EXPERIMENT NO.-1

Objective:

Take a decimal number from user. Convert it to different bases (e.g.: 2,8,16 etc.) and send those values to message queue. Write three separate programs to read and display the binary, octal and hex value from the message queue distinctively.

Program Code:

sender.c

```
#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include <errno.h>
#include <unistd.h>
#include <sys/msg.h>

#define MAX_TEXT 512

struct my_msg_st{

    long int my_msg_type;

    char some_text[MAX_TEXT];

};

long long int decimalToBinary(int num){

    long long int bin = 0;

    int i = 1;

    while (num != 0){

        int rem = num % 2;

        num /= 2;

        bin += rem * i;

        i *= 10;

    }

    return bin;

}

long long int decimalToOctal(int num){

    long long int octal = 0;

    int i = 1;

    while (num != 0){

        int rem = num % 8;
```

```
        num /= 8;
        octal += rem * i;
        i *= 10;
    }
    return octal;
}
int main(){
    int running = 1;
    struct my_msg_st some_data_bin;
    struct my_msg_st some_data_oct;
    struct my_msg_st some_data_hex;
    int msgid;
    char buffer[BUFSIZ];
    msgid = msgget((key_t)1234, 0666 | IPC_CREAT);
    if (msgid == -1){
        fprintf(stderr, "msgget failed with error: %d\n", errno);
        exit(EXIT_FAILURE);
    }
    while (running){
        printf("Enter The Decimal Number : ");
        fgets(buffer, BUFSIZ, stdin);
        some_data_bin.my_msg_type = 2;
        some_data_oct.my_msg_type = 8;
        some_data_hex.my_msg_type = 16;
        if (strncmp(buffer, "end", 3) != 0){
            int num = atoi(buffer);
            sprintf(some_data_bin.some_text, "%lld", decimalToBinary(num));
            num = atoi(buffer);
            sprintf(some_data_oct.some_text, "%lld", decimalToOctal(num));
            int quotient, remainder;
            char str[100] = "";
            quotient = atoi(buffer);
            int j = 0;
            if (quotient == 0)
```

```
        strcpy(some_data_hex.some_text, "0");
    else{
        while (quotient != 0){
            remainder = quotient % 16;
            if (remainder < 10)
                str[j++] = 48 + remainder;
            else
                str[j++] = 55 + remainder;
            quotient = quotient / 16;
        }
        int k = 0;
        char hexadecimalnum[100] = "";
        for (int l = j - 1; l >= 0; l--){
            hexadecimalnum[k++] = str[l];
        }
        strcpy(some_data_hex.some_text, hexadecimalnum);
    }
}
else{
    strcpy(some_data_hex.some_text, buffer);
    strcpy(some_data_bin.some_text, buffer);
    strcpy(some_data_oct.some_text, buffer);
}
if (msgsnd(msgid, (void *)&some_data_bin, MAX_TEXT, 0) == -1){
    fprintf(stderr, "msgsnd failed\n");
    exit(EXIT_FAILURE);
}
if (msgsnd(msgid, (void *)&some_data_oct, MAX_TEXT, 0) == -1){
    fprintf(stderr, "msgsnd failed\n");
    exit(EXIT_FAILURE);
}
if (msgsnd(msgid, (void *)&some_data_hex, MAX_TEXT, 0) == -1){
    fprintf(stderr, "msgsnd failed\n");
    exit(EXIT_FAILURE);
```

```
        }
        if (strncmp(buffer, "end", 3) == 0){
            running = 0;
        }
    }
    exit(EXIT_SUCCESS);
}
```

==========

binaryreceiver.c

```
#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include <errno.h>
#include <unistd.h>
#include <sys/msg.h>
struct my_msg_st{
    long int my_msg_type;
    char some_text[BUFSIZ];
};
int main(){
    int running = 1;
    int msgid;
    struct my_msg_st some_data;
    long int msg_to_receive = 2;
    msgid = msgget((key_t)1234, 0666 | IPC_CREAT);
    if (msgid == -1){
        fprintf(stderr, "msgget failed with error: %d\n", errno);
        exit(EXIT_FAILURE);
    }
    while (running){
        if (msgrcv(msgid, (void *)&some_data, BUFSIZ, msg_to_receive, 0) == -1){
            fprintf(stderr, "msgrcv failed with error: %d\n", errno);
            exit(EXIT_FAILURE);
        }
        if (strncmp(some_data.some_text, "end", 3) == 0){
            running = 0;
```

```
            printf("Program Terminated\n");
            break;
        }
        printf("Decimal to Binary : %s\n", some_data.some_text);
    }
    exit(EXIT_SUCCESS);
}
```

==========

octalreceiver.c

```
#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include <errno.h>
#include <unistd.h>
#include <sys/msg.h>
struct my_msg_st{
    long int my_msg_type;
    char some_text[BUFSIZ];
};
int main(){
    int running = 1;
    int msgid;
    struct my_msg_st some_data;
    long int msg_to_receive = 8;
    msgid = msgget((key_t)1234, 0666 | IPC_CREAT);
    if (msgid == -1){
        fprintf(stderr, "msgget failed with error: %d\n", errno);
        exit(EXIT_FAILURE);
    }
    while (running){
        if (msgrcv(msgid, (void *)&some_data, BUFSIZ, msg_to_receive, 0) == -1){
            fprintf(stderr, "msgrcv failed with error: %d\n", errno);
            exit(EXIT_FAILURE);
        }
        if (strncmp(some_data.some_text, "end", 3) == 0){
```

```
            running = 0;
            printf("Program Terminated\n");
            break;
        }
        printf("Decimal to Octal : %s\n", some_data.some_text);
    }
    exit(EXIT_SUCCESS);
}
```

==========

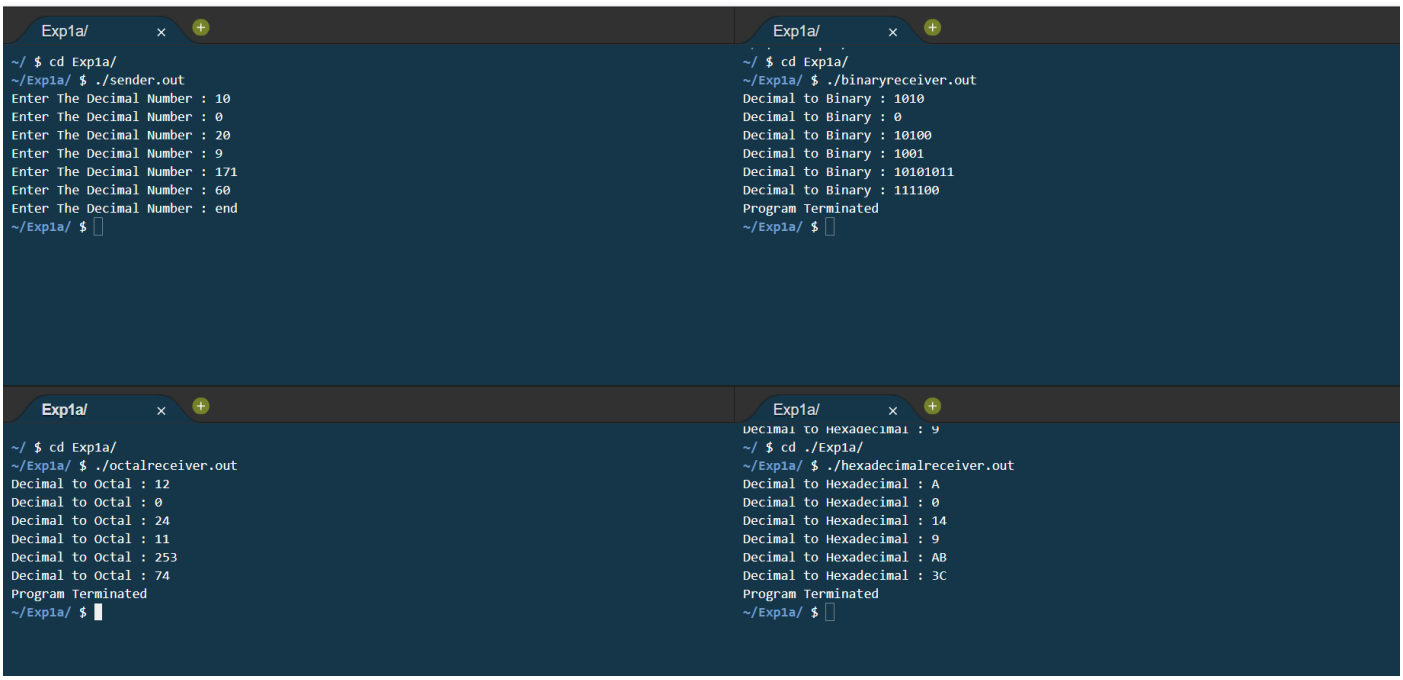
hexadecimalreceiver.c

```
#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include <errno.h>
#include <unistd.h>
#include <sys/msg.h>
struct my_msg_st{
    long int my_msg_type;
    char some_text[BUFSIZ];
};
int main(){
    int running = 1;
    int msgid;
    struct my_msg_st some_data;
    long int msg_to_receive = 16;
    msgid = msgget((key_t)1234, 0666 | IPC_CREAT);
    if (msgid == -1){
        fprintf(stderr, "msgget failed with error: %d\n", errno);
        exit(EXIT_FAILURE);
    }
    while (running){
        if (msgrcv(msgid, (void *)&some_data, BUFSIZ, msg_to_receive, 0) == -1){
            fprintf(stderr, "msgrcv failed with error: %d\n", errno);
            exit(EXIT_FAILURE);
        }
```

```
        if (strncmp(some_data.some_text, "end", 3) == 0){
            running = 0;
            printf("Program Terminated\n");
            break;
        }
        printf("Decimal to Hexadecimal : %s\n", some_data.some_text);
    }
    if (msgctl(msgid, IPC_RMID, 0) == -1){
        fprintf(stderr, "msgctl(IPC_RMID) failed\n");
        exit(EXIT_FAILURE);
    }
    exit(EXIT_SUCCESS);
}
```

==========

Screenshot of the Output:



EXPERIMENT NO.- 2

Objective:

Write C Programs to implement a simple client-server application. A client will send N integers to the server, which will sort the integers and send back to client. The client will print the result. Use Unix File socket for communication.

Program Code:

client.c

```
#include <sys/types.h>
#include <sys/socket.h>
#include <stdio.h>
#include <sys/un.h>
#include <unistd.h>
#include <stdlib.h>

int main(){
   int sockfd;
   int len;
   struct sockaddr_un address;
   int result;
   int arr[5], i;

   sockfd = socket(AF_UNIX, SOCK_STREAM, 0);
   address.sun_family = AF_UNIX;
   strcpy(address.sun_path, "server_socket");
   len = sizeof(address);
   result = connect(sockfd, (struct sockaddr *)&address, len);
   if (result == -1){
      perror("oops:client1");
      exit(1);
   }

   printf("Enter 5 elements\n");
   for (i = 0; i < 5; i++)
      scanf("%d", &arr[i]);

   write(sockfd, arr, sizeof(arr));
   read(sockfd, arr, sizeof(arr));

   printf("Sorted Array From Server:\n");
   for (i = 0; i < 5; i++)
      printf("%d ", arr[i]);

   close(sockfd);
   exit(0);
}
```

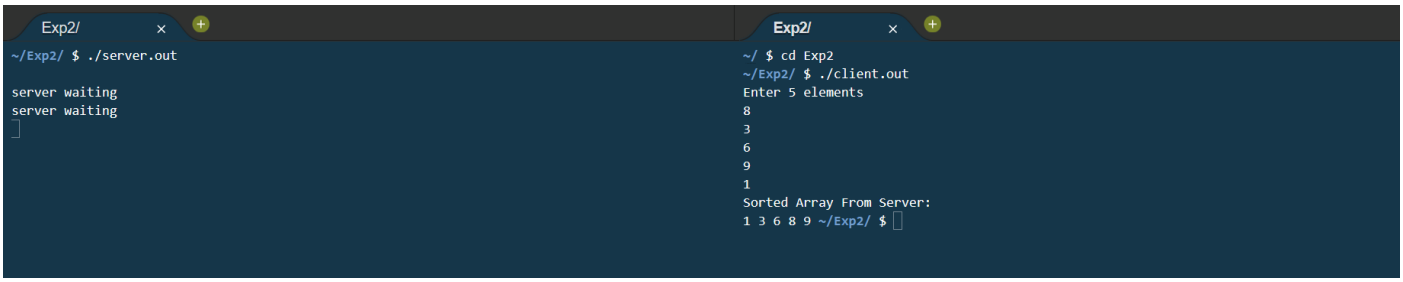
==========

server.c

```
#include <sys/types.h>
#include <sys/socket.h>
#include <stdio.h>
#include <sys/un.h>
#include <unistd.h>
#include <stdlib.h>

int main(){
    int server_sockfd, client_sockfd;
    int server_len, client_len;
    struct sockaddr_un server_address;
    struct sockaddr_un client_address;
    int arr[5], i, j, t;

    unlink("server_socket");
    server_sockfd = socket(AF_UNIX, SOCK_STREAM, 0);
    server_address.sun_family = AF_UNIX;
    strcpy(server_address.sun_path, "server_socket");
    server_len = sizeof(server_address);
    bind(server_sockfd, (struct sockaddr *)&server_address, server_len);
    listen(server_sockfd, 5);
    while (1){
        printf("server waiting\n");
        client_len = sizeof(client_address);
        client_sockfd = accept(server_sockfd, (struct sockaddr *)&client_address, &client_len);
        read(client_sockfd, arr, sizeof(arr));
        for (i = 1; i < 5; i++)
            for (j = 0; j < 5 - i; j++)
                if (arr[j] > arr[j + 1]){
                    t = arr[j];
                    arr[j] = arr[j + 1];
                    arr[j + 1] = t;
                }
        write(client_sockfd, arr, sizeof(arr));
        close(client_sockfd);
    }
}
```

==========

Screenshot of the Output:



EXPERIMENT NO.- 3A

Objective:

Write a C Program to implement TCP socket. The client will take a bit-stream from the user and send it to the server. The server will implement bit stuffing and send the stream back to the client. The client will print it.

Program Code:

client.c

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

int main()
{
   int sockfd;
   int len;
   struct sockaddr_in address;
   int result;
   int st[8] = {0};
   sockfd = socket(AF_INET, SOCK_STREAM, 0);
   address.sin_family = AF_INET;
   address.sin_addr.s_addr = inet_addr("127.0.0.1");
   address.sin_port = 9734;
   len = sizeof(address);
   result = connect(sockfd, (struct sockaddr *)&address, len);
   if (result == -1)
   {
      perror("oops:client1");
      exit(1);
   }
   printf("Frame Size is Eight. Enter a bit sequence: ");
   for (int i = 0; i < 8; i++)
   {
      scanf("%d", &st[i]);
   }
   write(sockfd, st, sizeof(st));
   read(sockfd, st, sizeof(st));
   printf("Received Sequence: \n");
   for (int i = 0; i < 8; i++)
   {
      printf("%d", st[i]);
   }
   printf("\n\n");
```

```
    exit(0);
}
```

==========

server.c

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

int main()
{
    int client_sockfd, server_sockfd;
    int server_len, client_len;
    struct sockaddr_in server_address;
    struct sockaddr_in client_address;
    server_sockfd = socket(AF_INET, SOCK_STREAM, 0);
    server_address.sin_family = AF_INET;
    server_address.sin_addr.s_addr = inet_addr("127.0.0.1");
    server_address.sin_port = 9734;
    server_len = sizeof(server_address);
    bind(server_sockfd, (struct sockaddr *)&server_address, server_len);
    listen(server_sockfd, 5);
    printf("Server Started.\n");
    while (1)
    {
        int st[8];
        int i = 0;
        printf("Server Waiting\n");
        client_len = sizeof(client_address);
        client_sockfd = accept(server_sockfd, (struct sockaddr *)&client_address, &client_len);
        read(client_sockfd, st, sizeof(st));
        if ((st[i] == 0) && (st[i + 1] == 1) && (st[i + 2] == 1) && (st[i + 3] == 1) && (st[i + 4] == 1) && (st[i
+ 5] == 1))
        {
            st[i + 5] = 10;
            printf("Bit Stream is Stuffed.\n");
        }
        else
        {
            printf("Bit Stream is not Stuffed.\n");
        }
        write(client_sockfd, st, sizeof(st));
    }
}
```

==========

Screenshot of the Output:

```
Exp3/
~/ $ cd Exp3
~/Exp3/ $ ./server.out
Server Started.
Server Waiting
Bit Stream is Stuffed.
Server Waiting
Bit Stream is not Stuffed.
Server Waiting
```

```
Exp3/
~/ $ cd Exp3
~/Exp3/ $ ./client.out
Frame Size is Eight. Enter a bit sequence: 0 1 1 1 1 1 1 1
Received Sequence:
011111011

~/Exp3/ $ ./client.out
Frame Size is Eight. Enter a bit sequence: 1 1 1 1 1 1 1 1
Received Sequence:
11111111

~/Exp3/ $
```

EXPERIMENT NO.- 3B

Objective:

Create a multi-client TCP server. The client will take a dataword and divisor from the user and send them to the server. The server will find out the codeword using CRC and send it to the client.

Program Code:

client.c

```
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <arpa/inet.h>
#define MAXSIZE 15

int main()
{
   char val[MAXSIZE];
   int sockfd, result, len;
   struct sockaddr_in address;

   sockfd = socket(AF_INET, SOCK_STREAM, 0);
   address.sin_family = AF_INET;
   address.sin_addr.s_addr = inet_addr("127.0.0.1");
   address.sin_port = 9734;
   len = sizeof(address);
   result = connect(sockfd, (struct sockaddr *)&address, len);
   if (result == -1)
   {
      perror("Client Error!");
      exit(1);
   }
   printf("Enter the dataword: ");
   fgets(val, MAXSIZE, stdin);
   write(sockfd, val, sizeof(val));

   printf("Enter the divisor: ");
   fgets(val, MAXSIZE, stdin);
   write(sockfd, val, sizeof(val));

   read(sockfd, val, sizeof(val));
   printf("Codeword from Server = %s", val);
   close(sockfd);
   return 0;
```

```
}
==========================================================================
```

server.c

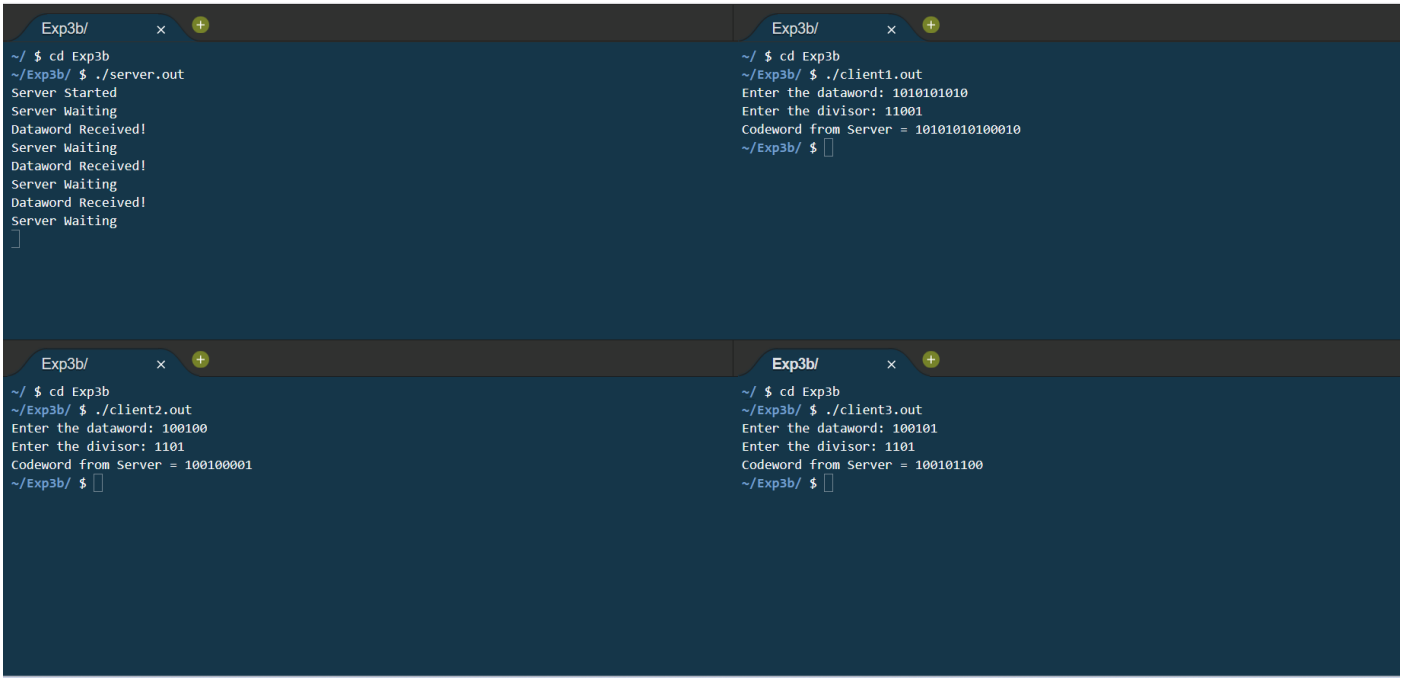
```
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <arpa/inet.h>
#include <pthread.h>
#include <math.h>
#define MAXCLIENT 3
#define MAXSIZE 15

void *serve(void *arg)
{
    int client_sockfd, client_len;
    struct sockaddr_in client_address;
    char data[MAXSIZE], tmp[MAXSIZE];
    char val[MAXSIZE], div[MAXSIZE];
    int i, j, end, start, data_len = 0, div_len = 0;
    int socket = *((int *)arg);
    client_len = sizeof(client_address);
    client_sockfd = accept(socket, (struct sockaddr *)&client_address, &client_len);
    read(client_sockfd, val, sizeof(val));
    i = 0;
    while (val[i] != 10)
    {
        data_len++;
        i++;
    }
    strcpy(data, val);
    strcpy(tmp, val);
    printf("Dataword Received!\n");
    read(client_sockfd, val, sizeof(val));
    i = 0;
    while (val[i] != 10)
    {
        div_len++;
        i++;
    }
    strcpy(div, val);
    i = data_len;
    data_len = data_len + div_len - 1;
    while (i < data_len)
    {
        data[i] = '0';
        i++;
```

```
    }
    data[i] = 10;
    start = 0;
    end = div_len - 1;
    while (end < data_len)
    {
        if (data[start] == '1')
        {
            for (i = start, j = 0; i <= end, j < div_len; i++, j++)
            {
                if (data[i] == div[j])
                    data[i] = '0';
                else
                    data[i] = '1';
            }
        }
        start++;
        end++;
    }
    i = 0;
    end = div_len - 1;
    while (end)
    {
        tmp[data_len - 1 - i] = data[data_len - 1 - i];
        end--;
        i++;
    }
    tmp[data_len] = 10;
    write(client_sockfd, tmp, sizeof(tmp));
    return NULL;
}

int main()
{
    int server_sockfd, server_len, temp;
    struct sockaddr_in server_address;
    pthread_t th[MAXCLIENT];
    server_sockfd = socket(AF_INET, SOCK_STREAM, 0);
    server_address.sin_family = AF_INET;
    server_address.sin_addr.s_addr = inet_addr("127.0.0.1");
    server_address.sin_port = 9734;
    server_len = sizeof(server_address);
    bind(server_sockfd, (struct sockaddr *)&server_address, server_len);
    listen(server_sockfd, MAXCLIENT);
    printf("Server Started\n");
    while (1)
    {
        temp = 0;
        while (temp < MAXCLIENT)
        {
            int *pserver = malloc(sizeof(int));
```

```
        *pserver = server_sockfd;
        pthread_create(&th[temp], NULL, serve, (void *)pserver);
        temp++;
    }
    temp = 0;
    while (temp < MAXCLIENT)
    {
        printf("Server Waiting\n");
        pthread_join(th[temp], NULL);
        temp++;
    }
  }
  return 0;
}
```

==========

Screenshot of the Output:



EXPERIMENT NO.- 4

Objective:

Take a IPV4 address as input. Write a C program to check in which class does it belong. Also print special comment for network ID and broadcast ID and Default Mask ID.

Program Code:

ipv4.c

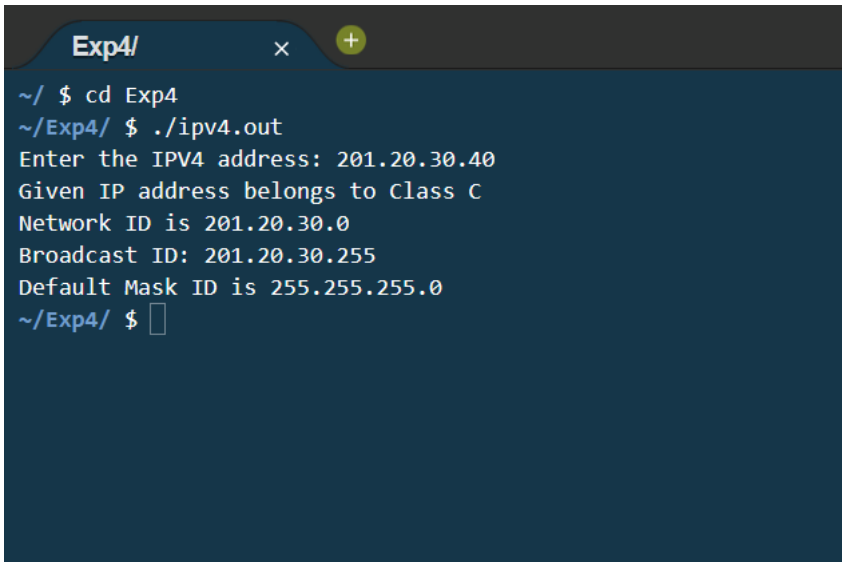
```
#include <stdio.h>
#include <string.h>

char findClass(char 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';

   else if (ip >= 128 && ip <= 191)
      return 'B';

   else if (ip >= 192 && ip <= 223)
      return 'C';

   else if (ip >= 224 && ip <= 239)
      return 'D';

   else
      return 'E';
}

void separate(char str[], char ipClass)
{
   char network[12];
```

```
    for (int k = 0; k < 12; k++)
        network[k] = '\0';

    if (ipClass == 'A')
    {
        int i = 0, j = 0;
        while (str[j] != '.')
            network[i++] = str[j++];
        printf("Network ID is %s.0.0.0\n", network);
        printf("Broadcast ID:%s.255.255.255\n", network);
        printf("Default Mask ID is 255.0.0.0\n");
    }

    else if (ipClass == 'B')
    {
        int i = 0, j = 0, dotCount = 0;
        while (dotCount < 2)
        {
            network[i++] = str[j++];
            if (str[j] == '.')
                dotCount++;
        }

        printf("Network ID is %s.0.0\n", network);
        printf("Broadcast ID: %s.255.255\n", network);
        printf("Default Mask ID is 255.255.0.0\n");
    }

    else if (ipClass == 'C')
    {
        int i = 0, j = 0, dotCount = 0;
        while (dotCount < 3)
        {
            network[i++] = str[j++];
            if (str[j] == '.')
                dotCount++;
        }

        printf("Network ID is %s.0\n", network);
        printf("Broadcast ID: %s.255\n", network);
        printf("Default Mask ID is 255.255.255.0\n");
    }

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

int main()
{
    char str[15];
    printf("Enter the IPV4 address: ");
```

```
    fgets(str, 15, stdin);
    char ipClass = findClass(str);
    printf("Given IP address belongs to Class %c\n", ipClass);
    separate(str, ipClass);
    return 0;
}
```

==========

Screenshot of the Output:



EXPERIMENT NO.- 5

Objective:

Write client-server programs using UDP socket. The client will take a data word from the user and send it to the server. The server will find the codeword (use Hamming code error correction technique) and send it back to the client.

Program Code:

client.c

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

#define PORT 8080

int main()
{
    int sockfd;
    struct sockaddr_in servaddr;
    if ((sockfd = socket(AF_INET, SOCK_DGRAM, 0)) < 0)
    {
        perror("socket creation failed");
        exit(EXIT_FAILURE);
    }
    memset(&servaddr, 0, sizeof(servaddr));
    servaddr.sin_family = AF_INET;
    servaddr.sin_port = htons(PORT);
    servaddr.sin_addr.s_addr = INADDR_ANY;
    int arr[4];
    printf("Enter four data bits: ");
    for (int i = 0; i < 4; i++)
        scanf("%d", &arr[i]);
    sendto(sockfd, &arr, 4 * sizeof(int), MSG_CONFIRM, (const struct sockaddr *)&servaddr,
sizeof(servaddr));
    printf("Data sent\n");
    int ans[7], len;
    len = sizeof(servaddr);
    recvfrom(sockfd, &ans, 7 * sizeof(int), MSG_WAITALL, (struct sockaddr *)&servaddr, &len);
    printf("Received Dataword: ");
    for (int i = 0; i < 7; i++)
        printf("%d", ans[i]);
    close(sockfd);
    return 0;
```

```
}
==========================================================================
```

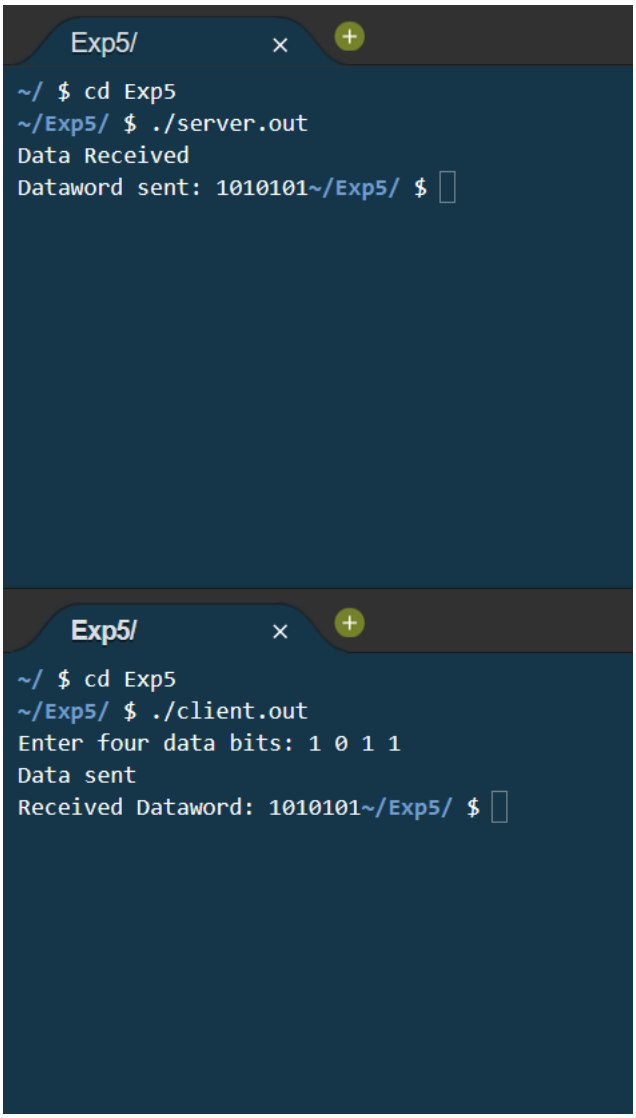
server.c

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

#define PORT 8080

int main()
{
    int sockfd;
    struct sockaddr_in servaddr, cliaddr;
    if ((sockfd = socket(AF_INET, SOCK_DGRAM, 0)) < 0)
    {
        perror("socket creation failed");
        exit(EXIT_FAILURE);
    }
    memset(&servaddr, 0, sizeof(servaddr));
    memset(&cliaddr, 0, sizeof(cliaddr));
    servaddr.sin_family = AF_INET;
    servaddr.sin_addr.s_addr = INADDR_ANY;
    servaddr.sin_port = htons(PORT);
    if (bind(sockfd, (const struct sockaddr *)&servaddr, sizeof(servaddr)) < 0)
    {
        perror("bind failed");
        exit(EXIT_FAILURE);
    }
    int len;
    len = sizeof(cliaddr);
    int arr[4];
    recvfrom(sockfd, &arr, 4 * sizeof(int), MSG_WAITALL, (struct sockaddr *)&cliaddr, &len);
    printf("Data Received \n");
    int ans[7];
    ans[0] = arr[0];
    ans[1] = arr[1];
    ans[2] = arr[2];
    ans[4] = arr[3];
    ans[3] = ans[0] ^ ans[1] ^ ans[2];
    ans[5] = ans[0] ^ ans[1] ^ ans[4];
    ans[6] = ans[0] ^ ans[2] ^ ans[4];
    sendto(sockfd, &ans, 7 * sizeof(int), MSG_CONFIRM, (const struct sockaddr *)&cliaddr, len);
    printf("Dataword sent: ");
    for (int i = 0; i < 7; i++)
```

```
        printf("%d", ans[i]);
    return 0;
}
```

==========

Screenshot of the Output:



EXPERIMENT NO.- 6

Objective:

Write C programs to implement a simple chat server (single client, single server) by using TCP Socket.

Program Code:

client.c

```
#include <stdio.h>
#include <string.h>
#include <netinet/in.h>
#include <arpa/inet.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <unistd.h>
#include <pthread.h>
#include <termios.h>
#include <stdlib.h>
void *recv_thread(void *a);
void *send_thread(void *a);
int cfd;
int main()
{
    struct sockaddr_in cl;
    int n;
    pthread_t snd, rcv;
    cfd = socket(AF_INET, SOCK_STREAM, 0);
    cl.sin_family = AF_INET;
    inet_aton("127.0.0.1", &(cl.sin_addr));
    cl.sin_port = htons(8760);
    connect(cfd, (struct sockaddr *)&cl, sizeof(cl));
    pthread_create(&snd, NULL, send_thread, NULL);
    pthread_create(&rcv, NULL, recv_thread, NULL);
    pthread_join(snd, NULL);
    pthread_join(rcv, NULL);
    close(cfd);
    return 0;
}
void *send_thread(void *a)
{
    int n;
    char str[200];
    while (1)
    {
        fgets(str, 200, stdin);
        write(cfd, (void *)str, sizeof(str));

        if (strncmp(str, "bye", 3) == 0)
            exit(0);
```

```
    }
    pthread_exit(NULL);
}
void *recv_thread(void *a)
{
    int n;
    char str[200];
    while (1)
    {
        n = read(cfd, (void *)str, sizeof(str));
        if (n > 0)
        {
            printf("Server: %s", str);
            fflush(stdout);
        }
        if (strncmp(str, "bye", 3) == 0)
            exit(0);
    }
    pthread_exit(NULL);
}
```

==========

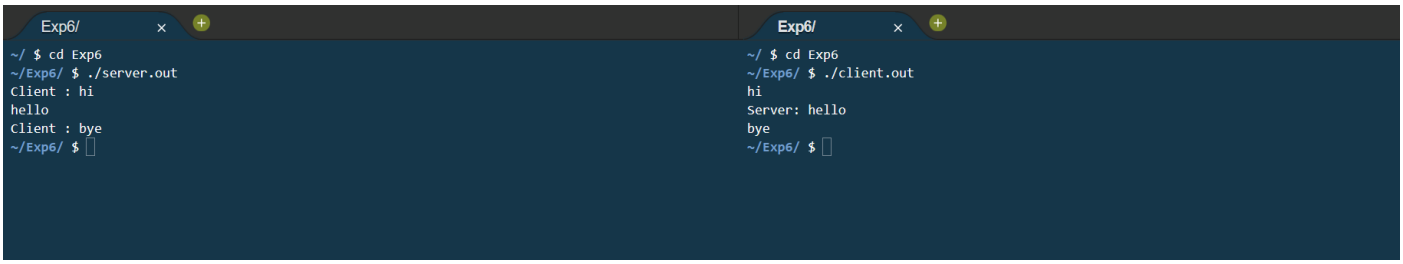
server.c

```
#include <stdio.h>
#include <string.h>
#include <netinet/in.h>
#include <arpa/inet.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <unistd.h>
#include <pthread.h>
#include <termios.h>
#include <stdlib.h>
void *recv_thread(void *a);
void *send_thread(void *a);
int cfd;
int main()
{
    struct sockaddr_in ser, cl;
    int sfd, len, i, n;
    pthread_t snd, rcv;
    len = sizeof(cl);
    sfd = socket(AF_INET, SOCK_STREAM, 0);
    ser.sin_family = AF_INET;
    inet_aton("127.0.0.1", &(ser.sin_addr));
    ser.sin_port = htons(8760);
    n = bind(sfd, (struct sockaddr *)&ser, sizeof(ser));
    n = listen(sfd, 1);
    cfd = accept(sfd, (struct sockaddr *)&cl, &len);
    pthread_create(&snd, NULL, send_thread, NULL);
    pthread_create(&rcv, NULL, recv_thread, NULL);
```

```
    pthread_join(snd, NULL);
    pthread_join(rcv, NULL);
    close(cfd);
    return 0;
}
void *send_thread(void *a)
{
    int n;
    char str[200];
    while (1)
    {
        fgets(str, 200, stdin);
        write(cfd, (void *)str, sizeof(str));
        if (strncmp(str, "bye", 3) == 0)
            exit(0);
    }
    pthread_exit(NULL);
}
void *recv_thread(void *a)
{
    int n;
    char str[200];
    while (1)

    {
        n = read(cfd, (void *)str, sizeof(str));
        if (n > 0)
        {
            printf("Client : %s", str);
            fflush(stdout);
        }
        if (strncmp(str, "bye", 3) == 0)
            exit(0);
    }
    pthread_exit(NULL);
}
```

==========

Screenshot of the Output:



EXPERIMENT NO.-7

Objective:

Write C programs to implement a multi-client chat server by using TCP Socket.

Program Code:

client.c

```
#include <stdio.h>
#include <string.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <arpa/inet.h>
#include <stdlib.h>
#include <unistd.h>
#include <pthread.h>
#define MAX_SIZE 50
char msg[MAX_SIZE];
void *recvmg(void *my_sock)
{
    int sock = *((int *)my_sock);
    int len;
    while ((len = recv(sock, msg, MAX_SIZE, 0)) > 0)
    {
        msg[len] = '\0';
        fputs(msg, stdout);
    }
}
int main(int argc, char *argv[])
{
    pthread_t recvt;
    int sock_desc;
    struct sockaddr_in serv_addr;
    char client_name[MAX_SIZE];
    char recvmsg[MAX_SIZE];
    strcpy(client_name, argv[1]);
    if ((sock_desc = socket(AF_INET, SOCK_STREAM, 0)) < 0)
        printf("Failed creating socket\n");
    bzero((char *)&serv_addr, sizeof(serv_addr));
    serv_addr.sin_family = AF_INET;
    serv_addr.sin_addr.s_addr = inet_addr("127.0.0.1");
    serv_addr.sin_port = htons(3000);

    if (connect(sock_desc, (struct sockaddr *)&serv_addr, sizeof(serv_addr)) < 0)
    {
        printf("Failed to connect to server\n");
        return -1;
    }
    pthread_create(&recvt, NULL, (void *)recvmg, &sock_desc);
```

```
    char data[MAX_SIZE];
    char sendMSG[MAX_SIZE];
    while (1)
    {
        fgets(data, MAX_SIZE, stdin);
        strcpy(sendMSG, client_name);
        strcat(sendMSG, ": ");
        strcat(sendMSG, data);
        write(sock_desc, &sendMSG, sizeof(sendMSG));
    }
    exit(0);
    close(sock_desc);
    return 0;
}
```

==========

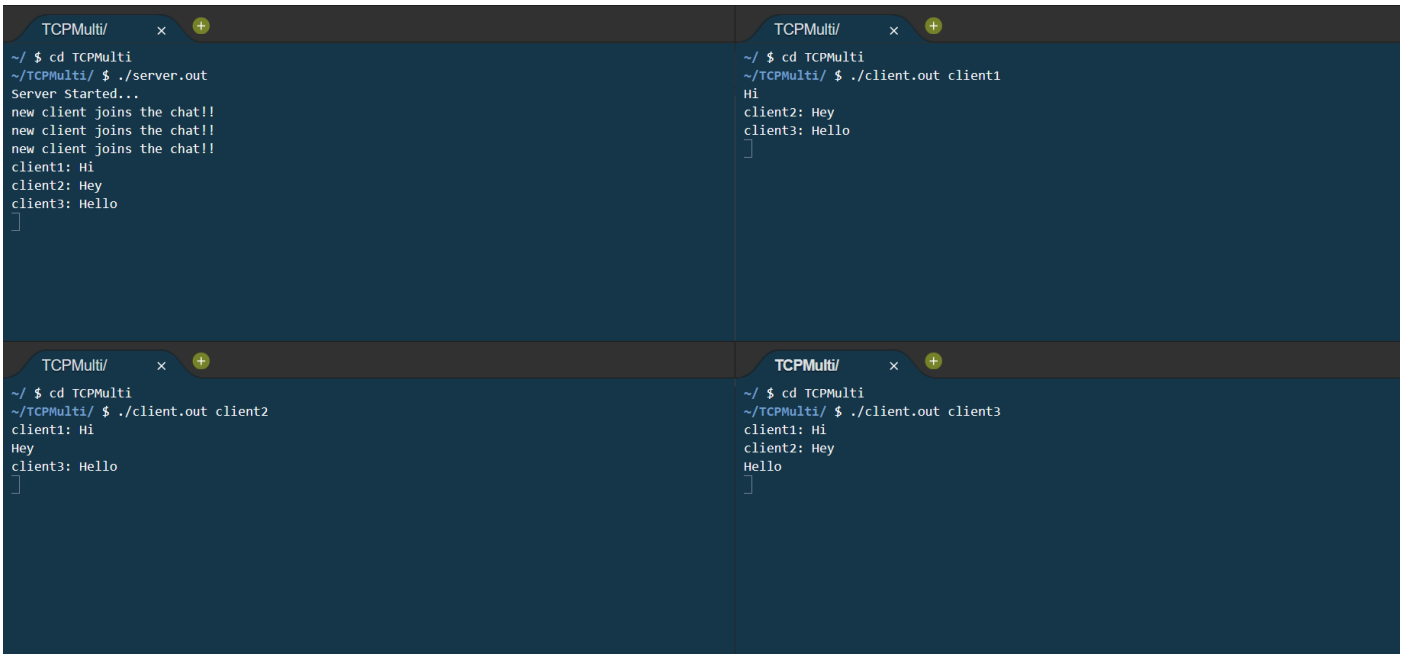
server.c

```
#include <stdio.h>
#include <sys/socket.h>
#include <string.h>
#include <arpa/inet.h>
#include <pthread.h>
pthread_mutex_t mutex;
int clients[20];
int n = 0;
void sendtoall(char *msg, int curr)
{
    int i;
    pthread_mutex_lock(&mutex);
    for (i = 0; i < n; i++)
    {
        if (clients[i] != curr)
        {
            if (send(clients[i], msg, strlen(msg), 0) < 0)
            {
                printf("sending failure \n");
                continue;
            }
        }
    }
    pthread_mutex_unlock(&mutex);
}
void *recvmg(void *client_sock)
{
    int sock = *((int *)client_sock);
    char msg[500];
    int len;
    while ((len = recv(sock, msg, 500, 0)) > 0)
```

```
    {
        msg[len] = '\0';
        fputs(msg, stdout);
        sendtoall(msg, sock);
    }
}
int main()
{
    struct sockaddr_in ServerIp;
    pthread_t recvt;
    int sock = 0, Client_sock = 0;

    ServerIp.sin_family = AF_INET;
    ServerIp.sin_port = htons(3000);
    ServerIp.sin_addr.s_addr = inet_addr("127.0.0.1");
    sock = socket(AF_INET, SOCK_STREAM, 0);

    if (bind(sock, (struct sockaddr *)&ServerIp, sizeof(ServerIp)) == -1)
        printf("cannot bind, error!! \n");
    else
        printf("Server Started...\n");

    if (listen(sock, 20) == -1)
        printf("listening failed!! \n");

    while (1)
    {
        if ((Client_sock = accept(sock, (struct sockaddr *)NULL, NULL)) < 0)
        {
            printf("accept failed!!\n");
        }
        else
        {
            printf("new client joins the chat!!\n");
        }
        pthread_mutex_lock(&mutex);
        clients[n] = Client_sock;
        n++;
        pthread_create(&recvt, NULL, (void *)recvmg, &Client_sock);
        pthread_mutex_unlock(&mutex);
    }
    return 0;
}
```

==========

Screenshot of the Output:



EXPERIMENT NO.-8

Objective:

Write C programs to implement a simple chat server (single client, single server) by using UDP Socket.

Program Code:

client.c

```
#include <stdio.h>
#include <string.h>
#include <netinet/in.h>
#include <arpa/inet.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <unistd.h>
#include <pthread.h>
#include <termios.h>
#include <stdlib.h>
void *recv_thread(void *a);
void *send_thread(void *a);
int cfd;
int main()
{
    struct sockaddr_in cl;
    int n;
    pthread_t snd, rcv;
    cfd = socket(AF_INET, SOCK_STREAM, 0);
    cl.sin_family = AF_INET;
    inet_aton("127.0.0.1", &(cl.sin_addr));
    cl.sin_port = htons(8760);
    connect(cfd, (struct sockaddr *)&cl, sizeof(cl));
    pthread_create(&snd, NULL, send_thread, NULL);
    pthread_create(&rcv, NULL, recv_thread, NULL);
    pthread_join(snd, NULL);
    pthread_join(rcv, NULL);
    close(cfd);
    return 0;
}
void *send_thread(void *a)
{
    int n;
    char str[200];
    while (1)
    {
        fgets(str, 200, stdin);
        write(cfd, (void *)str, sizeof(str));

        if (strncmp(str, "bye", 3) == 0)
            exit(0);
```

```
    }
    pthread_exit(NULL);
}
void *recv_thread(void *a)
{
    int n;
    char str[200];
    while (1)
    {
        n = read(cfd, (void *)str, sizeof(str));
        if (n > 0)
        {
            printf("Server: %s", str);
            fflush(stdout);
        }
        if (strncmp(str, "bye", 3) == 0)
            exit(0);
    }
    pthread_exit(NULL);
}
```

==========

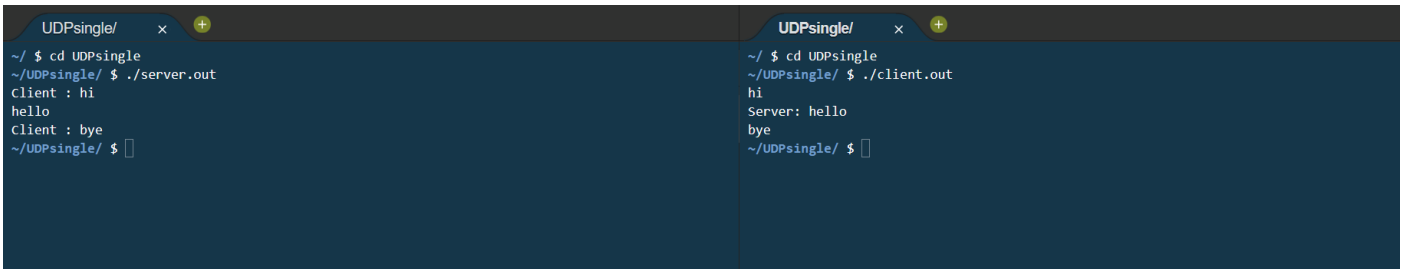
server.c

```
#include <stdio.h>
#include <string.h>
#include <netinet/in.h>
#include <arpa/inet.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <unistd.h>
#include <pthread.h>
#include <termios.h>
#include <stdlib.h>
void *recv_thread(void *a);
void *send_thread(void *a);
int cfd;
int main()
{
    struct sockaddr_in ser, cl;
    int sfd, len, i, n;
    pthread_t snd, rcv;
    len = sizeof(cl);
    sfd = socket(AF_INET, SOCK_STREAM, 0);
    ser.sin_family = AF_INET;
    inet_aton("127.0.0.1", &(ser.sin_addr));
    ser.sin_port = htons(8760);
    n = bind(sfd, (struct sockaddr *)&ser, sizeof(ser));
    n = listen(sfd, 1);
    cfd = accept(sfd, (struct sockaddr *)&cl, &len);
```

```
    pthread_create(&snd, NULL, send_thread, NULL);
    pthread_create(&rcv, NULL, recv_thread, NULL);
    pthread_join(snd, NULL);
    pthread_join(rcv, NULL);
    close(cfd);
    return 0;
}
void *send_thread(void *a)
{
    int n;
    char str[200];
    while (1)
    {
        fgets(str, 200, stdin);
        write(cfd, (void *)str, sizeof(str));
        if (strncmp(str, "bye", 3) == 0)
            exit(0);
    }
    pthread_exit(NULL);
}
void *recv_thread(void *a)
{
    int n;
    char str[200];
    while (1)

    {
        n = read(cfd, (void *)str, sizeof(str));
        if (n > 0)
        {
            printf("Client : %s", str);
            fflush(stdout);
        }
        if (strncmp(str, "bye", 3) == 0)
            exit(0);
    }
    pthread_exit(NULL);
}
```

==========

Screenshot of the Output:



EXPERIMENT NO.-9

Objective:

Write C programs to implement a multi-client chat server by using UDP Socket.

Program Code:

client.c

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

#define PORT 8080
#define MAXLINE 1024

int main()
{
    int sockfd;
    char buffer[MAXLINE];
    struct sockaddr_in servaddr;

    if ((sockfd = socket(AF_INET, SOCK_DGRAM, 0)) < 0)
    {
        perror("socket creation failed");
        exit(EXIT_FAILURE);
    }

    memset(&servaddr, 0, sizeof(servaddr));

    servaddr.sin_family = AF_INET;
    servaddr.sin_port = htons(PORT);
    servaddr.sin_addr.s_addr = INADDR_ANY;

    int n;

    socklen_t len;

    while (1)
    {
        printf("Enter message : ");
        fgets(buffer, MAXLINE, stdin);
        sendto(sockfd, (const char *)buffer, strlen(buffer),
            MSG_CONFIRM, (const struct sockaddr *)&servaddr,
            sizeof(servaddr));
        printf("Message sent.\n");
```

```
        n = recvfrom(sockfd, (char *)buffer, MAXLINE,
                    MSG_WAITALL, (struct sockaddr *)&servaddr,
                    &len);
        buffer[n] = '\0';
        printf("Server : %s\n", buffer);

        if ((strncmp(buffer, "bye", 3)) == 0)
        {
            printf("Client Exit...\n");
            break;
        }
    }
}
```

==========

server.c

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

#define PORT 8080
#define MAXLINE 1024

int main()
{
    int sockfd;
    char buffer[MAXLINE];
    struct sockaddr_in servaddr, cliaddr;

    if ((sockfd = socket(AF_INET, SOCK_DGRAM, 0)) < 0)
    {
        perror("socket creation failed");
        exit(EXIT_FAILURE);
    }

    memset(&servaddr, 0, sizeof(servaddr));
    memset(&cliaddr, 0, sizeof(cliaddr));

    servaddr.sin_family = AF_INET; // IPv4
```

```
    servaddr.sin_addr.s_addr = INADDR_ANY;
    servaddr.sin_port = htons(PORT);

    if (bind(sockfd, (const struct sockaddr *)&servaddr,
            sizeof(servaddr)) < 0)
    {
        perror("bind failed");
        exit(EXIT_FAILURE);
    }

    int len, n;

    len = sizeof(cliaddr); // len is value/resuslt

    while (1)
    {
        n = recvfrom(sockfd, (char *)buffer, MAXLINE,
                    MSG_WAITALL, (struct sockaddr *)&cliaddr,
                    &len);
        buffer[n] = '\0';
        printf("Client : %s\n", buffer);
        printf("Enter message : ");
        fgets(buffer, MAXLINE, stdin);
        sendto(sockfd, (const char *)buffer, strlen(buffer),
              MSG_CONFIRM, (const struct sockaddr *)&cliaddr,
              len);
        printf("message sent to client.\n");
    }

    return 0;
}
```

==========

Screenshot of the Output: