


System Security Lab EndSem Evaluation

Praneesh R V


CB.SC.U4CYS23036

Qn1,

a)

```
>_ Terminal 

(crimsonshadow@CrimsonShadow)-[~/SSLab]
$ sudo adduser cb_sc_u4cys23036_A --allow-bad-names
info: Allowing use of questionable username.
info: Adding user `cb_sc_u4cys23036_A' ...
info: Selecting UID/GID from range 1000 to 59999 ...
info: Adding new group `cb_sc_u4cys23036_A' (1001) ...
info: Adding new user `cb_sc_u4cys23036_A' (1001) with group `cb_sc_u4cys23036_A (1001)' ...
info: Creating home directory `/home/cb_sc_u4cys23036_A' ...
info: Copying files from `/etc/skel' ...
New password:
Retype new password:
passwd: password updated successfully
Changing the user information for cb_sc_u4cys23036_A
Enter the new value, or press ENTER for the default
    Full Name []: Praneesh
    Room Number []:
    Work Phone []:
    Home Phone []:
    Other []:
Is the information correct? [Y/n] y
info: Adding new user `cb_sc_u4cys23036_A' to supplemental / extra groups `users' ...
info: Adding user `cb_sc_u4cys23036_A' to group `users' ...
```

```
>_ Terminal 

(crimsonshadow@CrimsonShadow)-[~/SSLab]
$ sudo adduser cb_sc_u4cys23036_A --allow-bad-names
info: Allowing use of questionable username.
info: Adding user `cb_sc_u4cys23036_A' ...
info: Selecting UID/GID from range 1000 to 59999 ...
info: Adding new group `cb_sc_u4cys23036_A' (1001) ...
info: Adding new user `cb_sc_u4cys23036_A' (1001) with group `cb_sc_u4cys23036_A (1001)' ...
info: Creating home directory `/home/cb_sc_u4cys23036_A' ...
info: Copying files from `/etc/skel' ...
New password:
Retype new password:
passwd: password updated successfully
Changing the user information for cb_sc_u4cys23036_A
Enter the new value, or press ENTER for the default
    Full Name []: Praneesh
    Room Number []:
    Work Phone []:
    Home Phone []:
    Other []:
Is the information correct? [Y/n] y
info: Adding new user `cb_sc_u4cys23036_A' to supplemental / extra groups `users' ...
info: Adding user `cb_sc_u4cys23036_A' to group `users' ...
```

b)

Entries in linux user management files

/etc/passwd - contains basic info about users

Separated by colon

```
cb_sc_u4cys23036_A:x:1001:1001:Praneesh,,,:/home/cb_sc_u4cys23036_A:/bin/bash
cb_sc_u4cys23036_B:x:1002:1002:Praneesh,,,:/home/cb_sc_u4cys23036_B:/bin/bash
```

Username, password placeholder, userID, GroupID, user info, home directory, default shell

c)

```
(crimsonshadow@CrimsonShadow)~[~/SSLab]
$ sudo groupadd exam

(crimsonshadow@CrimsonShadow)~[~/SSLab]
$ sudo usermod -g exam cb_sc_u4cys23036_A

(crimsonshadow@CrimsonShadow)~[~/SSLab]
$ sudo usermod -g exam cb_sc_u4cys23036_B

(crimsonshadow@CrimsonShadow)~[~/SSLab]
$ id cb_sc_u4cys23036_A
uid=1001(cb_sc_u4cys23036_A) gid=1006(exam) groups=1006(exam),100(users)


(crimsonshadow@CrimsonShadow)~[~/SSLab]
$ id cb_sc_u4cys23036_B
uid=1002(cb_sc_u4cys23036_B) gid=1006(exam) groups=1006(exam),100(users)

(crimsonshadow@CrimsonShadow)~[~/SSLab]
$
```

- Default shell

Qn2,

Making /bin/ls a SetUID Program

```
>_ Terminal   
  
[crimsonshadow@CrimsonShadow]~[~/SSLab]  
$ sudo chmod u+s /bin/ls  
  
[crimsonshadow@CrimsonShadow]~[~/SSLab]  
$ ls -l /bin/ls  
-rwsr-xr-x 1 root root 155472 Oct 23 21:06 /bin/ls
```

Yes, it can be Undone

```
[crimsonshadow@CrimsonShadow]~[~/SSLab]  
$ sudo chmod u-s /bin/ls  
  
[crimsonshadow@CrimsonShadow]~[~/SSLab]  
$ ls -l /bin/ls  
-rwxr-xr-x 1 root root 155472 Oct 23 21:06 /bin/ls  
  
[crimsonshadow@CrimsonShadow]~[~/SSLab]  
$
```

Qn3,

a)

Symlink

```
[crimsonshadow@CrimsonShadow]~[~/SSLab]  
$ touch SSLab.txt  
  
[crimsonshadow@CrimsonShadow]~[~/SSLab]  
$ sudo ln -s /home/crimsonshadow/SSLab/SSLab.txt /home/tmp/SSLab_symlink
```

Hardlink

```
[crimsonshadow@CrimsonShadow]~[~/SSLab]  
$ sudo ln /home/crimsonshadow/SSLab/SSLab.txt /home/tmp/SSLab_hardlink
```

b)

```
(crimsonshadow@CrimsonShadow)-[~]
$ sudo mkdir -p /tmp/jail/bin /tmp/jail/lib /tmp/jail/lib64

(crimsonshadow@CrimsonShadow)-[~]
$ sudo cp /bin/bash /tmp/jail/bin/

(crimsonshadow@CrimsonShadow)-[~]
$ ldd /bin/bash
linux-vdso.so.1 (0x00007f12ad8c3000)
libtinfo.so.6 => /lib/x86_64-linux-gnu/libtinfo.so.6 (0x00007f12ad70f000)
libc.so.6 => /lib/x86_64-linux-gnu/libc.so.6 (0x00007f12ad519000)
/lib64/ld-linux-x86-64.so.2 (0x00007f12ad8c5000)


(crimsonshadow@CrimsonShadow)-[~]
$ sudo cp /lib/x86_64-linux-gnu/libtinfo.so.6 /tmp/jail/lib/

(crimsonshadow@CrimsonShadow)-[~]
$ sudo cp /lib/x86_64-linux-gnu/libdl.so.2 /tmp/jail/lib/

(crimsonshadow@CrimsonShadow)-[~]
$ sudo cp /lib/x86_64-linux-gnu/libc.so.6 /tmp/jail/lib/

(crimsonshadow@CrimsonShadow)-[~]
$ sudo cp /lib64/ld-linux-x86-64.so.2 /tmp/jail/lib64/

(crimsonshadow@CrimsonShadow)-[~]
$
```

```
>_ Terminal 

(crimsonshadow@CrimsonShadow)-[~]
$ sudo cp /lib/x86_64-linux-gnu/libc.so.6 /tmp/jail/lib/x86_64-linux-gnu/

(crimsonshadow@CrimsonShadow)-[~]
$ sudo cp /lib64/ld-linux-x86-64.so.2 /tmp/jail/lib64/

(crimsonshadow@CrimsonShadow)-[~]
$ ls -l /tmp/jail/lib/x86_64-linux-gnu/
total 2176
-rwxr-xr-x 1 root root 2003408 Mar 26 11:28 libc.so.6
-rw-r--r-- 1 root root 220464 Mar 26 11:24 libtinfo.so.6

(crimsonshadow@CrimsonShadow)-[~]
$ ls -l /tmp/jail/lib64/
total 220
-rwxr-xr-x 1 root root 222968 Mar 26 11:28 ld-linux-x86-64.so.2

(crimsonshadow@CrimsonShadow)-[~]
$ sudo chmod 755 /tmp/jail/lib/x86_64-linux-gnu/libc.so.6
sudo chmod 755 /tmp/jail/lib64/ld-linux-x86-64.so.2

(crimsonshadow@CrimsonShadow)-[~]
$ sudo chroot /tmp/jail /bin/bash
bash-5.2#
```

```
(crimsonshadow@CrimsonShadow)-[~]
$ sudo mkdir -p /tmp/jail/bin /tmp/jail/lib /tmp/jail/lib64 /tmp/jail/usr/bin

(crimsonshadow@CrimsonShadow)-[~]
$ sudo cp /bin/cat /tmp/jail/bin/

(crimsonshadow@CrimsonShadow)-[~]
$
```

```
(crimsonshadow@CrimsonShadow)-[~]
$ sudo chroot /tmp/jail /bin/bash
bash-5.2# exit
exit

(crimsonshadow@CrimsonShadow)-[~]
$
```

c)

Yes, symbolic links still point to the original file outside /tmp allowing escape.

d)

No, Hardlinks keep the file inside /tmp, preventing escape


e)

Most chroot prevent SetUID execution and prevents escape

Qn4,

a)

Math lib source file

```
>_ Terminal 

#include "mathlib.h"


float add(float a, float b) {
    return a + b;
}

float subtract(float a, float b) {
    return a - b;
}

float multiply(float a, float b) {
    return a * b;
}

float divide(float a, float b) {
    if (b != 0)
        return a / b;
    else
        return 0;
}
```

Mathlib headerfile

```
>_ Terminal 

#ifndef MATHLIB_H
#define MATHLIB_H

float add(float a, float b);
float subtract(float a, float b);
float multiply(float a, float b);
float divide(float a, float b);

#endif
```

b)

Static and dynamic libraries

i)static

```
(crimsonshadow@CrimsonShadow)~[~/SSLab]
$ gcc -c mathlib.c -o mathlib.o

(crimsonshadow@CrimsonShadow)~[~/SSLab]
$ ar rcs libmathlib.a mathlib.o
```

ii)dynamic

```
(crimsonshadow@CrimsonShadow)~[~/SSLab]
$ gcc -fPIC -c mathlib.c

(crimsonshadow@CrimsonShadow)~[~/SSLab]
$ gcc -shared -o libmathlib.so mathlib.o
```

c)Program

```
>_ Terminal □
#include <stdio.h>
#include "mathlib.h"

#define PI 3.14159

void cylinder(float r, float h) {
    float CSA = multiply(multiply(2, PI), multiply(r, h));
    float TSA = add(CSA, multiply(2, multiply(PI, multiply(r, r))));
    float volume = multiply(PI, multiply(multiply(r, r), h));

    printf("Cylinder - CSA: %.2f, TSA: %.2f, Volume: %.2f\n", CSA, TSA, volume);
}

void cone(float r, float h, float l) {
    float CSA = multiply(PI, multiply(r, l));
    float TSA = add(CSA, multiply(PI, multiply(r, r)));
    float volume = divide(multiply(PI, multiply(multiply(r, r), h)), 3);

    printf("Cone - CSA: %.2f, TSA: %.2f, Volume: %.2f\n", CSA, TSA, volume);
}

void cube(float a) {
    float TSA = multiply(6, multiply(a, a));
    float volume = multiply(a, multiply(a, a));


    printf("Cube - TSA: %.2f, Volume: %.2f\n", TSA, volume);
}

void cuboid(float l, float b, float h) {
    float TSA = multiply(2, add(add(multiply(l, b), multiply(b, h)), multiply(l, h)));
    float volume = multiply(l, multiply(b, h));

    printf("Cuboid - TSA: %.2f, Volume: %.2f\n", TSA, volume);
}

int main() {
    cylinder(3, 5);
    cone(3, 5, 6);
    cube(4);
    cuboid(3, 4, 5);
    return 0;
}
```


d) Makefile

```
>_ Terminal 

CC = gcc
CFLAGS = -Wall -fPIC
AR = ar rcs

STATIC_LIB = libmathlib.a
DYNAMIC_LIB = libmathlib.so
MATHLIB_OBJ = mathlib.o
MATHLIB_HEADER = mathlib.h
MAIN_OBJ = qn4.o
MAIN_PROG = qn4

$(STATIC_LIB): $(MATHLIB_OBJ)
    $(AR) $(STATIC_LIB) $(MATHLIB_OBJ)

$(DYNAMIC_LIB): $(MATHLIB_OBJ)
    $(CC) -shared -o $(DYNAMIC_LIB) $(MATHLIB_OBJ)

$(MATHLIB_OBJ): mathlib.c $(MATHLIB_HEADER)
    $(CC) $(CFLAGS) -c mathlib.c

$(MAIN_PROG): $(MAIN_OBJ) $(STATIC_LIB)
    $(CC) -o $(MAIN_PROG) $(MAIN_OBJ) -L. -lmathlib

$(MAIN_OBJ): qn4.c $(MATHLIB_HEADER)
    $(CC) $(CFLAGS) -c qn4.c

clean:
    rm -f *.o *.a *.so $(MAIN_PROG)
```

```
(crimsonshadow@CrimsonShadow)~[~/SSLab]
$ nvim Makefile

(crimsonshadow@CrimsonShadow)~[~/SSLab]
$ make
ar rcs libmathlib.a mathlib.o

(crimsonshadow@CrimsonShadow)~[~/SSLab]
$ ls
Makefile  SSLab.txt  libmathlib.a  libmathlib.so  mathlib.c  mathlib.h  mathlib.o  qn4.c
```

```
(crimsonshadow@CrimsonShadow)~[/SSLab]
$ gcc -c qn4.c -o qn4.o

(crimsonshadow@CrimsonShadow)~[/SSLab]
$ gcc -o qn4 qn4.o -L. -lmathlib

(crimsonshadow@CrimsonShadow)~[/SSLab]
$ ls
Makefile  SSLab.txt  libmathlib.a  libmathlib.so  mathlib.c  mathlib.h  mathlib.o  qn4  qn4.c  qn4.o
```

```
(crimsonshadow@CrimsonShadow)~[/SSLab]
$ export LD_LIBRARY_PATH=.

(crimsonshadow@CrimsonShadow)~[/SSLab]
$ ./qn4
Cylinder - CSA: 94.25, TSA: 150.80, Volume: 141.37
Cone - CSA: 56.55, TSA: 84.82, Volume: 47.12
Cube - TSA: 96.00, Volume: 64.00
Cuboid - TSA: 94.00, Volume: 60.00

(crimsonshadow@CrimsonShadow)~[/SSLab]
$
```


Qn 5,

a)

```
>_ Terminal

(crimsonshadow@CrimsonShadow)~[/SSLab]
$ su root
Password:
(root@CrimsonShadow)~[/home/crimsonshadow/SSLab]
#
```

b)

```
>_ Terminal 

(root@CrimsonShadow)-[~crimsonshadow/SSLab]
# useradd -m -s /bin/bash cb_sc_u4cys23036amrita

(root@CrimsonShadow)-[~crimsonshadow/SSLab]
# useradd -m -s /bin/bash cb_sc_u4cys23036coimbatore

(root@CrimsonShadow)-[~crimsonshadow/SSLab]
# passwd cb_sc_u4cys23036amrita
New password:
Retype new password:
passwd: password updated successfully

(root@CrimsonShadow)-[~crimsonshadow/SSLab]
# passwd cb_sc_u4cys23036coimbatore
New password:
Retype new password:
passwd: password updated successfully
```

c)

```
(root@CrimsonShadow)-[~crimsonshadow/SSLab]
# su - cb_sc_u4cys23036amrita
(cb_sc_u4cys23036amrita@CrimsonShadow)-[~]
$ ssh-keygen -t rsa -b 4096
Generating public/private rsa key pair.
Enter file in which to save the key (/home/cb_sc_u4cys23036amrita/.ssh/id_rsa): /home/cb_sc_u4cys23036amrita/.ssh/id_rsa
Created directory '/home/cb_sc_u4cys23036amrita/.ssh'.
Enter passphrase for "/home/cb_sc_u4cys23036amrita/.ssh/id_rsa" (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/cb_sc_u4cys23036amrita/.ssh/id_rsa
Your public key has been saved in /home/cb_sc_u4cys23036amrita/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:78/hdCUEAncpqWIIJoRjJmiekrAo709Hvk1jlgagThCI cb_sc_u4cys23036amrita@CrimsonShadow
The key's randomart image is:
+---[RSA 4096]-----+
|00 .. ..0.0. |
|E=... ..00.. |
|00. o . . . |
|=.0 . * . . |
|. + o + +S . . |
|+ + . o . o |
|00 = . . o . |
|= . + . + o |
|. + ... ..+ |
+---[SHA256]-----+

(cb_sc_u4cys23036amrita@CrimsonShadow)-[~]
$
```

d)

```
(cb_sc_u4cys23036amrita@CrimsonShadow)~$ ssh-copy-id cb_sc_u4cys23036coimbatore@localhost
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/cb_sc_u4cys23036amrita/.ssh/id_rsa.pub"
The authenticity of host 'localhost (::1)' can't be established.
ED25519 key fingerprint is SHA256:+oC5dojc+6JjYmrDIXYuDREhmvrBnp0oCWezDPiCn4.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install all the new keys
cb_sc_u4cys23036coimbatore@localhost's password:

Number of key(s) added: 1

Now try logging into the machine, with: "ssh 'cb_sc_u4cys23036coimbatore@localhost'"
and check to make sure that only the key(s) you wanted were added.

(cb_sc_u4cys23036amrita@CrimsonShadow)~$
```

```
(crimsonshadow@CrimsonShadow)~$ sudo cat /home/cb_sc_u4cys23036coimbatore/.ssh/authorized_keys
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAQDDU9oGh6ZI6hr0vqeoZSuYsTH4Yw09YcHrKn+H7pDmtbYihH+wUfYA7X98zBgCHxTq97nHjn0jA+lVLZ40hxVMTfA3G2ABKAMEgtjtCZ1Vm0VPjYLVz3UhSCz/ZwXwZGCeDEMPyvST2bW8HEATE1yB56qRuTheb3WeDiz5x5DYRua9iAS1hilyYewLDqJ7WkzCHVak6dfCrkxxwAfQdArhJxfyttEV6DmQwXY8/AqPJrzvKpwkgLK0nTatYu7Rff2jzGTx8Q8Sx8MvqtWqNS4gk2aWu4Em8E3tWJSzJyLLKGzRwWQu147/Kqd2CBFjQ5XiCB2NiZP8ZeV5Abeway6jff2fsQEp1dRJ4qnlqql+ddv880cdn8MskphIRDwMoDMHYxbMT8cW4NzrkMb3Cm7R+Iu/SRXc477SbC4r/rZEZLj0Cbf7x7Jx5r9hyqIhFRpXbcIPrGk3387yz8A+tChZemVdIRCu/58GI3lVorHoZYeBkw9TIGijc9hgHUPts3ZIav/C7zgLkQqMki9iS7uk8YHZgE7scse5LJkXgsX/Q2FjpgamB7prke/ztt7RQ3XH+v25jLq@k7WkAG/A6UdRueNCRVw/sTTx+YXBlsfGtj4MV0GqP0pi0Gb6F3qYeXS2VZI9DI29nb6Vr3sW6hNJCnX3MeGd0IsnHSZDUnyB7Q== cb_sc_u4cys23036amrita@CrimsonShadow
```

e)

```
(root@CrimsonShadow)~[~crimsonshadow/SSLab]
# sudo systemctl restart ssh

(root@CrimsonShadow)~[~crimsonshadow/SSLab]
# sudo chmod 700 /home/cb_sc_u4cys23036coimbatore/.ssh

(root@CrimsonShadow)~[~crimsonshadow/SSLab]
# sudo chmod 600 /home/cb_sc_u4cys23036coimbatore/.ssh/authorized_keys

(root@CrimsonShadow)~[~crimsonshadow/SSLab]
# su - cb_sc_u4cys23036amrita
(cb_sc_u4cys23036amrita@CrimsonShadow)~$
```

f) Connected without password

```
(cb_sc_u4cys23036amrita@CrimsonShadow)-[~]
$ ssh cb_sc_u4cys23036coimbatore@localhost
Linux CrimsonShadow 6.12.13-amd64 #1 SMP PREEMPT_DYNAMIC Kali 6.12.13-1kali1 (2025-02-11) x86_64

The programs included with the Kali GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.


Kali GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Mar 26 12:18:17 2025 from ::1
(cb_sc_u4cys23036coimbatore@CrimsonShadow)-[~]
$ pwd
/home/cb_sc_u4cys23036coimbatore
(cb_sc_u4cys23036coimbatore@CrimsonShadow)-[~]
$
```

g)

```
(cb_sc_u4cys23036coimbatore@CrimsonShadow)-[~]
$ exit
logout
Connection to localhost closed.

(cb_sc_u4cys23036amrita@CrimsonShadow)-[~]
$ su - cb_sc_u4cys23036amrita
Password:
(cb_sc_u4cys23036amrita@CrimsonShadow)-[~]
$
```

h)

```
>_ Terminal 

#!/bin/bash

echo "Current user: ${whoami}"

ROLLNUMBER=23036

is_prime() {
    num=$1
    if (( num < 2 )); then
        return 1
    fi
    for (( i=2; i*i<=num; i++ )); do
        if (( num % i == 0 )); then
            return 1
        fi
    done
    return 0
}


is_palindrome() {
    num=$1
    rev=$(echo "$num" | rev)
    [[ "$num" == "$rev" ]]
}

if (( ROLLNUMBER % 2 == 1 )); then
    if is_prime $ROLLNUMBER; then
        echo "$ROLLNUMBER is Prime"
        COMPILE_BINARY="Prime"
    else
        echo "$ROLLNUMBER is Not Prime"
        exit 1
    fi
else
    if is_palindrome $ROLLNUMBER; then
        echo "$ROLLNUMBER is Palindrome"
        COMPILE_BINARY="Palindrome"
    else
        echo "$ROLLNUMBER is Not Palindrome"
        exit 1
    fi
fi

make


scp $COMPILE_BINARY cb_sc_u4cys23036coimbatore@localhost:~/

ssh cb_sc_u4cys23036coimbatore@localhost "echo 'Current user on server:' \$(whoami); ~/\$(basename $COMPILE_BINARY)"
```

```
>_ Terminal 

(cb_sc_u4cys23036amrita@CrimsonShadow)-[~]
$ chmod +x remoteshell.sh
```

```

>_ Terminal 

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

// Function to check if a number is prime
int is_prime(int num) {
    if (num < 2) return 0;
    for (int i = 2; i * i <= num; i++) {
        if (num % i == 0) return 0;
    }
    return 1;
}

// Function to check if a number is palindrome
int is_palindrome(int num) {
    char str[20], rev[20];
    sprintf(str, "%d", num);
    strcpy(rev, str);
    strrev(rev);
    return strcmp(str, rev) == 0;
}

int main() {
    int rollnumber = 23036; // Replace with your roll number

    if (rollnumber % 2 == 1) {
        if (is_prime(rollnumber)) {
            printf("%d is Prime\n", rollnumber);
        } else {
            printf("%d is Not Prime\n", rollnumber);
        }
    } else {
        if (is_palindrome(rollnumber)) {
            printf("%d is Palindrome\n", rollnumber);
        } else {
            printf("%d is Not Palindrome\n", rollnumber);
        }
    }

    return 0;
}

```

```

└─(cb_sc_u4cys23036amrita@CrimsonShadow)-[~]
$ ./remoteshell.sh
Current user: cb_sc_u4cys23036amrita
23036 is Not Palindrome

```

Qn6,

```
(crimsonshadow@CrimsonShadow)-[~]
$ sudo mariadb -u root
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 35
Server version: 11.4.5-MariaDB-1 Debian n/a

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Support MariaDB developers by giving a star at https://github.com/MariaDB/server
Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MariaDB [(none)]> USE my_db
Database changed
MariaDB [my_db]> CREATE TABLE Accounts (
    ->     accID INT PRIMARY KEY,
    ->     balance INT
    -> );
Query OK, 0 rows affected (0.010 sec)

MariaDB [my_db]> INSERT INTO Accounts (accID, balance) VALUES (1, 1000);
Query OK, 1 row affected (0.006 sec)

MariaDB [my_db]> █
```

Transaction 1

```
MariaDB [my_db]> BEGIN;
Query OK, 0 rows affected (0.000 sec)

MariaDB [my_db]> SELECT balance FROM Accounts WHERE accID = 1;
+-----+
| balance |
+-----+
|    1000 |
+-----+
1 row in set (0.000 sec)

MariaDB [my_db]> UPDATE Accounts SET balance = 500 WHERE accID = 1;
Query OK, 1 row affected (0.000 sec)
Rows matched: 1  Changed: 1  Warnings: 0

MariaDB [my_db]> COMMIT;
Query OK, 0 rows affected (0.001 sec)
```


Transaction 2

```
MariaDB [my_db]> BEGIN;
Query OK, 0 rows affected (0.000 sec)

MariaDB [my_db]> SELECT balance FROM Accounts WHERE accID = 1;
+-----+
| balance |
+-----+
|      500 |
+-----+
1 row in set (0.000 sec)

MariaDB [my_db]> UPDATE Accounts SET balance = 1300 WHERE accID = 1;
Query OK, 1 row affected (0.000 sec)
Rows matched: 1  Changed: 1  Warnings: 0

MariaDB [my_db]> COMMIT;
Query OK, 0 rows affected (0.006 sec)
```

Balance

```
MariaDB [my_db]> SELECT balance FROM Accounts;
+-----+
| balance |
+-----+
|      1300 |
+-----+
1 row in set (0.000 sec)
```

In transaction 1, you should withdraw 500 and in Transaction 2, you should deposit 300, So, the correct balance should be 800, but due to blind overwriting, It becomes:

If Transaction 1 commits last → Balance = ₹500
₹1000 - ₹500

If Transaction 2 commits last → Balance = ₹1300
₹1000 + ₹300

To fix this,

```
MariaDB [my_db]> BEGIN;
Query OK, 0 rows affected (0.000 sec)

MariaDB [my_db]>
MariaDB [my_db]> -- Lock row for update
MariaDB [my_db]> SELECT balance FROM Accounts WHERE accID = 1 FOR UPDATE;
+-----+
| balance |
+-----+
|    1300 |
+-----+
1 row in set (0.000 sec)

MariaDB [my_db]>
MariaDB [my_db]> -- Update balance safely
MariaDB [my_db]> UPDATE Accounts SET balance = balance - 500 WHERE accID = 1;
Query OK, 1 row affected (0.000 sec)
Rows matched: 1  Changed: 1  Warnings: 0

MariaDB [my_db]>
MariaDB [my_db]> COMMIT;
Query OK, 0 rows affected (0.001 sec)
```

```
MariaDB [my_db]> SELECT balance FROM Accounts
+-----+
| balance |
+-----+
|     800 |
+-----+
1 row in set (0.000 sec)
```

Now balance is correct