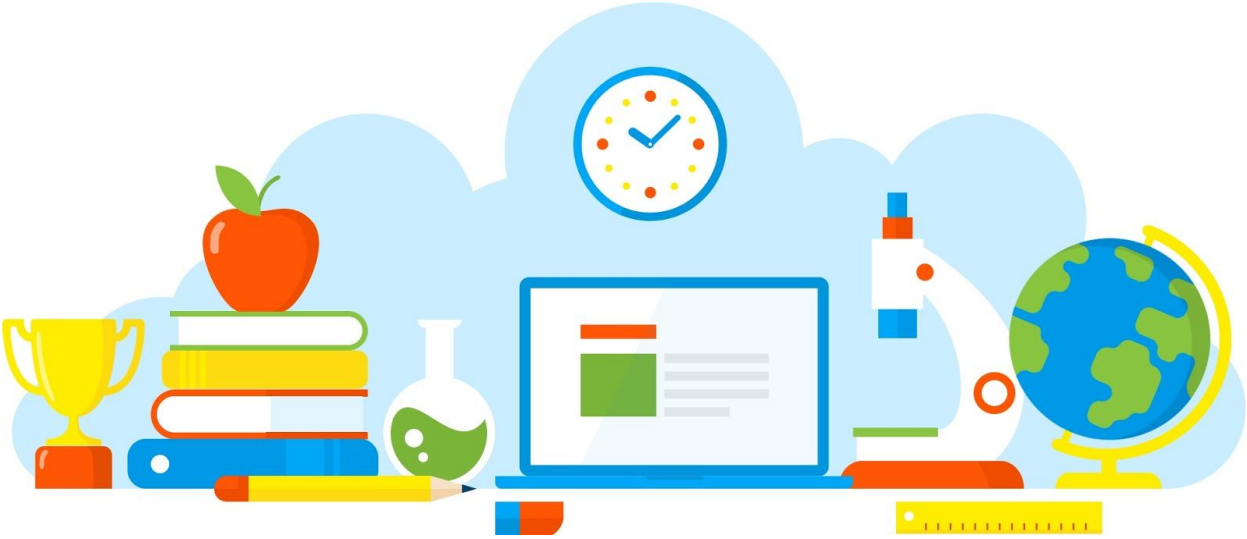

Assignment Report

This report contains work from Assignment 2 of course CSN 361.

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Submission Files - Repository Link

QUESTION 1: Write a socket program in C to connect two nodes on a network to communicate with each other, where one socket listens on a particular port at an IP, while other socket reaches out to the other to form a connection.

SOLUTION: The solution has 2 programs:

Server: Program creates a node which has a socket to listen on the port 8080 (localhost).

`int sockfd = socket(AF_INET, SOCK_STREAM,0)` Socket creation with IPv4 communication domain and TCP communication type.

`setsockopt()` Helper Method in manipulating options for the socket referred by the file descriptor sockfd.

`bind()` method binds the socket to the address and port number specified in addr(custom data structure).

`listen()` method puts the server socket in a passive mode, where it waits for the client to approach the server to make a connection.

`accept()` method extracts the first connection request on the queue of pending connections for the listening socket, sockfd, creates a new connected socket, and returns a new file descriptor referring to that socket.

`sockaddr_in` is a struct for all syscalls and functions that deal with internet addresses.

ServerCode:

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

#define PORT 8080

int main(int argc, char const *argv[]) {
```

```
      int serverfd, newSocket, valRead;
      struct sockaddr_in address;
      int opt = 1;
      int addrlen = sizeof(address);
      char buffer[1024] = {0};
      char *response = "Server responded!"; // Response message from
server

      serverfd = socket(AF_INET, SOCK_STREAM, 0); // File descripter
for socket with IPv4 and TCP.

      if(serverfd == 0) {
            perror("socket failed!");
            exit(EXIT_FAILURE);
      }

      // Attach the socket to port 8080 forcefully
      if(setsockopt(serverfd, SOL_SOCKET, SO_REUSEADDR |
SO_REUSEPORT, &opt, sizeof(opt))) {
            perror("setsockopt");
            exit(EXIT_FAILURE);
      }

      address.sin_family = AF_INET;
      address.sin_addr.s_addr = INADDR_ANY; // For localhost
    address.sin_port = htons(PORT);

    // Bind the socket to localhost 8080
    if (bind(serverfd, (struct sockaddr *)&address,
sizeof(address))<0) {
        perror("bind failed");
        exit(EXIT_FAILURE);
    }

    printf("Server listening...\n");

    if (listen(serverfd, 3) < 0) {    // Wait for client to make
approach. Backlog here is 3 (max size of wait queue).
        perror("listen");
```

```
        exit(EXIT_FAILURE);
    }

    // Extract the first connection from pending queue and establish
connection b/w client and server by creating a new socket.
    if ((newSocket = accept(serverfd, (struct sockaddr *)&address,
(socklen_t*)&addrlen))<0) {
        perror("accept");
        exit(EXIT_FAILURE);
    }

    valRead = read( newSocket , buffer, 1024);
    printf("%s\n",buffer );
    send(newSocket , response , strlen(response) , 0 );
    printf("Response message sent\n");
    return 0;
}
```

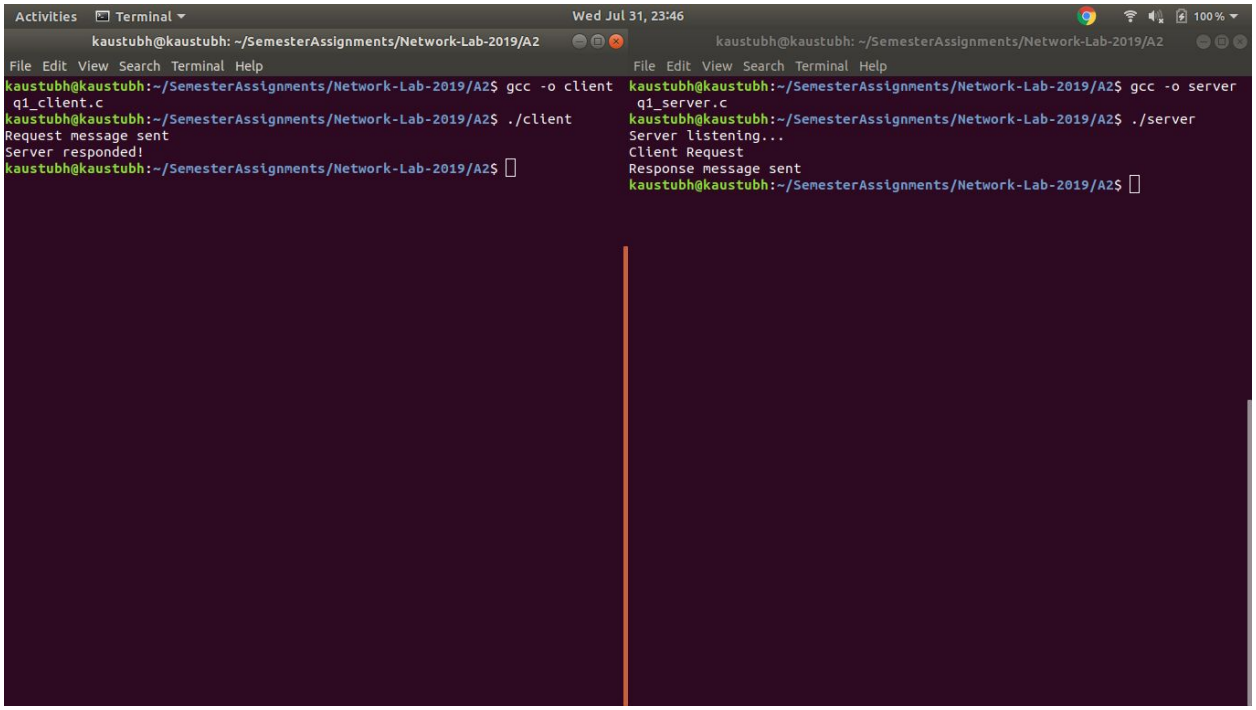
Client: This program creates a node which sends a request on port 8080 to be read by the server program. The `connect()` system call connects the socket referred to by the file descriptor sockfd to the address specified by addr. Server's address and port is specified in addr.

ClientCode:

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

#define PORT 8080

int main(int argc, char const *argv[])
{
    int sock = 0, valread;
```

```
    struct sockaddr_in serv_addr;
    char *request = "Client Request";
    char buffer[1024] = {0};

    if ((sock = socket(AF_INET, SOCK_STREAM, 0)) < 0)
    {
        printf("\n Error in socket creation. \n");
        return -1;
    }

    serv_addr.sin_family = AF_INET;
    serv_addr.sin_port = htons(PORT);

    // Convert IPv4 and IPv6 addresses from text to binary form
    if(inet_pton(AF_INET, "127.0.0.1", &serv_addr.sin_addr)<=0)
    {
        printf("\nInvalid address/ Address not supported \n");
        return -1;
    }

    if (connect(sock, (struct sockaddr *)&serv_addr, sizeof(serv_addr)) <
0)
    {
        printf("\nConnection Failed \n");
        return -1;
    }

    send(sock , request , strlen(request) , 0 );
    printf("Request message sent\n");
    valread = read( sock , buffer, 1024);
    printf("%s\n",buffer );
    return 0;
}
```

SCREENSHOTS:



QUESTION 2: Write a C program to demonstrate both Zombie and Orphan process.
SOLUTION: The following program uses the fork() and sleep() system calls to create a simulation of orphan and zombie processes.

SOLUTION CODE:
Here I create a simulation of a parent and child process for demonstration.

```
#include <stdio.h>
#include <sys/wait.h>
#include <bits/stdc++.h>
#include <unistd.h>

using namespace std;

int main() {

      cout << "Parent's process id: " << getpid() << endl << endl;

      pid_t child_pid = fork();

    if (child_pid > 0) {
      cout << "Parent active..." << endl;
      sleep(4);
      cout << "Parent terminated" << endl;
    }
    else if (child_pid == 0) {
      cout << "Child created with pid "<< getpid() << " from parent pid "
<< getppid() << endl;
      child_pid = fork();
      if(child_pid > 0) {
            sleep(1);
            cout << "Child sleeping..." << endl;
            sleep(2);
            cout << "Child awake again and active!" << endl;
            sleep(2);
                  cout << "Child is now orphan!" << endl << endl;
      }
      else if(child_pid == 0) {
            cout << "Grandchild created with pid "<< getpid() << " from
parent pid " << getppid() << endl << endl;
            sleep(1);
            cout << "Terminating grandchild" << endl;
```

```
            cout << "Grandchild is now zombie" << endl << endl;
        }
    }

    return 0;
}
```

SCREENSHOTS: