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Department of Computer Science & Engineering

Programme Name: B.Tech **Semester: VII** **Branch: Computer Science & Engg.**

Course Code: CS17201 **Course Name: Distributed Systems (Lab)**

Lab Assignment 5

Lab #	Name of Experiments
5	**(i)** Implement concurrent echo client-server application.

Client-----

Node No	Ip Address	Port no
1	172.31.100.36	2345
2	172.31.100.40	3128
3	172.31.100.52	2323

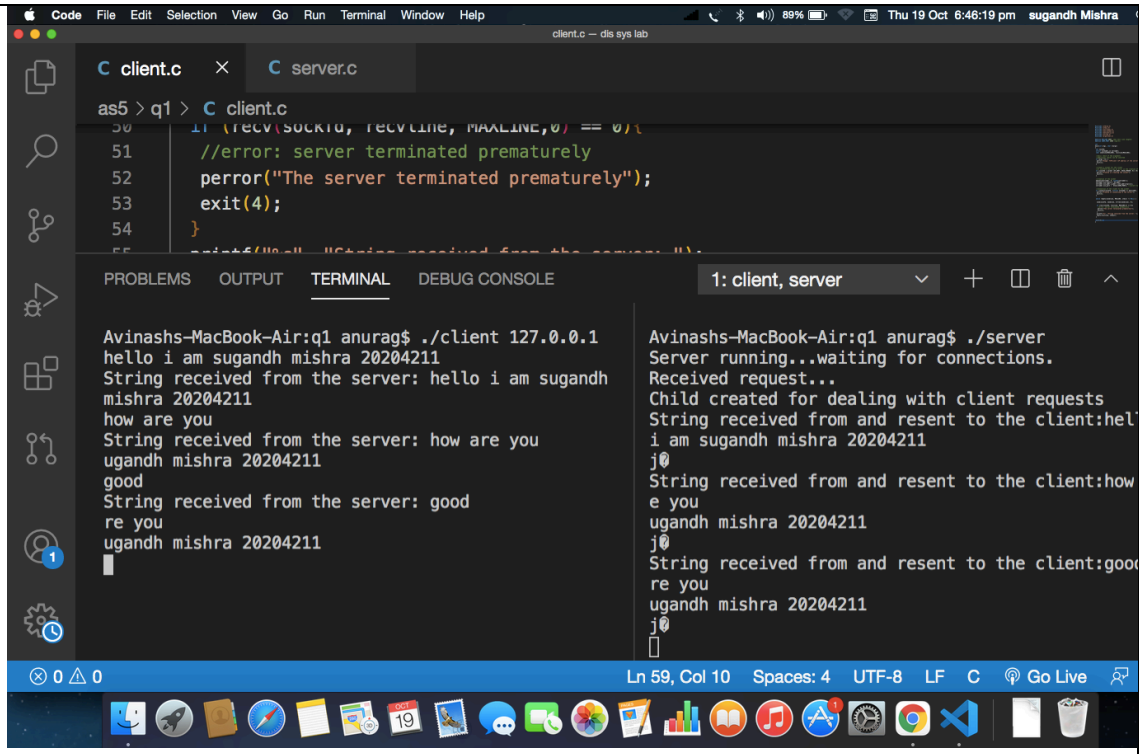
```c
#include <stdlib.h>
#include <stdio.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <string.h>
#include <arpa/inet.h>

#define MAXLINE 4096 /*max text line length*/
#define SERV_PORT 3000 /*port*/

int
main(int argc, char **argv)
{
 int sockfd;
 struct sockaddr_in servaddr;
 char sendline[MAXLINE], recvline[MAXLINE];

 //basic check of the arguments
 //additional checks can be inserted
 if (argc !=2) {
  perror("Usage: TCPClient <IP address of the server");
  exit(1);
 }

 //Create a socket for the client
 //If sockfd<0 there was an error in the creation of the socket
 if ((sockfd = socket (AF_INET, SOCK_STREAM, 0)) <0) {
  perror("Problem in creating the socket");
  exit(2);
 }

 //Creation of the socket
```

```
memset(&servaddr, 0, sizeof(servaddr));
servaddr.sin_family = AF_INET;
servaddr.sin_addr.s_addr= inet_addr(argv[1]);
servaddr.sin_port =  htons(SERV_PORT); //convert to big-endian order

//Connection of the client to the socket
if (connect(sockfd, (struct sockaddr *) &servaddr, sizeof(servaddr))<0) {
 perror("Problem in connecting to the server");
 exit(3);
}

while (fgets(sendline, MAXLINE, stdin) != NULL) {

 send(sockfd, sendline, strlen(sendline), 0);

 if (recv(sockfd, recvline, MAXLINE,0) == 0){
  //error: server terminated prematurely
  perror("The server terminated prematurely");
  exit(4);
 }
 printf("%s", "String received from the server: ");
 fputs(recvline, stdout);
}

exit(0);
}
```

server------

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

#define MAXLINE 4096 /*max text line length*/
#define SERV_PORT 3000 /*port*/
#define LISTENQ 8 /*maximum number of client connections*/

int main (int argc, char **argv)
{
 int listenfd, connfd, n;
 pid_t childpid;
 socklen_t clilen;
 char buf[MAXLINE];
 struct sockaddr_in cliaddr, servaddr;

 //Create a socket for the soclet
 //If sockfd<0 there was an error in the creation of the socket
 if ((listenfd = socket (AF_INET, SOCK_STREAM, 0)) <0) {
  perror("Problem in creating the socket");
  exit(2);
 }
```

```
//preparation of the socket address
servaddr.sin_family = AF_INET;
servaddr.sin_addr.s_addr = htonl(INADDR_ANY);
servaddr.sin_port = htons(SERV_PORT);

//bind the socket
bind (listenfd, (struct sockaddr *) &servaddr, sizeof(servaddr));

//listen to the socket by creating a connection queue, then wait for clients
listen (listenfd, LISTENQ);

printf("%s\n","Server running...waiting for connections.");

for ( ; ; ) {

 clilen = sizeof(cliaddr);
 //accept a connection
 connfd = accept (listenfd, (struct sockaddr *) &cliaddr, &clilen);

 printf("%s\n","Received request...");

 if ( (childpid = fork ()) == 0 ) {//if it's 0, it's child process

 printf ("%s\n","Child created for dealing with client requests");

 //close listening socket
 close (listenfd);

 while ( (n = recv(connfd, buf, MAXLINE,0)) > 0)  {
  printf("%s","String received from and resent to the client:");
  puts(buf);
  send(connfd, buf, n, 0);
 }

 if (n < 0)
  printf("%s\n", "Read error");
 exit(0);
}
//close socket of the server
close(connfd);
}
}
```



(ii) Implement a client-server program in which the server accepts a connection from a client and updates it own Master table by adding the client information and send the updated table to client, so client can update their own table.

Table format:

Node No Ip Address Port no

1 172.31.100.36 2345

2 172.31.100.40 3128

3 172.31.100.52 2323

client----

```c
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <arpa/inet.h>
#include <sys/socket.h>
#include <unistd.h>
#define MAX_CLIENTS 10

struct ClientInfo {
    int node_no;
    char ip_address[20];
    int port_no;
};

int main() {
    int client_socket;
    struct sockaddr_in server_addr;
    struct ClientInfo my_info;

    // Create a socket
    client_socket = socket(AF_INET, SOCK_STREAM, 0);
    if (client_socket < 0) {
        perror("Socket creation error");
        exit(1);
```

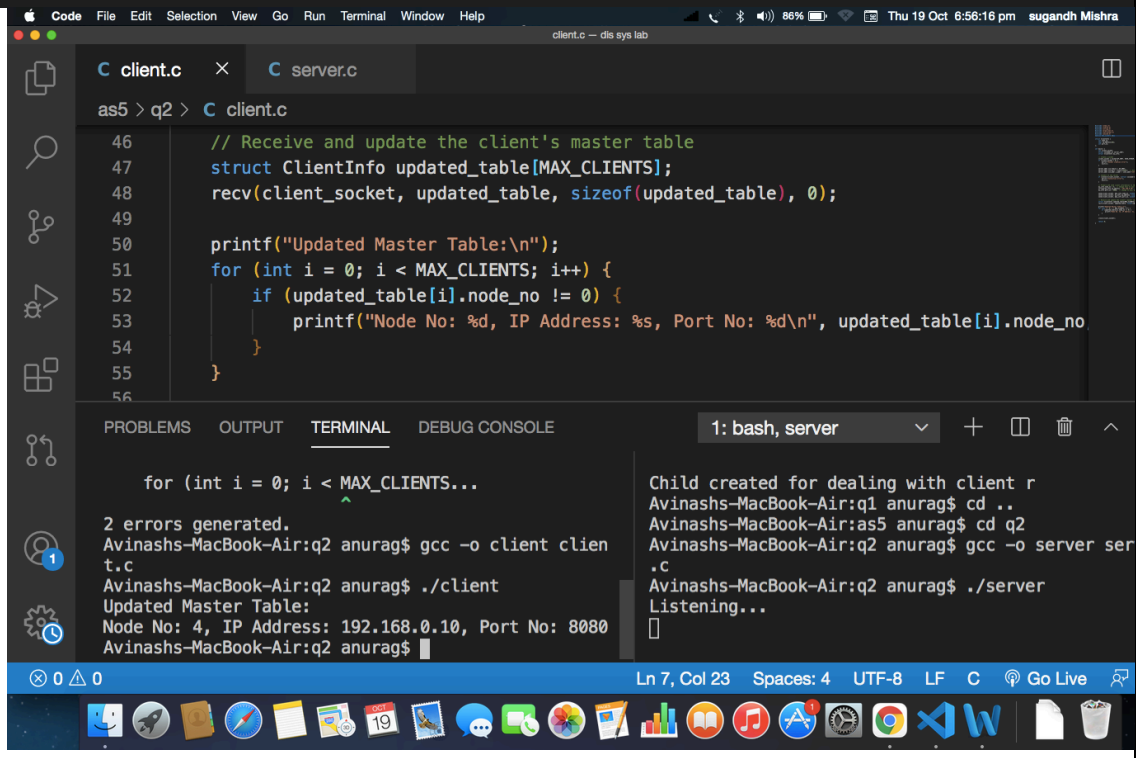
```
    }

    server_addr.sin_family = AF_INET;
    server_addr.sin_port = htons(12345);  // Use the same port as the server
    server_addr.sin_addr.s_addr = inet_addr("127.0.0.1");  // Use the server's IP

    // Connect to the server
    if (connect(client_socket, (struct sockaddr*)&server_addr,
sizeof(server_addr)) < 0) {
        perror("Connection error");
        exit(1);
    }

    // Prepare and send client information to the server
    my_info.node_no = 4;  // Change this to your node number
    strncpy(my_info.ip_address, "192.168.0.10", sizeof(my_info.ip_address));  //
Change to your IP
    my_info.port_no = 8080;  // Change to your port

    send(client_socket, &my_info.node_no, sizeof(my_info.node_no), 0);
    send(client_socket, my_info.ip_address, sizeof(my_info.ip_address), 0);
    send(client_socket, &my_info.port_no, sizeof(my_info.port_no), 0);

    // Receive and update the client's master table
    struct ClientInfo updated_table[MAX_CLIENTS];
    recv(client_socket, updated_table, sizeof(updated_table), 0);

    printf("Updated Master Table:\n");
    for (int i = 0; i < MAX_CLIENTS; i++) {
        if (updated_table[i].node_no != 0) {
            printf("Node No: %d, IP Address: %s, Port No: %d\n",
updated_table[i].node_no, updated_table[i].ip_address, updated_table[i].port_no);
        }
    }

    close(client_socket);

    return 0;
}
```

server---

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

#define MAX_CLIENTS 10

struct ClientInfo {
    int node_no;
    char ip_address[20];
    int port_no;
};
```

```c
struct ClientInfo master_table[MAX_CLIENTS];
int num_clients = 0;

void updateMasterTable(int node_no, char* ip_address, int port_no) {
    if (num_clients < MAX_CLIENTS) {
        master_table[num_clients].node_no = node_no;
        strncpy(master_table[num_clients].ip_address, ip_address,
sizeof(master_table[num_clients].ip_address));
        master_table[num_clients].port_no = port_no;
        num_clients++;
    } else {
        printf("Master table is full.\n");
    }
}

int main() {
    int server_socket, client_socket;
    struct sockaddr_in server_addr, client_addr;
    socklen_t addr_size;
    int node_no;
    char client_ip[20];
    int client_port;

    // Initialize master table (you can pre-fill this with initial data)

    // Create a socket
    server_socket = socket(AF_INET, SOCK_STREAM, 0);
    if (server_socket < 0) {
        perror("Socket creation error");
        exit(1);
    }

    server_addr.sin_family = AF_INET;
    server_addr.sin_port = htons(12345);  // Use your desired port
    server_addr.sin_addr.s_addr = INADDR_ANY;

    // Bind the socket
    if (bind(server_socket, (struct sockaddr*)&server_addr, sizeof(server_addr)) <
0) {
        perror("Binding error");
        exit(1);
    }

    // Listen for clients
    if (listen(server_socket, 10) == 0) {
        printf("Listening...\n");
    } else {
        perror("Listening error");
        exit(1);
    }

    // Accept client connections and update the master table
    addr_size = sizeof(client_addr);
    while (1) {
```

```
        client_socket = accept(server_socket, (struct sockaddr*)&client_addr,
&addr_size);

        // Receive client information
        recv(client_socket, &node_no, sizeof(node_no), 0);
        recv(client_socket, client_ip, sizeof(client_ip), 0);
        recv(client_socket, &client_port, sizeof(client_port), 0);

        // Update master table with client information
        updateMasterTable(node_no, client_ip, client_port);

        // Send the updated table back to the client
        send(client_socket, master_table, sizeof(master_table), 0);

        close(client_socket);
    }

    close(server_socket);

    return 0;
}
```



(iii) Develop a client-server program to implement a date-time server and client. Upon connection establishment, the server should send its current date, time and CPU load information to its clients.

Client----

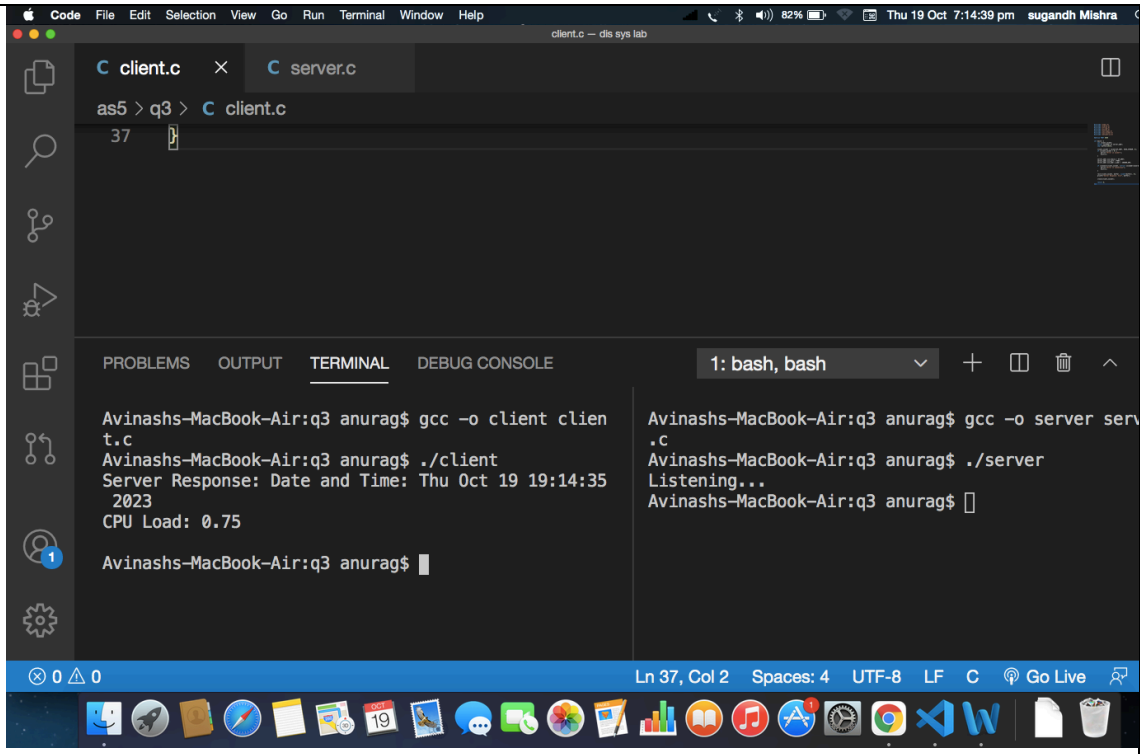
```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
```

```c
#include <unistd.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>

#define PORT 8080

int main() {
    int client_socket;
    struct sockaddr_in server_addr;
    char buffer[1024];

    client_socket = socket(AF_INET, SOCK_STREAM, 0);
    if (client_socket < 0) {
        perror("Error in socket");
        exit(1);
    }

    server_addr.sin_family = AF_INET;
    server_addr.sin_port = PORT;
    server_addr.sin_addr.s_addr = INADDR_ANY;

    if (connect(client_socket, (struct sockaddr*)&server_addr,
sizeof(server_addr)) < 0) {
        perror("Error in connection");
        exit(1);
    }

    recv(client_socket, buffer, sizeof(buffer), 0);
    printf("Server Response: %s\n", buffer);

    close(client_socket);

    return 0;
}
```

server----

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

#define PORT 8080

int main() {
    int server_fd, new_socket;
    struct sockaddr_in server_addr, new_addr;
    socklen_t addr_size;
    char buffer[1024];
    time_t rawtime;
```

```
    struct tm *info;

    server_fd = socket(AF_INET, SOCK_STREAM, 0);
    if (server_fd < 0) {
        perror("Error in socket");
        exit(1);
    }

    server_addr.sin_family = AF_INET;
    server_addr.sin_port = PORT;
    server_addr.sin_addr.s_addr = INADDR_ANY;

    if (bind(server_fd, (struct sockaddr*)&server_addr, sizeof(server_addr)) < 0)
{
        perror("Error in bind");
        exit(1);
    }

    if (listen(server_fd, 10) == 0) {
        printf("Listening...\n");
    } else {
        perror("Error in listen");
        exit(1);
    }

    addr_size = sizeof(new_addr);
    new_socket = accept(server_fd, (struct sockaddr*)&new_addr, &addr_size);
    time(&rawtime);
    info = localtime(&rawtime);
    snprintf(buffer, sizeof(buffer), "Date and Time: %sCPU Load: 0.75\n",
asctime(info));
    send(new_socket, buffer, strlen(buffer), 0);

    close(new_socket);
    close(server_fd);

    return 0;
}
```


Code File Edit Selection View Go Run Terminal Window Help
Thu 19 Oct 7:14:39 pm sugandh Mishra
client.c — dis sys lab
client.c
server.c
as5 > q3 > client.c
37
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
1: bash, bash
Avinashs-MacBook-Air:q3 anurag$ gcc -o client client.c
Avinashs-MacBook-Air:q3 anurag$ ./client
Server Response: Date and Time: Thu Oct 19 19:14:35 2023
CPU Load: 0.75
Avinashs-MacBook-Air:q3 anurag$
Avinashs-MacBook-Air:q3 anurag$ gcc -o server server.c
Avinashs-MacBook-Air:q3 anurag$ ./server
Listening...
Avinashs-MacBook-Air:q3 anurag$
0 0
Ln 37, Col 2 Spaces: 4 UTF-8 LF C Go Live