Testcase 1: Normal operation of the chat client with three clients connected

```
Received message from 'shubh2':
Received message from 'shubh': hi1

Received message from 'shubh3':
Received message from 'shubh2': hi2

Received message from 'shubh':
Received message from 'shubh3': hi3

Received message from 'shubh2':
Received message from 'shubh':
Received message from 'shubh3':
Received message from 'shubh2':
```

**Server Side**

Three Clients connected one after another and are able to send messages broadcasted at the Server side.

Testcase 2: Server rejects a client with a duplicate username,

```
[[shubkumr7@olympus optimized_chatGPT]$ ./server 127.0.0.1 12345 5
New connection from client.
Server accepted Client shubh
New connection from client.
Duplicate username 'shubh' detected — rejecting connection.
Received message from 'shubh':
Received message from 'shubh':
```

**Server side**

```
[[shubkumr7@olympus optimized_chatGPT]$ ./client shubh 127.0.0.1 12345
Disconnected NAK Message from Server: Username is incorrect
[shubkumr7@olympus optimized_chatGPT]$
```

**Client Side**

A client named shubh is created successfully, another client attempted to join the chat with same username so the request was rejected from Server side.

Testcase 3: Server allows a previously used username to be reused.

```
[[shubkumr7@olympus optimized_chatGPT]$ ./client shubh 127.0.0.1 12345
Disconnected NAK Message from Server: Username is incorrect
[shubkumr7@olympus optimized_chatGPT]$ ./client shubh 127.0.0.1 12345
ACK Message from Server: 1 shubh
Server connection successful
```

**Client Side**

Earlier there is a client connected named shubh, so when another client with same username tried connecting the server it was rejected but when the client shubh got disconnected and

again connection was retried with this username from another client, the connection is successful.

Testcase 4: Server rejects the client because it exceeds the maximum number of clients allowed.

```
[[shubkumr7@olympus optimized_chatGPT]$ ./server 127.0.0.1 12345 3
New connection from client.
Server accepted Client client1
Received message from 'client1':
New connection from client.
Server accepted Client client2
Received message from 'client1':
New connection from client.
Server accepted Client client3
Received message from 'client2':
Received message from 'client1':
Received message from 'client2':
Received message from 'client3':
Received message from 'client1':
Received message from 'client2':
Received message from 'client3':
Received message from 'client1':
Received message from 'client2':
Received message from 'client3':
Received message from 'client1':
Received message from 'client2':
Received message from 'client3':
Received message from 'client1':
New connection from client.
Client count exceeded - rejecting connection.
```

**Server Side**

MAX Clients count =3, So, three clients are connected successfully but when fourth client tried connecting the server , it was rejected from the server.

```
[[shubkumr7@olympus optimized_chatGPT]$ ./client client4 127.0.0.1 12345
Disconnected NAK Message from Server: Client count exceeded request
[shubkumr7@olympus optimized_chatGPT]$ 
```

**Client Side**

Testcase 5: IPv6 address used

```
[[shubkumr7@olympus optimized_chatGPT]$ ./server ::1 12345 10
New connection from client.
Server accepted Client client1
Received message from 'client1': hi

Received message from 'client1':
Received message from 'client1': hi ipv6

Received message from 'client1':
Received message from 'client1':
Received message from 'client1':
New connection from client.
Server accepted Client client2
Received message from 'client1':
Received message from 'client2': Hello on ipv6

Received message from 'client1':
Received message from 'client2':
Received message from 'client1':
Received message from 'client2':
Received message from 'client1':
Received message from 'client2':
Received message from 'client1':
Received message from 'client2':
Received message from 'client1':
New connection from client.
Duplicate username 'client2' detected — rejecting connection.
Received message from 'client2':
Received message from 'client1':
New connection from client.
Server accepted Client client3
Received message from 'client2':
Received message from 'client1':
Received message from 'client3': Hello from client 3 on ipv6

Received message from 'client2':
Received message from 'client1':
Received message from 'client2':
```

IPv6 equivalent of 127.0.0.1 is used for server creation i.e, ::1, three clients are connected successfully. Also when client2 was connected and another client attempted to join using same username , it was rejected.