfd = socket(AF_INET, SOCK_DGRAM, IP_PROTOCOL);

    if (sockfd < 0)
        printf("\nfile descriptor not received!!\n");
    else
        printf("\nfile descriptor %d received\n", sockfd);

    // bind()
    if (bind(sockfd, (struct sockaddr*)&addr_con, sizeof(addr_con)) == 0)
        printf("\nSuccessfully binded!\n");
    else
        printf("\nBinding Failed!\n");

    while (1) {
```

```
printf("\nWaiting for file name...\n");

// receive file name
clearBuf(net_buf);

nBytes = recvfrom(sockfd, net_buf,
                NET_BUF_SIZE, sendrecvflag,
                (struct sockaddr*)&addr_con, &addrlen);

fp = fopen(net_buf, "r");
printf("\nFile Name Received: %s\n", net_buf);
if (fp == NULL)
   printf("\nFile open failed!\n");
else
   printf("\nFile Successfully opened!\n");

while (1) {

   // process
   if (sendFile(fp, net_buf, NET_BUF_SIZE)) {
      sendto(sockfd, net_buf, NET_BUF_SIZE,
            sendrecvflag,
         (struct sockaddr*)&addr_con, addrlen);
      break;
   }

   // send
   sendto(sockfd, net_buf, NET_BUF_SIZE,
         sendrecvflag,
      (struct sockaddr*)&addr_con, addrlen);
   clearBuf(net_buf);
}
```

```
        if (fp != NULL)
            fclose(fp);
    }
    return 0;
}
```

Q3 - Write a TCL code for network simulator NS2 to demonstrate the star topology among a set of computer nodes. Given N nodes, one node will be assigned as the central node and the other nodes will be connected to it to form the star. You have to set up a TCP connection between k pairs of nodes and demonstrate the packet transfer between them using Network Animator (NAM). Use File Transfer Protocol (FTP) for the same. Each link should have a different colour of packets to differentiate the packets transferred between each pair of nodes. The program should take the number of nodes (N) as input followed by k pairs of nodes.

Screenshot :



Source code :

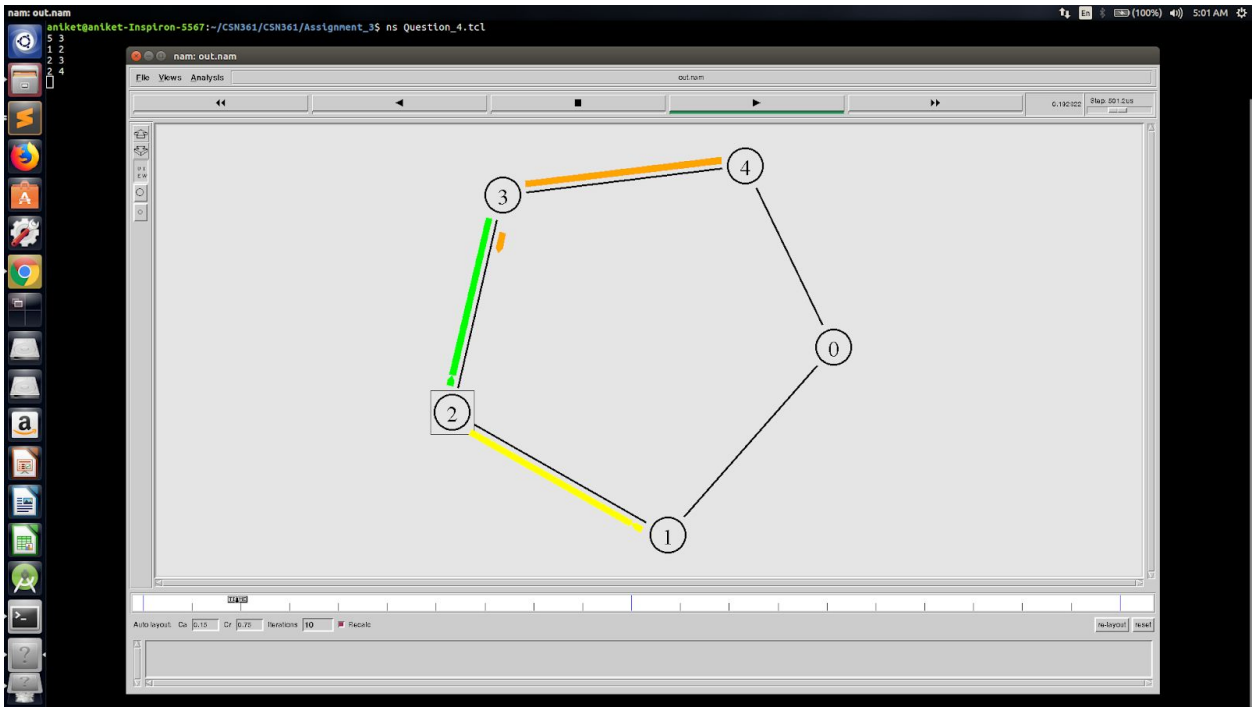
```
set input [gets stdin]
scan $input "%d %d" N k

set ns [new Simulator]

$ns rtproto DV

set nf [open out.nam w]
$ns namtrace-all $nf

proc finish {} {
    global ns nf
    $ns flush-trace
    close $nf
    exec nam out.nam
    exit 0
```

```
}

for {set i 0} {$i < $N} {incr i} {
        set node($i) [$ns node]
}

for {set i 1} {$i < $N} {incr i} {
        $ns duplex-link $node($i) $node(0) 1Mb 10ms DropTail
}

set colors(0) Yellow
set colors(1) Green
set colors(2) Orange
set colors(3) Pink
set colors(4) Red
set colors(5) Blue


for {set i 0} {$i < $k} {incr i} {
        set input [gets stdin]
        scan $input "%d %d" u v

        set tcp_con [new Agent/TCP]
        $ns attach-agent $node($u) $tcp_con
        $tcp_con set class_ $i

        set sink_node [new Agent/TCPSink]
        $ns attach-agent $node($v) $sink_node
        $ns connect $tcp_con $sink_node

        $ns color $i $colors([expr ($i) % 6])
        $tcp_con set fid_ $i
```

```
        set ftp_con [new Application/FTP]
        $ftp_con attach-agent $tcp_con
        $ns at 0.1 "$ftp_con start"
        $ns at 1.5 "$ftp_con stop"
}

$ns at 2.0 "finish"
$ns run
```

Q4 - Write a TCL code for network simulator NS2 to demonstrate the ring topology among a set of computer nodes. Given N nodes, each node will be connected to two other nodes in the form of a ring. You have to set up a TCP connection between k pairs of nodes and demonstrate packet transfer between them using Network Animator (NAM). Use File Transfer Protocol (FTP) for the same. Each link should have a different colour of packets to differentiate the packets transferred between each pair of nodes. The program should take the number of nodes (N) as input followed by k pairs of nodes.

Screenshot :



Source code :

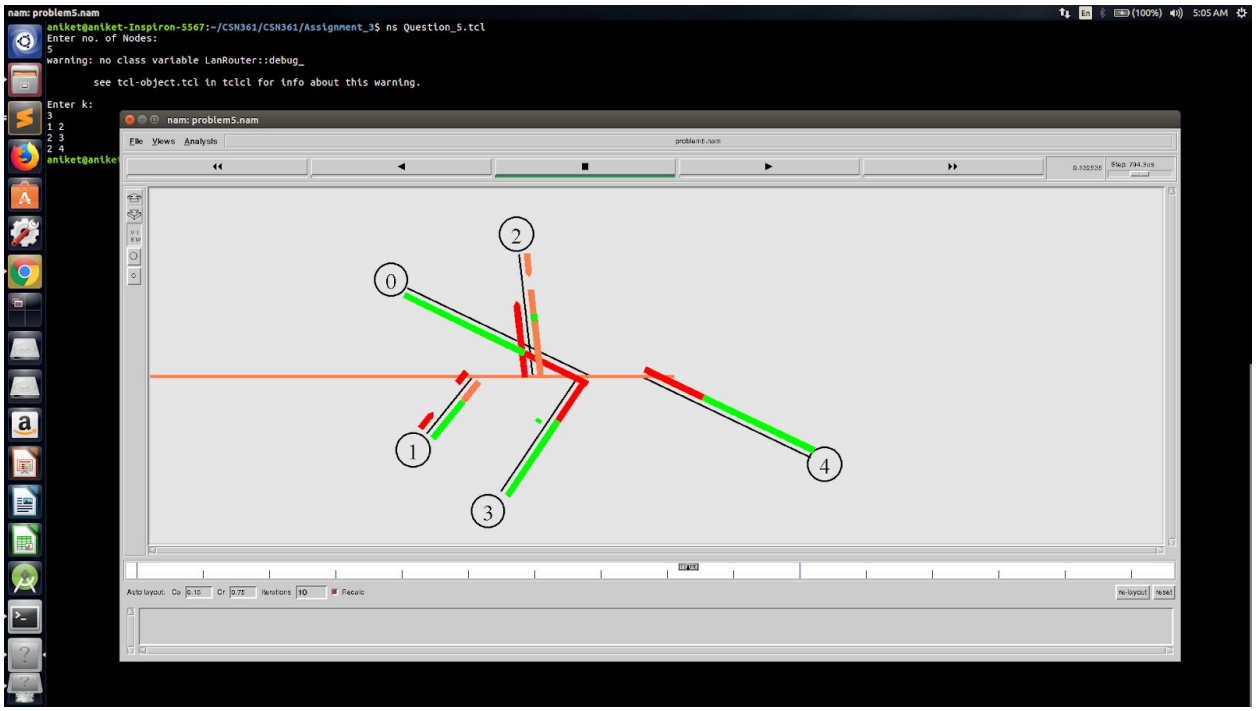
```
set input [gets stdin]
scan $input "%d %d" N k

set ns [new Simulator]

$ns rtproto DV

set nf [open out.nam w]
$ns namtrace-all $nf

proc finish {} {
    global ns nf
    $ns flush-trace
    close $nf
    exec nam out.nam
    exit 0
```

```
}

for {set i 0} {$i < $N} {incr i} {
        set node($i) [$ns node]
}

for {set i 0} {$i < $N} {incr i} {
        $ns duplex-link $node($i) $node([expr ($i + 1) % $N]) 512Kb 5ms DropTail
}

set colors(0) Yellow
set colors(1) Green
set colors(2) Orange
set colors(3) Pink
set colors(4) Red
set colors(5) Blue

for {set i 0} {$i < $k} {incr i} {
        set input [gets stdin]
        scan $input "%d %d" u v

        set tcp_con [new Agent/TCP]
        $ns attach-agent $node($u) $tcp_con
        $tcp_con set class_ $i

        set sink_node [new Agent/TCPSink]
        $ns attach-agent $node($v) $sink_node
        $ns connect $tcp_con $sink_node

        $ns color $i $colors([expr ($i) % 6])
        $tcp_con set fid_ $i
```

```
        set ftp_con [new Application/FTP]
        $ftp_con attach-agent $tcp_con
        $ns at 0.1 "$ftp_con start"
        $ns at 1.5 "$ftp_con stop"
}

$ns at 2.0 "finish"
$ns run
```

Q5 - Write a TCL code for network simulator NS2 to demonstrate the bus topology among a set of computer nodes. Given N nodes, each node will be connected to a common link. You have to set up a TCP connection between k pairs of nodes and demonstrate packet transfer between them using Network Animator (NAM). Use File Transfer Protocol (FTP) for the same. Each link should have a different colour of packets to differentiate the packets transferred between each pair of nodes. The program should take the number of nodes (N) as input followed by k pairs of nodes.

Screenshot :



Source code :

```
set ns [new Simulator]

$ns color 0 Red
$ns color 1 Green
$ns color 2 Coral
$ns color 3 Blue
$ns color 4 Azure

set f [open problem5.nam w]
$ns namtrace-all $f

proc finish {} {
    global ns f
    $ns flush-trace
    close $f

    exec nam problem5.nam &
```

```
    exit 0
}
puts "Enter no. of Nodes: "
gets stdin N
set n(0) [$ns node]
set y "$n(0)"
for {set i 1} {$i < $N} {incr i} {
    set n($i) [$ns node]
    append y " "
    append y "$n($i)"
}
$ns make-lan $y 0.5Mb 40ms LL Queue/DropTail Mac/802_3
puts "Enter k: "
gets stdin k
for {set i 0} {$i < $k} {incr i} {
    set input [gets stdin]
            scan $input "%d %d" i1 i2
    set tcp [new Agent/TCP]
    $tcp set class_ [expr $i%5]
    $ns attach-agent $n($i1) $tcp

    set sink [new Agent/TCPSink]
    $ns attach-agent $n($i2) $sink
    $ns connect $tcp $sink
    $tcp set fid_ $i

    set ftp($i) [new Application/FTP]
    $ftp($i) attach-agent $tcp
    $ftp($i) set type_ FTP
}
for {set i 0} {$i < $k} {incr i} {
    $ns at [expr ($i/10)+0.1] "$ftp($i) start"
```

```
    $ns at [expr ($i/10)+1.5] "$ftp($i) stop"
}
$ns at [expr ($k/10)+1.5] "finish"

$ns run
```