CS 349: Networks Lab

(January-May 2020)

Assignment – 3: Socket Programming

Submission Deadline: 11:55 pm on Friday, 13th March 2020 (hard deadline)

This assignment is a programming assignment where you need to implement an application using socket programming in C programming language. The assignment will be solved in groups where each group is comprised of 3 members. The group membership information is given in pages 11-13 of this document. The applications' description and requirement specification are given in pages 2-10 of this document.

Instructions:

1. Each group needs to implement one application assigned to it and make one single submission on Moodle. Only one member from a group needs to make the submission. The information about the assignment of applications to groups is contained in **Table 1** given below.
2. The application should be implemented with socket programming in C programming language only. No other programming language other than C will be accepted.
3. Submit the set of source code files of the application as a zipped file on Moodle (maximum file size is 1 MB) by the deadline of **11:55 pm on Friday, 13th March 2020 (hard deadline)**. The **ZIP file's name should be the same as your group number**, for example, "Group_4.zip", or "Group_4.rar", or "Group_4.tar.gz".
4. The assignment will be evaluated through viva voce in your lab during your lab session on **Wednesday, 25th March 2020 (ML-3: 9:00 am to 11:55 am)** where you will need to explain your source codes and execute them before the evaluator (evaluation schedule and TA allocation will be notified in due time).
5. **Write your own source codes and do not copy from any source. Plagiarism detection tool will be used and any detection of unfair means will be penalised by awarding NEGATIVE marks (equal to the maximum marks for the assignment).**
6. **Only one member from each group needs to submit the solution file(s) to moodle**

Reference Text Book:

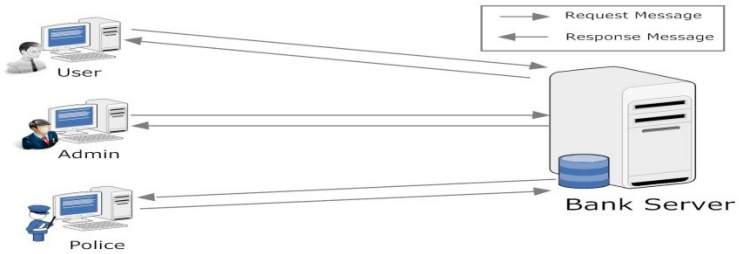
- "*Unix Network Programming*", Volume 1, by W. Richard Stevens (publisher: Prentice Hall) (refer to first few chapters)

Table 1: Allocation of applications to groups

Application ID	Application Name	Group Numbers
1	Banking System	1, 2, 11, 20, 29, 38
2	Trading System	3, 12, 21, 30, 39, 47
3	Base64 Encoding System	4, 13, 22, 31, 40, 48
4	DNS Resolving System	5, 14, 23, 32, 41, 49
5	TCP and UDP Sockets	6, 15, 24, 33, 42
6	Peer-to-Peer System	7, 16, 25, 34, 43
7	Point-of-Sale Terminal	8, 17, 26, 35, 44
8	Error Detection using CRC	9, 18, 27, 36, 45
9	File Transfer Protocol	10, 19, 28, 37, 46

Application ID 1: *Banking System using Client-Server socket programming*

In this application, you require implementing two C programs, namely Client and Bank Server, and they communicate with each other based on TCP sockets. The goal is to implement a simple Banking System.



Initially, the client will connect to the bank server using the server's TCP port already known to the client. After successful connection, the client sends a Login Message (containing the Username and password) to the bank server. The client side, we can have three different types of user modes namely, Bank_Customer, Bank_Admin and Police. The bank server has the following files with him: Login_file (contains the login entries, assume limited number of static entries only), Customer_Account_files (Assume the bank has 10 Bank_Customers only and one file for each customer, which maintains the transaction history. Refer to Login_file and Customer_Account_files formats for more details). Once the Bank server receives the login request, it validates the information and performs the functionalities according to the user mode type. The system must provide the following functionalities to the following users:

- **Bank_Customer:** The customer should able to see AVAILABLE BALANCE in his/her account and MINI STATEMENT of his/her account.
- **Bank_Admin:** The admin should be able to CREDIT/DEBIT the certain amount of money from any Bank_Customer ACCOUNT (as we do it in a SBI single window counter.ᴖ). The admin must update the respective "Customer_Account_file" by appending the new information. Handel the Customer account balance underflow cases carefully.
- **Police:** The police should only be able to see the available balance of all customers. He is allowed to view any Customers MINI STATEMENT by quoting the Customer _ID (i.e. User_ID with user_type as 'C').

Login_file entry format:

User_ID	Password	User_Type (C/A/P)

Customer _Account_files entry format:

Transaction_Date	Transaction Type (Credit/Debit)	Available Account_Balance

Implement the functionalities using proper REQUEST and RESPONSE Message formats. After each negotiation phase, the TCP connection on both sides should be closed gracefully releasing the socket resource. You should accept the IP Address and Port number from the command line (Don't use a hard-coded port number). Prototype for command line is as follows:

Prototypes for Client and Server

Client: <executable code><Server IP Address><Server Port number>
Server: <executable code><Server Port number>

NB: Please make necessary and valid assumptions whenever required.

Application ID 2: *Client Server Trading System using socket programming*

A Client-Server Based Trading System is to be designed with the following specifications. There will be a set of traders who will trade with each other in the automated system. There will be a Server which will register requests from traders for buying and selling quantities of Items. The Server will also match the buy with the sell requests from different traders based on certain price rules (as listed below). Traders will log on to the trading system through the trading client (assume Trader ID and password is stored in a file). They will have the option to view the currently available items (for buy/sell), their quantities and their prices. They will also send requests for buying and selling items and specify the quantity and price. Traders will also have the option to view their matched trades at any time. There are ten known items which the traders can trade in with their codes from 1 to 10. There will be a maximum of 5 traders (with codes from 1 to 5) who can log on to the system and work. One trader should work from one client at a time only.The functionalities of any client will be:

- **Login to the System:** The trader will execute the client, give the trader number and will be logged in. After that he/she will have the following options in a menu. Several clients will login (from different terminals) and assumed they don't trade simultaneously to reduce the complexity.
- **Send Buy Request:** The trader will send a buy request by stating the item code, the quantity and unit price.
- **Send Sell request:** The trader will send a sell request by stating the item code, the quantity and unit price.
- **View Order Status:** The Trader can view the position of buy and sell orders in the system. This will display the current best sell (least price) and the best buy (max price) for each item and their quantities.
- **View Trade Status:** The trader can view his/her matched trades. This will provide the trader with the details of what orders were matched, their quantities, prices and counterparty code.

There will be only one server which will be running and perform the functions of order processing and trade matching in addition to acknowledging logins by clients and servicing their requests. The order processing will be as follows. There will be a buy and a sell order queue for each item. On receiving buy/sell order request from a trader, the server will put it in the appropriate order queue. If there is a possibility of a trade match, then that trade match will take place, the traded items will be appropriately updated and the result of the trade along with the details of the counterparties, item, quantity and price will be stored in the traded set. The matching rule is as follows:

1. On a buy Request at price P and quantity Q of an item I, the server will check if there is any pending sell order for the same item at price P' ≤ P.
2. Among all such pending sell orders, the match will be made with the one having the least selling price.
3. If both have same quantity, i.e., Q'= Q, then both these orders will be removed from their respective queues and the result will be put into the traded set.
4. If Q' > Q then the buy request will be fully traded and the remaining part, i.e., Q' – Q of the sell order will remain in the sell queue at the same price P'.
5. On the other hand, if Q' < Q then the sell order will be fully traded and the remaining buy order will be tested for more matches.
6. If the buy order cannot be matched, it will be put into the buy queue.
7. A similar rule will apply for a sell request and all these requests will be handled in a FCFS basis.

You should accept the IP Address and Port number from the command line (Don't use a hard-coded port number). *Please make necessary and valid assumptions whenever required.

Prototype for command line is as follows:

Prototypes for Client and Server

Client: <executable code><Server IP Address><Server Port number>
Server: <executable code><Server Port number>

Application ID 3: *Base64 encoding system using Client-Server socket programming*

In this application, you require to implement two C programs, namely server and client to communicate with each other based on TCP sockets. The aim is to implement simple Base64 encoding communication protocol.

Initially, server will be waiting for a TCP connection from the client. Then, client will connect to the server using server's TCP port already known to the client. After successful connection, the client accepts the text input from the user and encodes the input using Base64 encoding system. Once encoded message is computed the client sends the Message (Type 1 message) to the server via TCP port. After receiving the Message, server should print the received and original message by decoding the received message, and sends an ACK (Type 2 message) to the client. The client and server should remain in a loop to communicate any number of messages. Once the client wants to close the communication, it should send a Message (Type 3 Message) to the server and the TCP connection on both the server and client should be closed gracefully by releasing the socket resource.

The messages used to communicate contain the following fields:

Message_ Type	**Message**

1. Message_type: integer
2. Message: Character [MSG_LEN], where MSG_LEN is an integer constant
3. <Message> content of the message in Type 3 message can be anything.

You also require implementing a "***Concurrent Server***", i.e., a server that accepts connections from multiple clients and serves all of them *concurrently*.

You should accept the IP Address and Port number from the command line (Don't use a hard-coded port number).

Prototype for command line is as follows:

Prototypes for Client and Server

Client: <executable code><Server IP Address><Server Port number>
Server: <executable code><Server Port number>

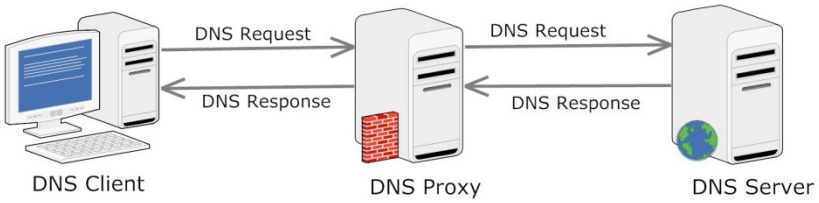
NB: Please make necessary and valid assumptions whenever required.

Base64 Encoding System Description:

Base64 encoding is used for sending a binary message over the net. In this scheme, groups of 24bit are broken into four 6 bit groups and each group is encoded with an ASCII character. For binary values 0 to 25 ASCII character 'A' to 'Z' are used followed by lower case letters and the digits for binary values 26 to 51 & 52 to 61 respectively. Character '+' and '/' are used for binary value 62 & 63 respectively. In case the last group contains only 8 & 16 bits, then "==" & "=" sequence are appended to the end.

Application ID 4: *Multi-stage DNS Resolving System using Client-Server socket programming*

In this application, you require implementing three C programs, namely Client, Proxy Server (which will act both as client and server) and DNS Server, and they communicate with each other based on TCP sockets. The aim is to implement a simple 2 stage DNS Resolver System.



Initially, the client will connect to the proxy server using the server's TCP port already known to the client. After successful connection, the client sends a Request Message (Type 1/Type 2) to the proxy server. The proxy server has a limited cache (assume a cache with three IP to Domain_Name mapping entries only). After receiving the Request Message, proxy server based on the Request Type (Type 1/Type 2) searches its cache for corresponding match. If match is successful, it will send the response to the client using a Response Message. Otherwise, the proxy server will connect to the DNS Server using a TCP port already known to the Proxy server and send a Request Message (same as the client). The DNS server has a database (say .txt file) with it containing set of Domain_name to IP_Address mappings. Once the DNS Server receives the Request Message from proxy server, it searches in its file for possible match and sends a Response Message (Type 3/Type 4) to the proxy server. On receiving the Response Message from DNS Server, the proxy server forwards the response back to the client. If the Response Message type is 3, then the proxy server must update its cache with the fresh information using FIFO scheme. After each negotiation phase, the TCP connection on both sides should be closed gracefully releasing the socket resource.

Request Message Format:

Request_Type	Message

- Type 1: Message field contains Domain Name and requests for corresponding IP address.
- Type 2: Message field contains IP address and request for the corresponding Domain Name.

Response Message Format:

Response_Type	Message

- Type 3: Message field contains Domain Name/IP address.
- Type 4: Message field contains error message "entry not found in the database".

You should accept the IP Address and Port number from the command line (Don't use a hard-coded port number).

Prototype for command line is as follows:

Prototypes for Client and Server

Client: <executable code><Server IP Address><Server Port number>
Server: <executable code><Server Port number>

NB: Please make necessary and valid assumptions whenever required.

Application ID 5: *Client-Server programming using both TCP and UDP sockets*

In this application, you require to implement two C programs, namely server and client to communicate with each other based on both TCP and UDP sockets. The aim is to implement a simple 2 stage communication protocol.

Initially, server will be waiting for a TCP connection from the client. Then, client will connect to the server using server's TCP port already known to the client. After successful connection, the client sends a Request Message (Type 1 message) to the server via TCP port to request a UDP port from server for future communication. After receiving the Request Message, server selects a UDP port number and sends this port number back to the client as a Response Message (Type 2 Message) over the TCP connection. After this negotiation phase, the TCP connection on both the server and client should be closed gracefully releasing the socket resource.

In the second phase, the client transmits a short Data Message (Type 3 message) over the earlier negotiated UDP port. The server will display the received Data Message and sends a Data Response (type 4 message) to indicate the successful reception. After this data transfer phase, both sides close their UDP sockets.

The messages used to communicate contain the following fields:

Message_Type	**Message_Length**	**Message**

1. Message_type: integer
2. Message_length: integer
3. Message: Character [MSG_LEN], where MSG_LEN is an integer constant

<Data Message> in **Client** will be a **Type 3** message with some content in its message section.

You also require implementing a "***Concurrent Server***", i.e., a server that accepts connections from multiple clients and serves all of them *concurrently*.

You should accept the IP Address and Port number from the command line (Don't use a hard-coded port number).

Prototype for command line is as follows:

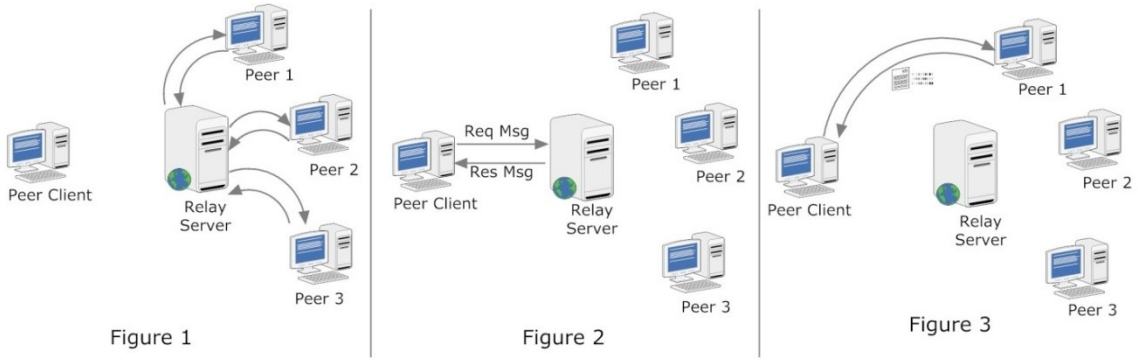
Prototypes for Client and Server

Client: <executable code><Server IP Address><Server Port number>
Server: <executable code><Server Port number>

NB: Please make necessary and valid assumptions whenever required.

Application ID 6: *Relay based Peer-to-Peer System using Client-Server socket programming*

In this application, you require implementing three C programs, namely Peer_Client, and Relay_Server and Peer_Nodes, and they communicate with each other based on TCP sockets. The aim is to implement a simple Relay based Peer-to-Peer System.



Initially, the Peer_Nodes (peer 1/2/3 as shown in Figure 1) will connect to the Relay_Server using the TCP port already known to them. After successful connection, all the Peer_Nodes provide their information (IP address and PORT) to the Relay_Server and close the connections (as shown in Figure 1). The Relay_Server actively maintains all the received information with it. Now the Peer_Nodes will act as servers and wait to accept connection from Peer_Clients (refer phase three).

In second phase, the Peer_Client will connect to the Relay_Server using the server's TCP port already known to it. After successful connection; it will request the Relay_Server for active Peer_Nodes information (as shown in Figure 2). The Relay_Server will response to the Peer_Client with the active Peer_Nodes information currently having with it. On receiving the response message from the Relay_Server, the Peer_Client closes the connection gracefully.

In third phase, a set of files (say, *.txt) are distributed evenly among the three Peer_Nodes. The Peer_Client will take "file_Name" as an input from the user. Then it connects to the Peer_Nodes one at a time using the response information. After successful connection, the Peer_Client tries to fetches the file from the Peer_Node. If the file is present with the Peer_Node, it will provide the file content to the Peer_Client and the Peer_Client will print the file content in its terminal. If not, Peer_Client will connect the next Peer_Node and performs the above action. This will continue till the Peer_Client gets the file content or all the entries in the Relay_Server Response are exhausted (Assume only three/four Peer_Nodes in the system).

Implement the functionalities using appropriate REQUEST and RESPONSE Message formats. After each negotiation phase, the TCP connection on both sides should be closed gracefully releasing the socket resource. You should accept the IP Address and Port number from the command line (Don't use a hard-coded port number).

Prototype for command line is as follows:

Prototypes for Client and Server

Client: <executable code><Server IP Address><Server Port number>
Server: <executable code><Server Port number>

NB: Please make necessary and valid assumptions whenever required.

Application ID 7: *Point-of-Sale Terminal using socket programming*

Use socket programming to implement a simple client and server that communicate over the network and implement a simple application involving Cash Registers. The client implements a simple cash register that opens a session with the server and then supplies a sequence of codes (refer ***request-response messages format***) for some products. The server returns the price of each one, if the product is available, and also keeps a running total of purchases for each client's transactions. When the client closes the session, the server returns the total cost. This is how the point-of-sale terminals should work. You can use a TXT file as a database to store the UPC code and item description at the server end.

You also require implementing a "***Concurrent Server***", i.e., a server that accepts connections from multiple clients and serves all of them *concurrently*.

Request-response messages format

Request_ Type	**UPC-Code**	**Number**

Where

- ***Request_Type*** is either 0 for ***item*** or 1 for ***close***.
- ***UPC-code*** is a 3-digit unique product code; this field is meaningful only if the ***Request_Type*** is 0.
- ***Number*** is the number of items being purchased; this field is meaningful only if the ***Request_Type*** is 0.

For the ***Close*** command, the server returns a number, which is the total cost of all the transactions done by the client. For the ***item*** command, the server returns:

Response_ Type	**Response**

Where:

- <Response_type> is 0 for ***OK*** and 1 for ***error***
- If ***OK***, then <Response> is as follows:
  - if client command was "close", then <response> contains the total amount.
  - if client command was "item", then <response> is of the form <price><name>
    where
    <price> is the price of the requested item
    <name> is the name of the requested item
- If ***error***, then <Response> is as follows: a null terminated string containing the error; the only possible errors are "***Protocol Error***" or "***UPC is not found in database***".

You should accept the IP Address and Port number from the command line (Don't use a hard-coded port number).

Prototype for command line is as follows:

Prototypes for Client and Server

Client: <executable code><Server IP Address><Server Port number>
Server: <executable code><Server Port number>

The connection to the server should be gracefully terminated. When the server is terminated by pressing ***Control+C***, the server should also gracefully release the open socket (Hint: requires use of a signal handler).

NB: Please make necessary and valid assumptions whenever required.

Application ID 8: *Error Detection using Cyclic Redundancy Code (Using CRC-8)*

In this application, your aim will be to implement a simple Stop-and-Wait based data link layer level logical channel between two nodes **A** and **B** using socket API, where node **A** and node **B** are the client and the server for the socket interface respectively. Data link layer protocol should provide the following Error handling technique in Data Link Layer.

- Error Detection using Cyclic Redundancy Code
(using CRC-8 as generator polynomial, i.e. $\mathbf{G(x) = x^8+x^2+x+1}$)

Operation to Implement:

- Client should construct the message to be transmitted (T(x)) from the raw message using CRC.
- At the sender side T(x) is completely divisible by G(x) (means no error), send ACK to the sender, otherwise (means error), send NACK to the sender.
- You must write error generating codes based on a user given BER or probability (random number between 0 and 1) to insert error into both T(x)and ACK/NACK.
- If NACK is received by the sender, it should retransmit the T(x) again following the above steps.
- In the client side also implement Timer Mechanism to detect the timeout (in case of error in ACK/ NACK) and retransmit the message T(x) again once time out happens.

You also require implementing a "***Concurrent Server***", i.e., a server that accepts connections from multiple clients and serves all of them *concurrently*.

You should accept the IP Address and Port number from the command line (Don't use a hard-coded port number).

Prototype for command line is as follows:

Prototypes for Client and Server

Client: <executable code><Server IP Address><Server Port number>
Server: <executable code><Server Port number>

The connection to the server should be gracefully terminated. When the server is terminated by pressing ***Control+C***, the server should also gracefully release the open socket (Hint: requires use of a signal handler).

NB: Please make necessary and valid assumptions whenever required.

Application ID 9: *File Transfer Protocol (FTP) using Client-Server socket programming*

In this assignment, you require to implement two C programs, namely server and client to communicate with each other based on TCP sockets. The goal is to implement a simple File Transfer Protocol (FTP). Initially, server will be waiting for a TCP connection from the client. Then, client will connect to the server using server's TCP port already known to the client. After successful connection, the client should be able to perform the following functionalities:

- **PUT:** Client should transfer the file specified by the user to the server. On receiving the file, server stores the file in its disk. If the file is already exists in the server disk, it communicates with the client to inform it. The client should ask the user whether to overwrite the file or not and based on the user choice the server should perform the needful action.
- **GET:** Client should fetch the file specified by the user from the server. On receiving the file, client stores the file in its disk. If the file is already exists in the client disk, it should ask the user whether to overwrite the file or not and based on the user choice require to perform the needful action.
- **MPUT and MGET:** MPUT and MGET are quite similar to PUT and GET respectively except they are used to fetch all the files with a particular extension (e.g. .c, .txt, etc.). To perform these functions both the client and server require to maintain the list of files they have in their disk. Also implement the file overwriting case for these two commands as well.

Use appropriate message types to implement the aforesaid functionalities. For simplicity assume only .txt and .c file(s) for transfer.

You should accept the IP Address and Port number from the command line (Don't use a hard-coded port number).

Prototype for command line is as follows:

Prototypes for Client and Server

Client: <executable code><Server IP Address><Server Port number>
Server: <executable code><Server Port number>

NB: Please make necessary and valid assumptions whenever required.

Please find the Group ID and assigned Application ID for the formed groups in the below table starting from next page:

Group ID	Roll	Name	Application ID Assigned
1	150123034	ROHIT KUMAR	1
1	170123014	BARISH BHAGAT	1
1	170123026	KONDRU SURAJ	1
1	170123006	ANKIT TRIPATHI	1
2	170101055	ROHAN NIGAM	1
2	170123036	MOHIT DHAKA	1
2	170123037	MOHIT KUMAR MEENA	1
3	170101005	AMAN MISHRA	2
3	170101031	KEERTI HARPAVAT	2
3	170101049	Priyanshu Singh	2
4	170101081	UDBHAV CHUGH	3
4	170123013	BAGAL SATEJ BABANRAO	3
4	170123052	TANYA CHAUHAN	3
5	170123015	BOJJA SAI PREETHAM	4
5	170123024	KESHETTI SAI KUMAR	4
5	170123031	MALISETTI KIRAN KARTHEEK	4
6	170101036	MANI MANNAMPALLI	5
6	170101068	SUNNY KUMAR	5
6	170101087	SIDDHARTH AGARWAL	5
7	170101084	MAYANK BARANWAL	6
7	170123017	DEV PRIYA GOEL	6
7	170123059	SHRUTI DINESH AGARWAL	6
8	170101035	MANAN GUPTA	7
8	170123011	ASHISH AGARWAL	7
8	170123038	MRIGANKA BASU ROY CHOWDHURY	7
9	170101043	PARTHA PRATIM MALAKAR	8
9	170101048	PRANSHU SRIVAS	8
9	170101070	THAHIR MAHMOOD POOVADA	8
10	170101039	NAGULAPALLI KASI VENKATA SAI KIRAN	9
10	170101051	RAJANALA HARSHAVARDHAN REDDY	9
10	170123016	CHINDAM SUJANA MAITHILI	9
11	170101029	KAPIL JANGID	1
11	170101044	PARVINDAR SINGH	1
11	170101057	RUTVIK GHUGHAL	1
12	170101077	VEMURI SAHITHYA	2
12	170123039	NAKKA LAHARI	2
12	170123054	TUMARADA ADITYA	2
13	170101054	RISHI PATHAK	3
13	170101063	SHIVAM BANSAL	3
13	170101088	SHASHANK SHARMA	3
14	170101040	NAKKA SRIHARSHA	4
14	170123025	KOMMINENI NIKHIL	4
14	170123028	KRISHNA PRIYATAM D	4
15	170101001	AAYUSH PATNI	5
15	170101052	RASHI SINGH	5
15	170101066	SOUMIK PAUL	5
16	170101033	LUCKY	6
16	170101034	MAKHARIA AAYUSH	6
16	170123021	HEMANT YADAV	6

Group ID	Roll	Name	Application ID Assigned
17	170123004	ADITYA RAJ	7
17	170123040	PARV SOOD	7
17	170123043	SAHILPREET SINGH THIND	7
18	160101011	AKHIL CHANDRA PANCHUMARTHI	8
18	170101017	CH ROHITH RAVI PRABHU TEJA	8
18	170101050	PULIKONDA ROOP SAI RAKESH GUPTA	8
19	170101006	AMAN RAJ	9
19	170123029	KUSHAGRA MAHAJAN	9
19	170123034	MIHIR YADAV	9
20	170101074	UMANG	1
20	170123051	TANVI OHRI	1
20	170123053	TEJASVEE PANWAR	1
21	170101078	VINEET MALIK	2
21	170101080	VIVEK KUMAR	2
21	170101085	Sparsh Sinha	2
22	170101019	CHIRAG GUPTA	3
22	170101076	VAKUL GUPTA	3
22	170101082	LAVISH GULATI	3
23	170101026	HARDIK KATYAL	4
23	170101030	KARTIK GUPTA	4
23	170101075	UTKARSH JAIN	4
24	170123023	KEDAR NATH	5
24	170123056	PRATHIK.S.NAYAK	5
24	170123064	AGNIV BANDYOPADHYAY	5
25	170101060	SANCHIT	6
25	170123018	GARVIT MEHTA	6
25	170123020	harit gupta	6
26	170101002	ABHISHEK JAISWAL	7
26	170101038	MAYANK WADHWANI	7
26	170123007	ANKUR PRAMOD INGALE	7
27	170101067	SOURABH JANGID	8
27	170101071	THEEGALA RAKESH REDDY	8
27	170101073	TUSHAR RAJENDRA BHUTADA	8
28	170101009	ANUBHAV TYAGI	9
28	170101045	Piyush Gupta	9
28	170101053	RAVI SHANKAR	9
29	160101017	AUTONU KRO	1
29	170101023	FUGARE ASHISH DILEEP	1
29	170101027	KADAM KIRAN ZATINGRAO	1
30	170101011	ARANYA ARYAMAN	2
30	170101015	AVNEET SINGH CHANNA	2
30	170101041	NAVEEN KUMAR GUPTA	2
31	170101059	Sachin Giri	3
31	170101061	SAYAK DUTTA	3
31	170123010	ARYAN RAJ	3
32	170101013	ARYAN AGRAWAL	4
32	170101014	AVIRAL GUPTA	4
32	170101022	DEVANSH GUPTA	4

Group ID	Roll	Name	Application ID Assigned
33	170101064	SHUBHAM KUMAR	5
33	170101065	SHYAM SUNDAR RAV	5
33	170101079	VINIT KUMAR	5
34	170101037	MAYANK CHANDRA	6
34	170101046	PRABHAT KUMAR	6
34	170123050	SUMEDH RAVI JOURAS	6
35	170123001	AAYUSH BANSAL	7
35	170123057	KARTIK SETHI	7
35	170123058	ARUN KUMAR	7
36	170101008	ANNANYA PRATAP SINGH CHAUHAN	8
36	170101012	ARPIT GUPTA	8
36	170101086	SHIVANG DALAL	8
37	170123027	KOTTA PREM SUJAN	9
37	170123035	MOGILLAPALLI NIKHIL	9
37	170123042	S SAI VAMSHI	9
38	170101007	ANIKET RAJPUT	1
38	170101020	DEEPAK GAMI	1
38	170101047	PRANAY GARG	1
39	170101056	ROUNAK PARIHAR	2
39	170101058	RYTHUM SINGLA	2
39	170101083	UTKARSH SANTOSH MISHRA	2
40	170123060	TRIKAY NALAMADA	3
40	170123061	MAHFOOZUR RAHMAN KHAN	3
40	170123062	DIVYANSH MANGAL	3
41	170123003	ABHINAV R	4
41	170123008	ARAV GARG	4
41	170123063	JOEL RAJA SINGH	4
42	170101021	DEVAISHI TIWARI	5
42	170123048	SIDDHANT SINHA	5
42	170123022	JAYANT PATIDAR	5
43	170123012	AYUSH DALIA	6
43	170123033	MAYANK SAHARAN	6
43	170123044	SAKSHI SHARMA	6
44	170123002	ABHINAV ANAND	7
44	170123041	RUPAM SAHU	7
44	170123045	SAURABH KUMAR	7
45	170123019	GARVIT SARJARE	8
45	170123032	MANNE HEMA PRIYA	8
45	170123046	SHALINI KUMARI	8
46	170101004	AJINKYA SHIVASHANKAR SHIVASHANKAR	9
46	170101025	HANSRAJ PATEL	9
46	170101003	ADITYA VARDHAN GARA	9
47	170101016	BANDAGONDA SHRI RAAM REDDY	2
47	170101018	CHALUMURU BHAVANI DATT	2
47	170101024	GEDDAM IKYA VENUS	2
48	170101028	KANCHUGANTLA RHYTHM	3
48	170101032	KETHAVATH NAVEEN	3
48	170101042	NAYANJYOTI DEURY	3
49	170101062	SAYALKUMAR SUBHASH HAJARE	4
49	170101072	TIKARAM MEENA	4
49	170123005	ANKIT KUMAR KANOJIYA	4