# Instructions To RUN The Code

1. First open the VSCODE in the OS Project Folder and open terminal here.
2. Type the following command

```
>gcc data.c
>./a.out
```

3. Then open 2 terminals beside each other one for server and other for client.
Terminal 1:

```
>gcc -o server server.c products.c
>./server
```

Terminal 2:

```
>gcc -o client client.c
>./client
```

4. Client will show option for Login or Register. Choose by entering 1 or 2.
If you choose 2 (Register) then it asks for password , enter password and enter. It then asks for permissions like user or admin. Enter 0 or 1 accordingly. It generates userID for it.

Use this userID and password for logging in.

You can use the following hardcoded users:

admin : userID : 1000 , password : 1

user : userID : 1001 , password : 123

user : userID : 1002 , password : 123

5. Logging in as admin will give you admin functions and logging in as user will give you user functions

# Approach :

The project contains following files:
    server.c : Contains the server part of the code
    client.c : Contains the client part of the code
    products.c : Contains the product functions which server calls
    data.c : Contains the initial login data and empty cart
    server_file.h : headers for server
    client_file.h : headers for client
    products.h : headers for products
    receipt : This contains the user receipt
    adminReceipt.txt : This contains the log file when admin exits
    products : This is the file which contain products data
    userDetails : This is the file which contains userDetails

Products data is written into products file which stores data of product structure
Cart of each user is written into customer file where each cart struct contains an array of products of particular user.
userDetails contains user login information stored as user struct

User Usecases:
    1. Display all the products : shows all the products in inventory with it's P_ID P_name P_Cost and P_quantity
    2. Add a product to cart
    3. Display the Cart
    4. Edit the cart : This gives the option to change the product quantity , if quantity is updated to -1 , then the item is removed from cart
    5. Proceed with Payment : This lets user to purchase the items in the cart , the user is shown all the products in the cart with total cost and asked to pay , if he enters amount greater than total cost the transaction is succesful and the quantity decreases in the products data
    6. Exit : This quits the client program

Admin Usecases:
    1. Add a product
    2. Display all the products
    3. Delete a product
    4. Update a product : This allows to change the price and quantity of the product , if quantity entered is -1 then product is removed from the products data
    5. Exit

# OS concepts Used

1. OS syscalls and flags:

    open() , read()

    O_TRUNC Flag used while opening receipt to clear the log file.

2. Socket Programming :

    Used socket programming to establish connection between server and client and each of them can

    read and write to socket , so that they can communicate with each other

    Used fork() syscall to create concurrent server so that multiple clients can connect to server.

3. File Locking

    1. When admin is updating or deleting some product , it record locks that product in products file hold

    write lock on them.

    2. When user enters payment gateway , it record locks all the product in the cart holding write lock on
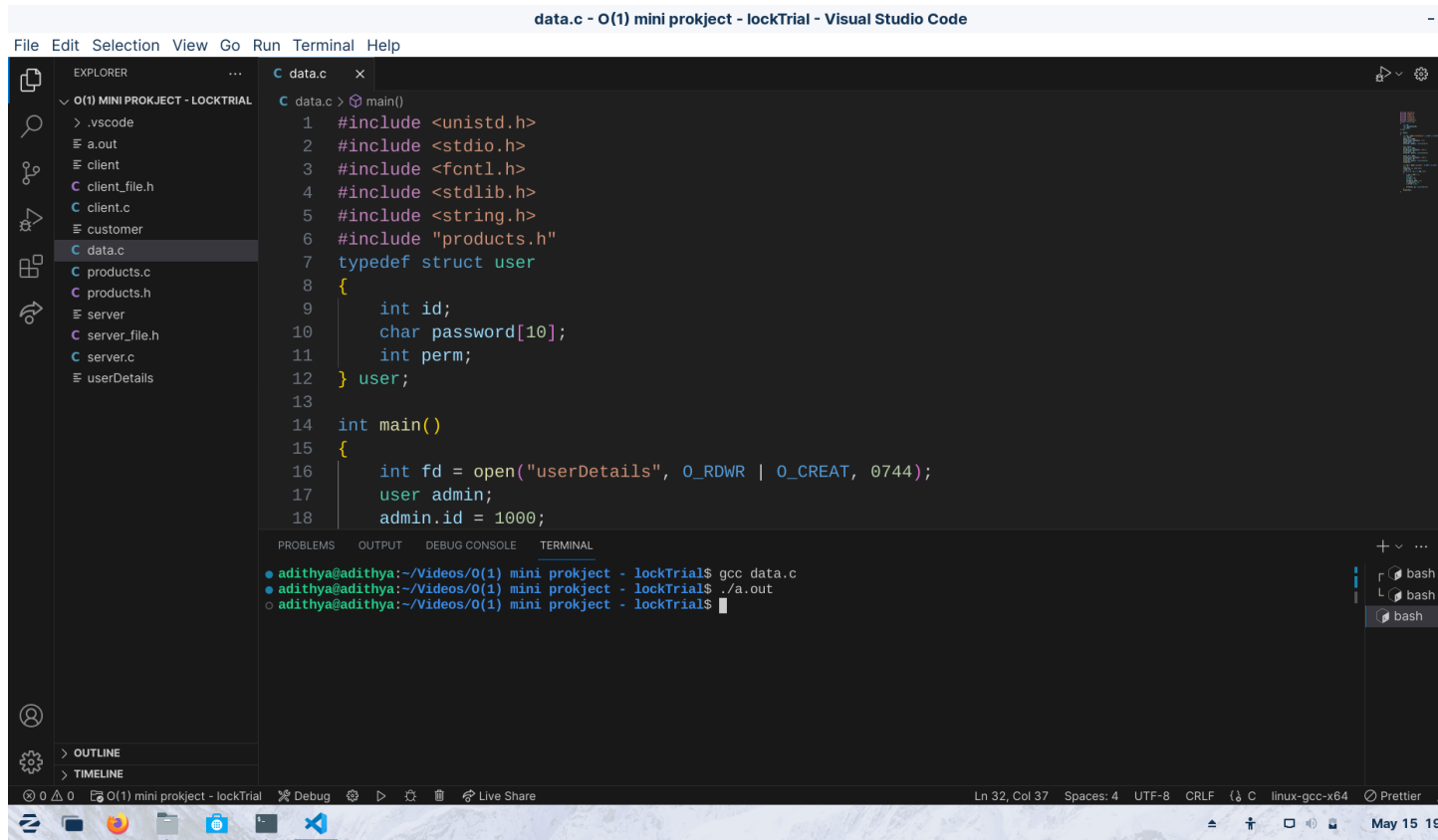
    them.

    3. While displaying products in inventory we hold manditory read lock on the whole file.

    4. While display products in cart we hold record read lock on the products in the cart.

# 1 Final Overview

This is how the code works , first client menu pops up and the client takes necessary input and sends the info to server side . Then the server calls the functions of products.c based on the choice passed to server. The server in the end takes the result of the products.c functions is passed back to client.

# Screenshots:



```c
#include <unistd.h>
#include <stdio.h>
#include <fcntl.h>
#include <stdlib.h>
#include <string.h>
#include "products.h"
typedef struct user
{
    int id;
    char password[10];
    int perm;
} user;

int main()
{
    int fd = open("userDetails", O_RDWR | O_CREAT, 0744);
    user admin;
    admin.id = 1000;
```

```
adithya@adithya:~/Videos/O(1) mini prokject - lockTrial$ gcc data.c
adithya@adithya:~/Videos/O(1) mini prokject - lockTrial$ ./a.out
adithya@adithya:~/Videos/O(1) mini prokject - lockTrial$
```

File Edit Selection View Go Run Terminal Help

EXPLORER

O(1) MINI PROKJECT - LOCKTRIAL
- .vscode
- a.out
- client
- client_file.h
- client.c
- customer
- data.c
- products
- products.c
- products.h
- server
- server_file.h
- server.c
- userDetails

C data.c    C client.c    C server.c

C data.c > ⊙ main()

```
27          write(fd, &user1, sizeof(user));
28
29          user1.id = 1002;
30          strcpy(user1.password, "123");
31          user1.perm = 0;
```

PROBLEMS    OUTPUT    DEBUG CONSOLE    TERMINAL

```
adithya@adithya:~/Videos/O(1) mini prokje
ct - lockTrial$ gcc -o server server.c pr
oducts.c
adithya@adithya:~/Videos/O(1) mini prokje
ct - lockTrial$ ./server
```

```
Choose one of the following
1. Login
2. Register
1
Enter the userid
1000
Enter the password
1
You are logged in as ADMIN
Choose one of the following
1. Add a product
2. Display the products
3. Delete a product
4. Update a product
5. Exit
2
ProductID      ProductName      Quantity      Price

Choose one of the following
1. Add a product
2. Display the products
3. Delete a product
4. Update a product
5. Exit
```

./server
./client
bash

Ln 32, Col 37    Spaces: 4    UTF-8    CRLF    {} C    linux-gcc-x64    Prettier

May 15 20:05

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File Edit Selection View Go Run Terminal Help

EXPLORER

O(1) MINI PROKJECT - LOCKTRIAL
- .vscode
- a.out
- client
- client_file.h
- client.c
- customer
- data.c
- products
- products.c
- products.h
- server
- server_file.h
- server.c
- userDetails

C data.c    C client.c    C server.c

C data.c > ⊙ main()

```
27   |        write(fd, &user1, sizeof(user));
```

PROBLEMS    OUTPUT    DEBUG CONSOLE    TERMINAL

```
adithya@adithya:~/Videos/O(1) mini prokject - lockTrial$ gcc -o ser
ver server.c products.c
adithya@adithya:~/Videos/O(1) mini prokject - lockTrial$ ./server
```

```
adithya@adithya:~/Videos/O(1) mini prokject - lockTrial$ gcc -o cl
ient client.c
adithya@adithya:~/Videos/O(1) mini prokject - lockTrial$ ./client
Choose one of the following
1. Login
2. Register
2
Enter the password
123
Please choose access permissions
Enter 1 for admin, 0 for user
0
User added succesfully
Your user id is 1003
Choose one of the following
1. Login
2. Register
1
Enter the userid
1003
Enter the password
123
Successfully logged in
Choose one of the following
1. Display all the products
2. Add a product to cart
3. Display the Cart
4. Edit the cart
5. Proceed with Payment
6. Exit
1
ProductID      ProductName      Quantity      Price

Choose one of the following
1. Display all the products
2. Add a product to cart
3. Display the Cart
4. Edit the cart
5. Proceed with Payment
6. Exit
```
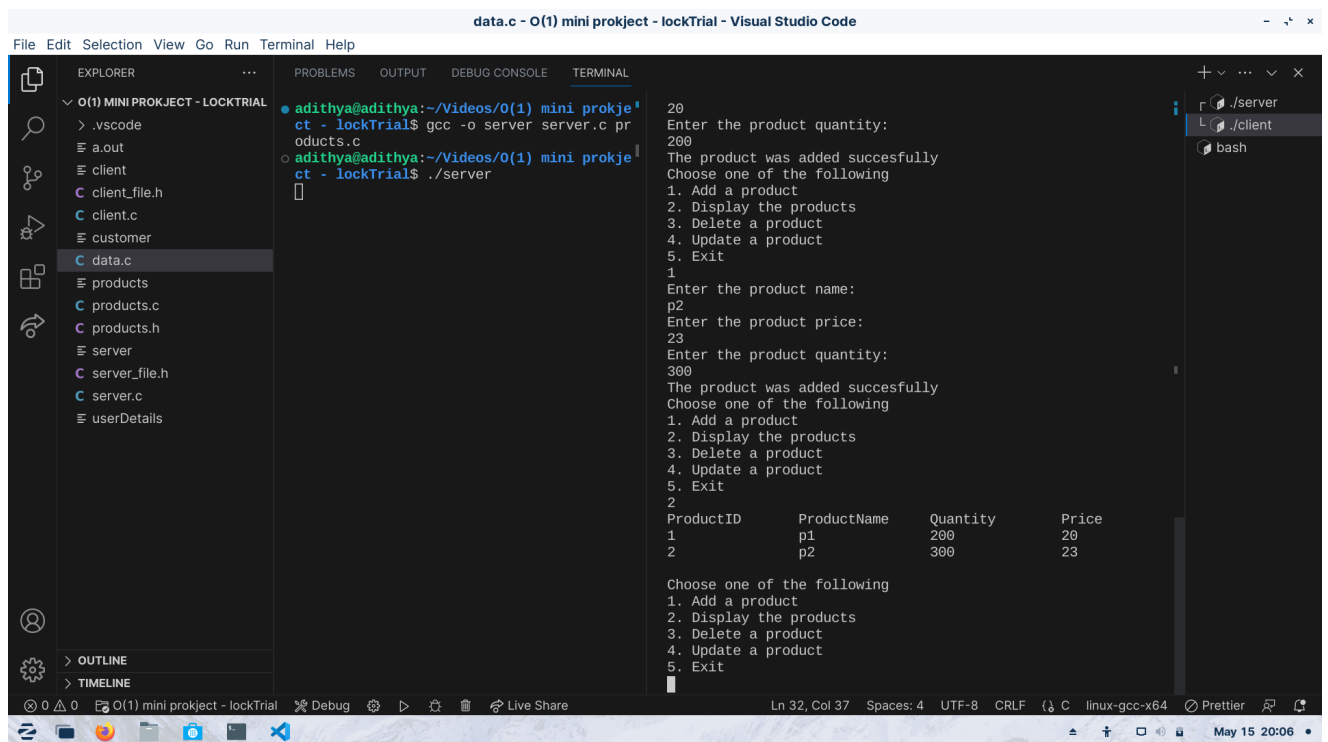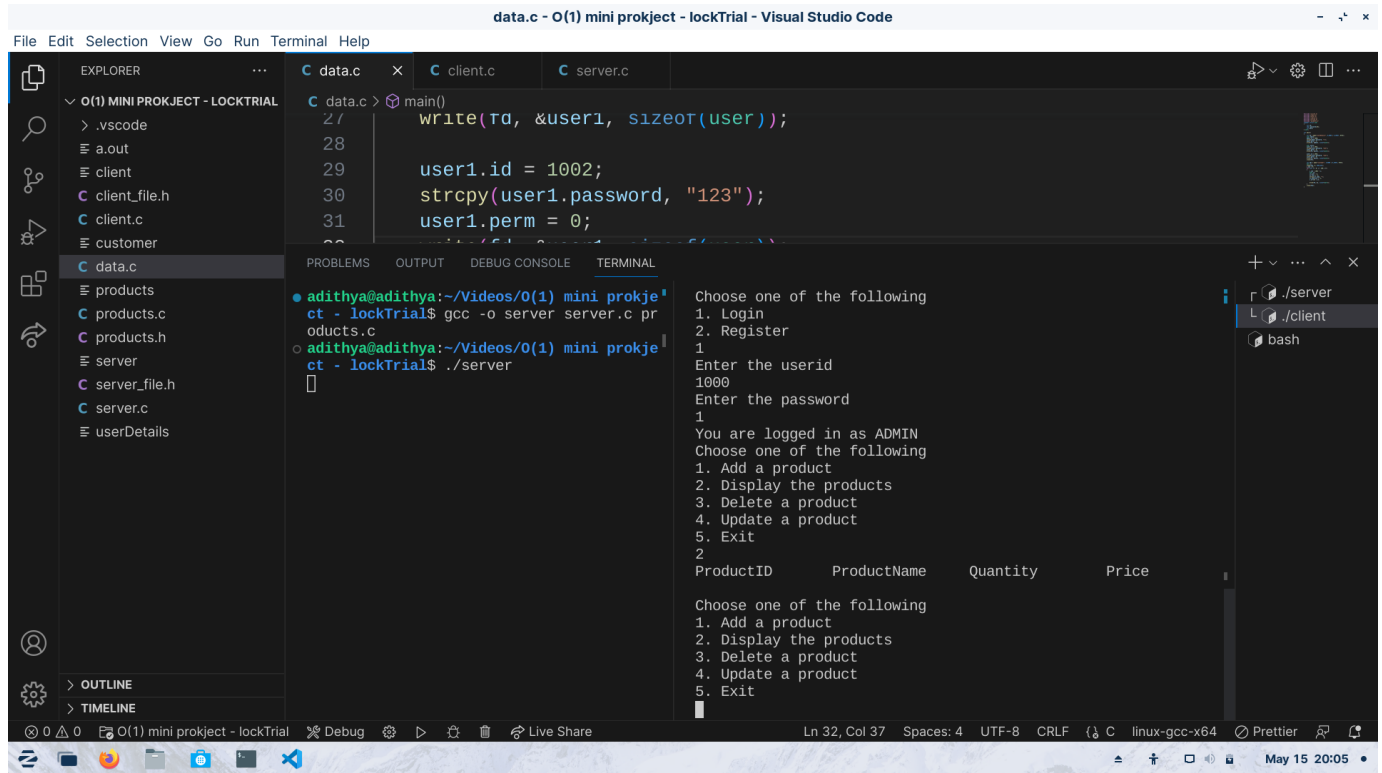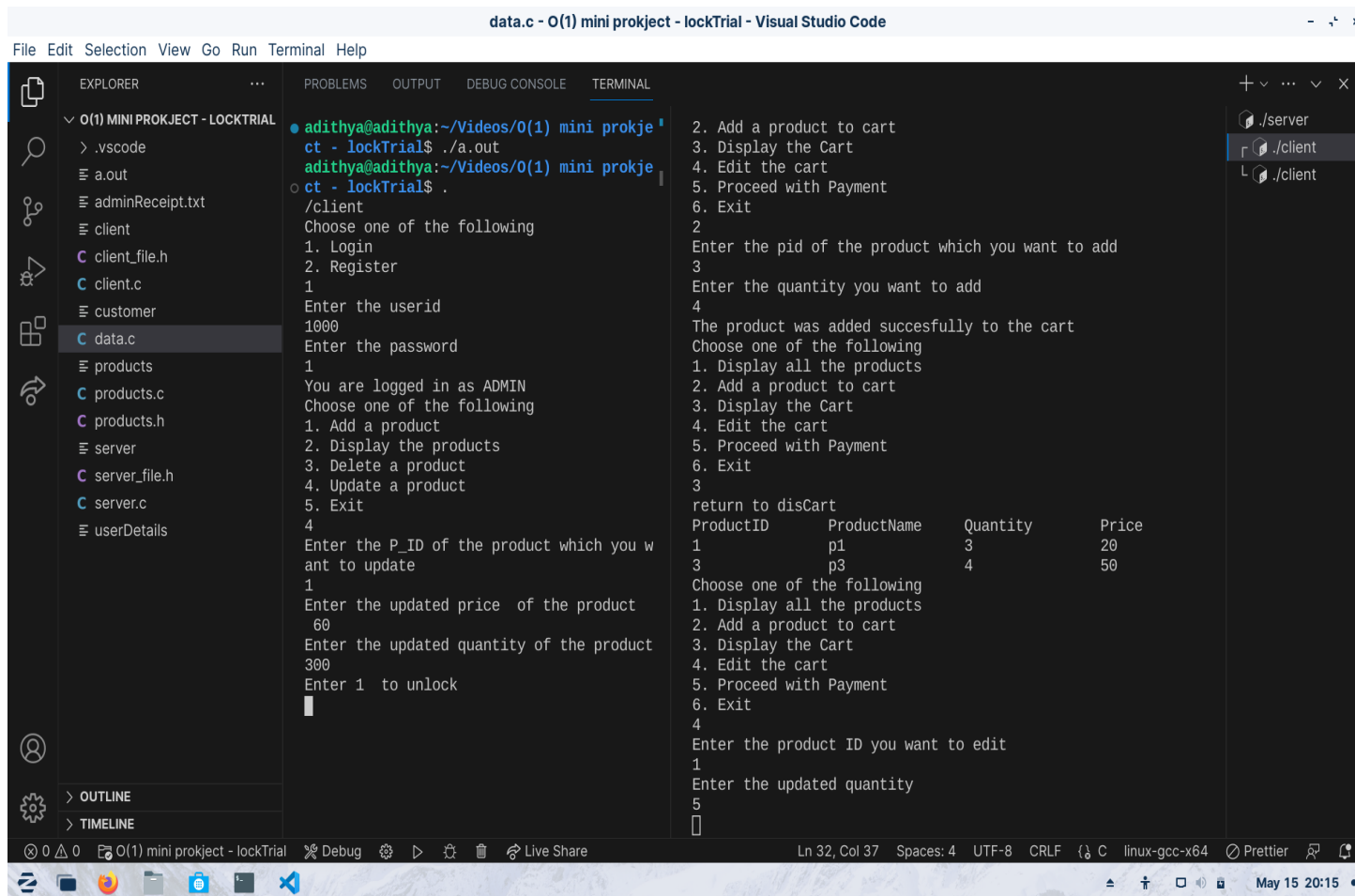
./server
./client
bash

Ln 32, Col 37    Spaces: 4    UTF-8    CRLF    {} C    linux-gcc-x64    Prettier

May 15 20:02

File  Edit  Selection  View  Go  Run  Terminal  Help

EXPLORER

O(1) MINI PROKJECT - LOCKTRIAL
- .vscode
- a.out
- client
- client_file.h
- client.c
- customer
- data.c
- products
- products.c
- products.h
- server
- server_file.h
- server.c
- userDetails

data.c > main()

```
27        write(fd, &user1, sizeof(user));
28
29        user1.id = 1002;
30        strcpy(user1.password, "123");
31        user1.perm = 0;
```

PROBLEMS   OUTPUT   DEBUG CONSOLE   TERMINAL

```
adithya@adithya:~/Videos/O(1) mini prokje
ct - lockTrial$ gcc -o server server.c pr
oducts.c
adithya@adithya:~/Videos/O(1) mini prokje
ct - lockTrial$ ./server
```

```
Choose one of the following
1. Login
2. Register
1
Enter the userid
1000
Enter the password
1
You are logged in as ADMIN
Choose one of the following
1. Add a product
2. Display the products
3. Delete a product
4. Update a product
5. Exit
2
ProductID       ProductName       Quantity       Price

Choose one of the following
1. Add a product
2. Display the products
3. Delete a product
4. Update a product
5. Exit
```

./server
./client
bash

OUTLINE
TIMELINE

⊗ 0 ⚠ 0   O(1) mini prokject - lockTrial   Debug      Live Share      Ln 32, Col 37   Spaces: 4   UTF-8   CRLF   C   linux-gcc-x64   Prettier

May 15 20:05

---

File  Edit  Selection  View  Go  Run  Terminal  Help

EXPLORER

O(1) MINI PROKJECT - LOCKTRIAL
- .vscode
- a.out
- client
- client_file.h
- client.c
- customer
- data.c
- products
- products.c
- products.h
- server
- server_file.h
- server.c
- userDetails

PROBLEMS   OUTPUT   DEBUG CONSOLE   TERMINAL

```
adithya@adithya:~/Videos/O(1) mini prokje
ct - lockTrial$ gcc -o server server.c pr
oducts.c
adithya@adithya:~/Videos/O(1) mini prokje
ct - lockTrial$ ./server
```

```
20
Enter the product quantity:
200
The product was added succesfully
Choose one of the following
1. Add a product
2. Display the products
3. Delete a product
4. Update a product
5. Exit
1
Enter the product name:
p2
Enter the product price:
23
Enter the product quantity:
300
The product was added succesfully
Choose one of the following
1. Add a product
2. Display the products
3. Delete a product
4. Update a product
5. Exit
2
ProductID       ProductName   Quantity       Price
1               p1            200            20
2               p2            300            23

Choose one of the following
1. Add a product
2. Display the products
3. Delete a product
4. Update a product
5. Exit
```

./server
./client
bash

OUTLINE
TIMELINE

⊗ 0 ⚠ 0   O(1) mini prokject - lockTrial   Debug      Live Share      Ln 32, Col 37   Spaces: 4   UTF-8   CRLF   C   linux-gcc-x64   Prettier

May 15 20:06

Following image contains file locking :

Case : When admin has the lock on product p1 and a user tries edit
the cart which contains



After releasing the lock :

File   Edit   Selection   View   Go   Run   Terminal   Help

PROBLEMS   OUTPUT   DEBUG CONSOLE   **TERMINAL**

EXPLORER   ...

∨ O(1) MINI PROKJECT - LOCKTRIAL
  › .vscode
  ☰ a.out
  ☰ adminReceipt.txt
  ☰ client
  C client_file.h
  C client.c
  ☰ customer
  C data.c
  ☰ products
  C products.c
  C products.h
  ☰ server
  C server_file.h
  C server.c
  ☰ userDetails

```
adithya@adithya:~/Videos/O(1) mini prokje
ct - lockTrial$ .
/client
Choose one of the following
1. Login
2. Register
1
Enter the userid
1000
Enter the password
1
You are logged in as ADMIN
Choose one of the following
1. Add a product
2. Display the products
3. Delete a product
4. Update a product
5. Exit
4
Enter the P_ID of the product which you w
ant to update
1
Enter the updated price  of the product
 60
Enter the updated quantity of the product
300
Enter 1  to unlock
1
The product was updated successfully
Choose one of the following
1. Add a product
2. Display the products
3. Delete a product
4. Update a product
5. Exit
```

```
Enter the quantity you want to add
4
The product was added succesfully to the cart
Choose one of the following
1. Display all the products
2. Add a product to cart
3. Display the Cart
4. Edit the cart
5. Proceed with Payment
6. Exit
3
return to disCart
ProductID        ProductName        Quantity        Price
1                p1                 3               20
3                p3                 4               50
Choose one of the following
1. Display all the products
2. Add a product to cart
3. Display the Cart
4. Edit the cart
5. Proceed with Payment
6. Exit
4
Enter the product ID you want to edit
1
Enter the updated quantity
5
The res is 2The product was successfully edited in the cart
Choose one of the following
1. Display all the products
2. Add a product to cart
3. Display the Cart
4. Edit the cart
5. Proceed with Payment
6. Exit
```

● ./server
⌐● ./client
└● ./client

⊗ 0 ⚠ 0   O(1) mini prokject - lockTrial   ⚒ Debug   ▷   Live Share      Ln 32, Col 37   Spaces: 4   UTF-8   CRLF   C   linux-gcc-x64   Prettier

Case : When admin holds the lock on p1 and user tries to go to payment gateway where the cart contains p1. Payment should wait.

File  Edit  Selection  View  Go  Run  Terminal  Help

EXPLORER                         ...

∨ O(1) MINI PROKJECT - LOCKTRIAL
  > .vscode
    ≡ a.out
    ≡ adminReceipt.txt
    ≡ client
    C client_file.h
    C client.c
    ≡ customer
    C data.c
    ≡ products
    C products.c
    C products.h
    ≡ server
    C server_file.h
    C server.c
    ≡ userDetails

> OUTLINE
> TIMELINE

PROBLEMS    OUTPUT    DEBUG CONSOLE    TERMINAL

```
Enter the password
1
You are logged in as ADMIN
Choose one of the following
1. Add a product
2. Display the products
3. Delete a product
4. Update a product
5. Exit
4
Enter the P_ID of the product which you w
ant to update
1
Enter the updated price  of the product
 60
Enter the updated quantity of the product
300
Enter 1  to unlock
1
The product was updated successfully
Choose one of the following
1. Add a product
2. Display the products
3. Delete a product
4. Update a product
5. Exit
4
Enter the P_ID of the product which you w
ant to update
1
Enter the updated price  of the product
 70
Enter the updated quantity of the product
500
Enter 1  to unlock
⬚
```

```
4
The product was added succesfully to the cart
Choose one of the following
1. Display all the products
2. Add a product to cart
3. Display the Cart
4. Edit the cart
5. Proceed with Payment
6. Exit
3
return to disCart
ProductID       ProductName        Quantity        Price
1                   p1             3               20
3                   p3             4               50
Choose one of the following
1. Display all the products
2. Add a product to cart
3. Display the Cart
4. Edit the cart
5. Proceed with Payment
6. Exit
4
Enter the product ID you want to edit
1
Enter the updated quantity
5
The res is 2The product was successfully edited in the
Choose one of the following
1. Display all the products
2. Add a product to cart
3. Display the Cart
4. Edit the cart
5. Proceed with Payment
6. Exit
5
⬚
```

⊗ 0 ⚠ 0    O(1) mini prokject - lockTrial    ✗ Debug    ⚙    ▷    ⚙    🗑    ⇗ Live Share          Ln 32, Col 37    Spaces: 4    UTF-8    CRLF    { } C    linux

After releasing lock :

File  Edit  Selection  View  Go  Run  Terminal  Help

EXPLORER                              PROBLEMS    OUTPUT    DEBUG CONSOLE    TERMINAL

∨ O(1) MINI PROKJECT - LOCKTRIAL
  › .vscode
  ≡ a.out
  ≡ adminReceipt.txt
  ≡ client
  C client_file.h
  C client.c
  ≡ customer
  C data.c
  ≡ products
  C products.c
  C products.h
  ≡ receipt
  ≡ server
  C server_file.h
  C server.c
  ≡ userDetails

```
5. Exit
4
Enter the P_ID of the product which you w
ant to update
1
Enter the updated price  of the product
 60
Enter the updated quantity of the product
300
Enter 1  to unlock
1
The product was updated successfully
Choose one of the following
1. Add a product
2. Display the products
3. Delete a product
4. Update a product
5. Exit
4
Enter the P_ID of the product which you w
ant to update
1
Enter the updated price  of the product
 70
Enter the updated quantity of the product
500
Enter 1  to unlock
1
The product was updated successfully
Choose one of the following
1. Add a product
2. Display the products
3. Delete a product
4. Update a product
5. Exit
```

```
3. Display the Cart
4. Edit the cart
5. Proceed with Payment
6. Exit
4
Enter the product ID you want to edit
1
Enter the updated quantity
5
The res is 2The product was successfully edited in the cart
Choose one of the following
1. Display all the products
2. Add a product to cart
3. Display the Cart
4. Edit the cart
5. Proceed with Payment
6. Exit
5
ProductID       ProductName       Quantity       Price    Tota
l Cost
1               p1                5              70       350
3               p3                4              50       200

The total cost is 550

Enter the amount
550
The payment was successful
Choose one of the following
1. Display all the products
2. Add a product to cart
3. Display the Cart
4. Edit the cart
5. Proceed with Payment
6. Exit
```

> OUTLINE
> TIMELINE

⊗ 0 ⚠ 0    O(1) mini prokject - lockTrial    ⚒ Debug                  ⚡ Live Share          Ln 32, Col 37    Spaces: 4    UTF-8    CRLF    {} C    linux-gcc-x6

Displaying Cart after successful payment:



As you can see the cart is empty now and the recept file has been generated.

Admin receipt when admin exits:



I have focussed on showing the file locking cases , other cases work normally as they should with error handling .

Thank You.