# Mini-Project 3

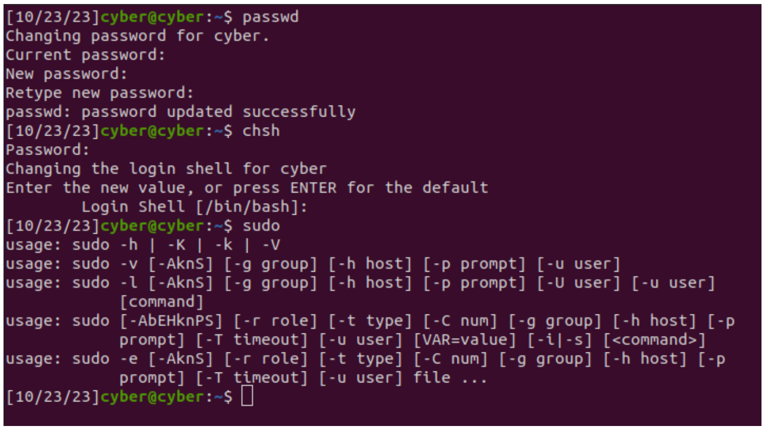
## Task 1: Explore Set-UID Programs

1. I have explored and run a few Set-UID programs like passwd, chsh, and sudo in their default location and my choice's directory or Desktop. The passwd program changes the user's account's password, the chsh program changes the login shell of the username if the entered password is valid and keeps the default shell if the Enter key is hit, and the sudo command grants the user with special permissions to execute commands at the root level. The commands and the results are shown on the first and the second screenshots of this task.

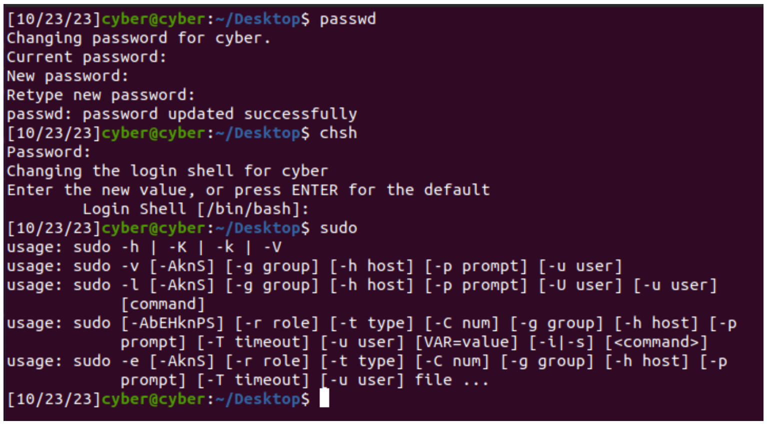
**Question 1. Did the programs work appropriately in both cases? Please briefly justify your observations.**

The programs work appropriately in these cases since they print the same results, and the Set-UID programs provide the same results for the directories because these Set-UID programs are allowed and used in any directories. Therefore, the programs work appropriately when they are used in their default location and the directory of my choice.

**Screenshots:**



```
[10/23/23]cyber@cyber:~$ passwd
Changing password for cyber.
Current password:
New password:
Retype new password:
passwd: password updated successfully
[10/23/23]cyber@cyber:~$ chsh
Password:
Changing the login shell for cyber
Enter the new value, or press ENTER for the default
        Login Shell [/bin/bash]:
[10/23/23]cyber@cyber:~$ sudo
usage: sudo -h | -K | -k | -V
usage: sudo -v [-AknS] [-g group] [-h host] [-p prompt] [-u user]
usage: sudo -l [-AknS] [-g group] [-h host] [-p prompt] [-U user] [-u user]
            [command]
usage: sudo [-AbEHknPS] [-r role] [-t type] [-C num] [-g group] [-h host] [-p
            prompt] [-T timeout] [-u user] [VAR=value] [-i|-s] [<command>]
usage: sudo -e [-AknS] [-r role] [-t type] [-C num] [-g group] [-h host] [-p
            prompt] [-T timeout] [-u user] file ...
[10/23/23]cyber@cyber:~$ 
```



```
[10/23/23]cyber@cyber:~/Desktop$ passwd
Changing password for cyber.
Current password:
New password:
Retype new password:
passwd: password updated successfully
[10/23/23]cyber@cyber:~/Desktop$ chsh
Password:
Changing the login shell for cyber
Enter the new value, or press ENTER for the default
        Login Shell [/bin/bash]:
[10/23/23]cyber@cyber:~/Desktop$ sudo
usage: sudo -h | -K | -k | -V
usage: sudo -v [-AknS] [-g group] [-h host] [-p prompt] [-u user]
usage: sudo -l [-AknS] [-g group] [-h host] [-p prompt] [-U user] [-u user]
            [command]
usage: sudo [-AbEHknPS] [-r role] [-t type] [-C num] [-g group] [-h host] [-p
            prompt] [-T timeout] [-u user] [VAR=value] [-i|-s] [<command>]
usage: sudo -e [-AknS] [-r role] [-t type] [-C num] [-g group] [-h host] [-p
            prompt] [-T timeout] [-u user] file ...
[10/23/23]cyber@cyber:~/Desktop$ 
```

## Task 2: Exploring Environment Variables

### 2.1 Manipulating Environment Variables

1. I have used the commands like export, printenv, unset, and env | grep for an environment variable. The commands and the results are shown on the first screenshot of this task.

**Question 2. Please set an environment variable called "foo" with a value of your choice, show its value, and unset it. Show your results with screenshots.**

I have set "foo" or an environment variable with the value of 100 by the export command that sets/creates this environment variable and its value and used the printenv command that shows this environment variable and its value on the terminal and the unset command that unsets/removes this environment variable and its value. The commands and the results are shown on the second screenshot of this task.

### 2.2 Passing Environment Variables from Parent Process to Child Process

1. I have compiled and run myprintenv.c program that has the commented parent process. Then, I have saved this output in test1 or a text file. The commands and the results are shown on the third screenshot of this task.

2. I have compiled and run myprintenv.c program that has the commented child process. Then, I have saved this output in test2 or another text file. The commands and the results are shown on the third screenshot of this task.

**Question 3. Compare the difference of the two output files using the diff command. Please describe your observations.**

I have compared the difference between the 2 outputs' text files by the diff command, and the results are same because the parent's environment variables are inherited by the child process. The commands and the results are shown on the third and the fourth screenshot of this task.

### 2.3 Environment Variables and execve()

1. I have compiled and run myenv.c program. I observe that the program prints nothing since the last parameter of the execve() function is NULL that doesn't print any environment variables. If I control the child's environment by passing my null terminal array of char pointers, then the program prints nothing since it is using NULL. The commands and the results are shown on the fifth and the eighth screenshots of this task.

2. I have compiled and run myenv.c program after the last parameter of the execve() function is changed from NULL to environ. I observe that the program prints the environment variables due to the environ parameter that passes an array of string pointers and variables. The commands and the results are shown on the sixth and the seventh screenshots of this task.

**Question 4. How does the new program get its environment variables? Please explain based on your observations.**

The new program gets its environment variables after the parameter is environ because the environ represents the array of string points, and that array is passed as the environment of the new program that will print the environment variables.

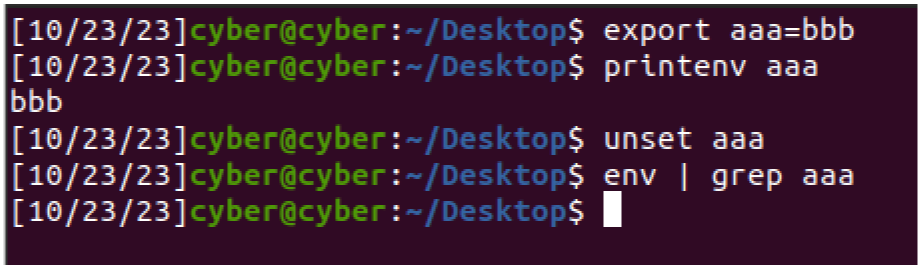
<u>2.4 Environment Variables and system()</u>

1. I have compiled and run mysystem.c program. The commands and the results are shown on the ninth and the tenth screenshots of this task. Then, the slides of this mini-project tell me to set "foo" or a customized environment variable and rerun this program that will show me a new result. The commands and the results are shown on the last 2 screenshots of this task.

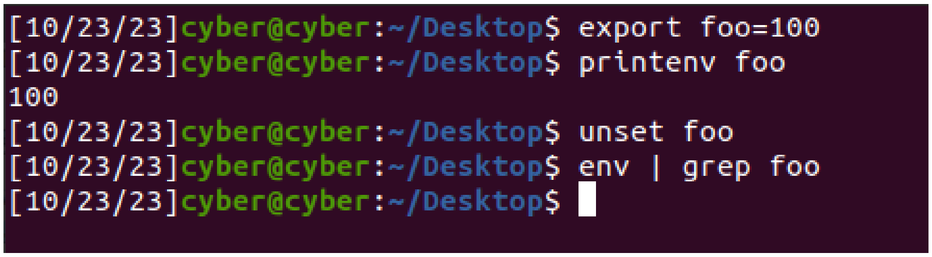
**Question 5. How does the new program /bin/sh get its environment variables? Please explain based on your observations.**

The new program /bin/sh/ gets its environment variable after it executes the /bin/sh -c command because the system() function uses the execl() function to execute /bin/sh path name, and execl() function calls execve() function that passes the environment variables' array to the function. Then, the system() function will show the environment variables.

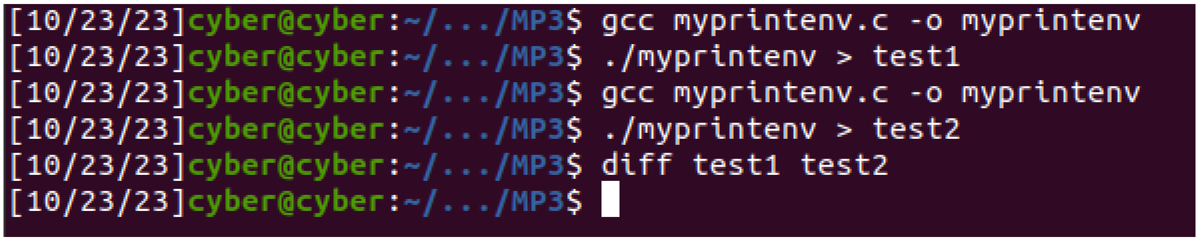
**Screenshots:**



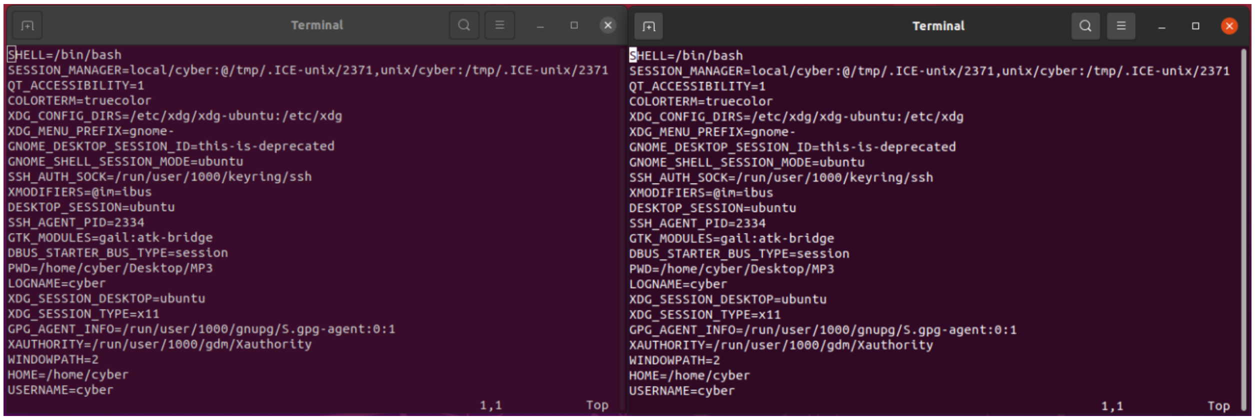
```
[10/23/23]cyber@cyber:~/Desktop$ export aaa=bbb
[10/23/23]cyber@cyber:~/Desktop$ printenv aaa
bbb
[10/23/23]cyber@cyber:~/Desktop$ unset aaa
[10/23/23]cyber@cyber:~/Desktop$ env | grep aaa
[10/23/23]cyber@cyber:~/Desktop$ 
```



```
[10/23/23]cyber@cyber:~/Desktop$ export foo=100
[10/23/23]cyber@cyber:~/Desktop$ printenv foo
100
[10/23/23]cyber@cyber:~/Desktop$ unset foo
[10/23/23]cyber@cyber:~/Desktop$ env | grep foo
[10/23/23]cyber@cyber:~/Desktop$ 
```

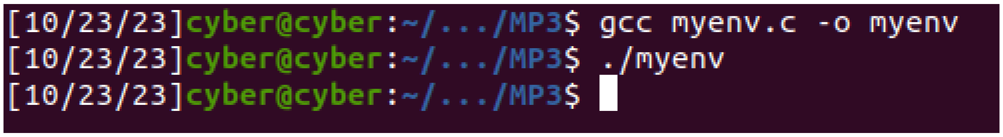


```
[10/23/23]cyber@cyber:~/.../MP3$ gcc myprintenv.c -o myprintenv
[10/23/23]cyber@cyber:~/.../MP3$ ./myprintenv > test1
[10/23/23]cyber@cyber:~/.../MP3$ gcc myprintenv.c -o myprintenv
[10/23/23]cyber@cyber:~/.../MP3$ ./myprintenv > test2
[10/23/23]cyber@cyber:~/.../MP3$ diff test1 test2
[10/23/23]cyber@cyber:~/.../MP3$ 
```

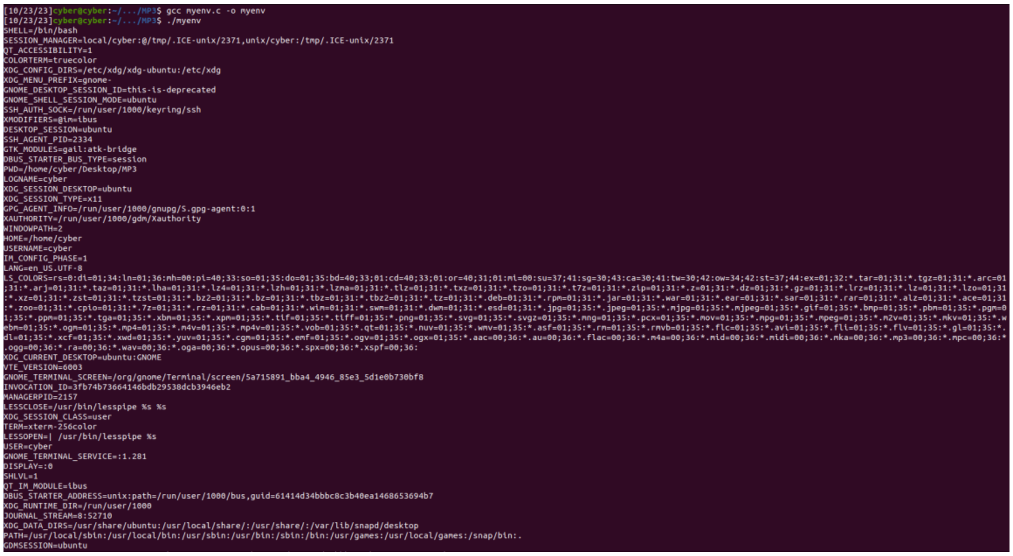


```
SHELL=/bin/bash
SESSION_MANAGER=local/cyber:@/tmp/.ICE-unix/2371,unix/cyber:/tmp/.ICE-unix/2371
QT_ACCESSIBILITY=1
COLORTERM=truecolor
XDG_CONFIG_DIRS=/etc/xdg/xdg-ubuntu:/etc/xdg
XDG_MENU_PREFIX=gnome-
GNOME_DESKTOP_SESSION_ID=this-is-deprecated
GNOME_SHELL_SESSION_MODE=ubuntu
SSH_AUTH_SOCK=/run/user/1000/keyring/ssh
XMODIFIERS=@im=ibus
DESKTOP_SESSION=ubuntu
SSH_AGENT_PID=2334
GTK_MODULES=gail:atk-bridge
DBUS_STARTER_BUS_TYPE=session
PWD=/home/cyber/Desktop/MP3
LOGNAME=cyber
XDG_SESSION_DESKTOP=ubuntu
XDG_SESSION_TYPE=x11
GPG_AGENT_INFO=/run/user/1000/gnupg/S.gpg-agent:0:1
XAUTHORITY=/run/user/1000/gdm/Xauthority
WINDOWPATH=2
HOME=/home/cyber
USERNAME=cyber
                                                             1,1           Top
```

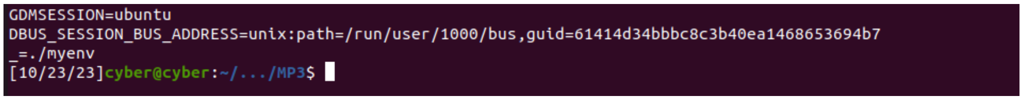
```
SHELL=/bin/bash
SESSION_MANAGER=local/cyber:@/tmp/.ICE-unix/2371,unix/cyber:/tmp/.ICE-unix/2371
QT_ACCESSIBILITY=1
COLORTERM=truecolor
XDG_CONFIG_DIRS=/etc/xdg/xdg-ubuntu:/etc/xdg
XDG_MENU_PREFIX=gnome-
GNOME_DESKTOP_SESSION_ID=this-is-deprecated
GNOME_SHELL_SESSION_MODE=ubuntu
SSH_AUTH_SOCK=/run/user/1000/keyring/ssh
XMODIFIERS=@im=ibus
DESKTOP_SESSION=ubuntu
SSH_AGENT_PID=2334
GTK_MODULES=gail:atk-bridge
DBUS_STARTER_BUS_TYPE=session
PWD=/home/cyber/Desktop/MP3
LOGNAME=cyber
XDG_SESSION_DESKTOP=ubuntu
XDG_SESSION_TYPE=x11
GPG_AGENT_INFO=/run/user/1000/gnupg/S.gpg-agent:0:1
XAUTHORITY=/run/user/1000/gdm/Xauthority
WINDOWPATH=2
HOME=/home/cyber
USERNAME=cyber
                                                             1,1           Top
```



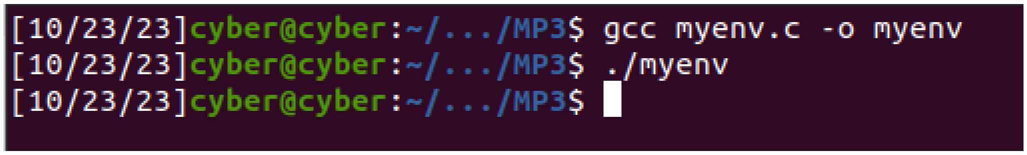
```
[10/23/23]cyber@cyber:~/.../MP3$ gcc myenv.c -o myenv
[10/23/23]cyber@cyber:~/.../MP3$ ./myenv
[10/23/23]cyber@cyber:~/.../MP3$ 
```



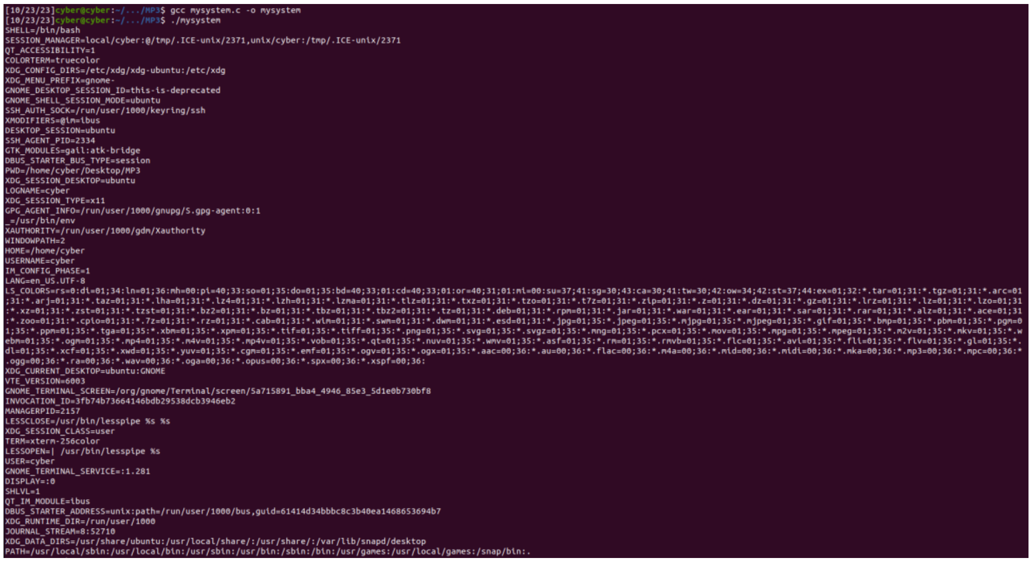
```
[10/23/23]cyber@cyber:~/.../MP3$ gcc myenv.c -o myenv
[10/23/23]cyber@cyber:~/.../MP3$ ./myenv
SHELL=/bin/bash
SESSION_MANAGER=local/cyber:@/tmp/.ICE-unix/2371,unix/cyber:/tmp/.ICE-unix/2371
QT_ACCESSIBILITY=1
COLORTERM=truecolor
XDG_CONFIG_DIRS=/etc/xdg/xdg-ubuntu:/etc/xdg
XDG_MENU_PREFIX=gnome-
GNOME_DESKTOP_SESSION_ID=this-is-deprecated
GNOME_SHELL_SESSION_MODE=ubuntu
SSH_AUTH_SOCK=/run/user/1000/keyring/ssh
XMODIFIERS=@im=ibus
DESKTOP_SESSION=ubuntu
SSH_AGENT_PID=2334
GTK_MODULES=gail:atk-bridge
DBUS_STARTER_BUS_TYPE=session
PWD=/home/cyber/Desktop/MP3
LOGNAME=cyber
XDG_SESSION_DESKTOP=ubuntu
XDG_SESSION_TYPE=x11
GPG_AGENT_INFO=/run/user/1000/gnupg/S.gpg-agent:0:1
XAUTHORITY=/run/user/1000/gdm/Xauthority
WINDOWPATH=2
HOME=/home/cyber
USERNAME=cyber
IM_CONFIG_PHASE=1
LANG=en_US.UTF-8
LS_COLORS=rs=0:di=01;34:ln=01;36:mh=00:pi=40;33:so=01;35:do=01;35:bd=40;33;01:cd=40;33;01:or=40;31;01:mi=00:su=37;41:sg=30;43:ca=30;41:tw=30;42:ow=34;42:st=37;44:ex=01;32:*.tar=01;31:*.tgz=01;31:*.arc=01
;31:*.arj=01;31:*.taz=01;31:*.lha=01;31:*.lz4=01;31:*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31:*.tzo=01;31:*.t7z=01;31:*.zip=01;31:*.z=01;31:*.dz=01;31:*.gz=01;31:*.lrz=01;31:*.lz=01;31:*.lzo=01;31
:*.xz=01;31:*.zst=01;31:*.tzst=01;31:*.bz2=01;31:*.bz=01;31:*.tbz=01;31:*.tbz2=01;31:*.tz=01;31:*.deb=01;31:*.rpm=01;31:*.jar=01;31:*.war=01;31:*.ear=01;31:*.sar=01;31:*.rar=01;31:*.alz=01;31:*.ace=01;31
:*.zoo=01;31:*.cpio=01;31:*.7z=01;31:*.rz=01;31:*.cab=01;31:*.wim=01;31:*.swm=01;31:*.dwm=01;31:*.esd=01;31:*.jpg=01;35:*.jpeg=01;35:*.mjpg=01;35:*.mjpeg=01;35:*.gif=01;35:*.bmp=01;35:*.pbm=01;35:*.pgm=0
1;35:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.tif=01;35:*.tiff=01;35:*.png=01;35:*.svg=01;35:*.svgz=01;35:*.mng=01;35:*.pcx=01;35:*.mov=01;35:*.mpg=01;35:*.mpeg=01;35:*.m2v=01;35:*.mkv=01;35:*.w
ebm=01;35:*.ogm=01;35:*.mp4=01;35:*.m4v=01;35:*.mp4v=01;35:*.vob=01;35:*.qt=01;35:*.nuv=01;35:*.wmv=01;35:*.asf=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi=01;35:*.fli=01;35:*.flv=01;35:*.gl=01;35:*.
dl=01;35:*.xcf=01;35:*.xwd=01;35:*.yuv=01;35:*.cgm=01;35:*.emf=01;35:*.ogv=01;35:*.ogx=01;35:*.aac=00;36:*.au=00;36:*.flac=00;36:*.m4a=00;36:*.mid=00;36:*.midi=00;36:*.mka=00;36:*.mp3=00;36:*.mpc=00;36:*
.ogg=00;36:*.ra=00;36:*.wav=00;36:*.oga=00;36:*.opus=00;36:*.spx=00;36:*.xspf=00;36:
XDG_CURRENT_DESKTOP=ubuntu:GNOME
VTE_VERSION=6003
GNOME_TERMINAL_SCREEN=/org/gnome/Terminal/screen/5a715891_bba4_4946_85e3_5d1e0b730bf8
INVOCATION_ID=3fb74b73664146bdb29538dcb3946eb2
MANAGERPID=2157
LESSCLOSE=/usr/bin/lesspipe %s %s
XDG_SESSION_CLASS=user
TERM=xterm-256color
LESSOPEN=| /usr/bin/lesspipe %s
USER=cyber
GNOME_TERMINAL_SERVICE=:1.281
DISPLAY=:0
SHLVL=1
QT_IM_MODULE=ibus
DBUS_STARTER_ADDRESS=unix:path=/run/user/1000/bus,guid=61414d34bbbc8c3b40ea1468653694b7
XDG_RUNTIME_DIR=/run/user/1000
JOURNAL_STREAM=8:52710
XDG_DATA_DIRS=/usr/share/ubuntu:/usr/local/share/:/usr/share/:/var/lib/snapd/desktop
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:.
GDMSESSION=ubuntu
```



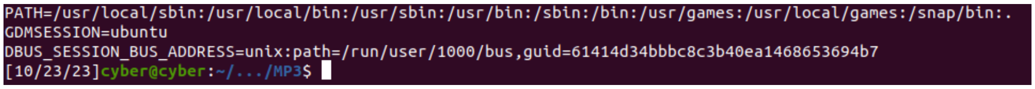
```
GDMSESSION=ubuntu
DBUS_SESSION_BUS_ADDRESS=unix:path=/run/user/1000/bus,guid=61414d34bbbc8c3b40ea1468653694b7
_=./myenv
[10/23/23]cyber@cyber:~/.../MP3$ 
```



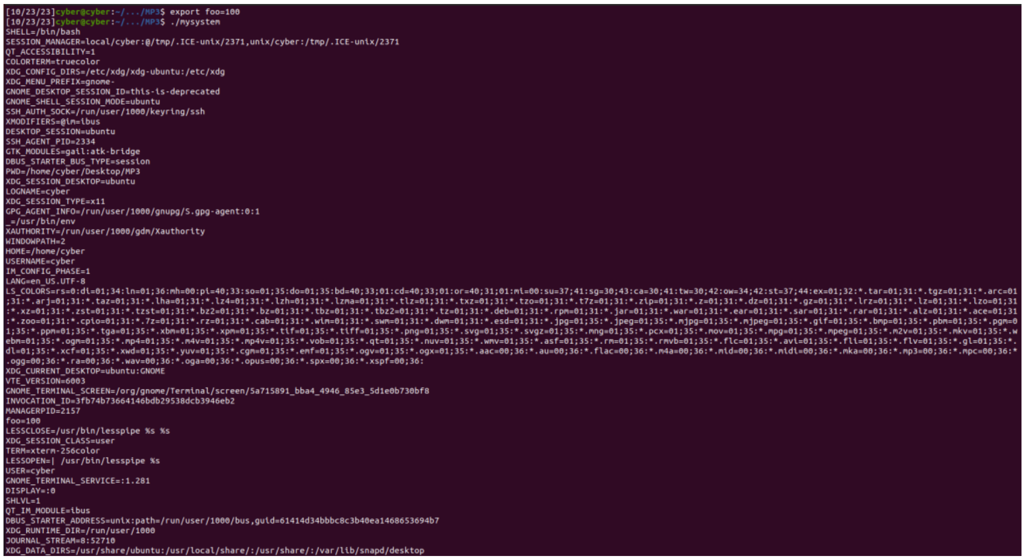
```
[10/23/23]cyber@cyber:~/.../MP3$ gcc myenv.c -o myenv
[10/23/23]cyber@cyber:~/.../MP3$ ./myenv
[10/23/23]cyber@cyber:~/.../MP3$ 
```



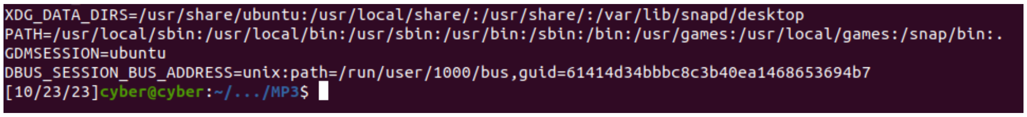
```
[10/23/23]cyber@cyber:~/.../MP3$ gcc mysystem.c -o mysystem
[10/23/23]cyber@cyber:~/.../MP3$ ./mysystem
SHELL=/bin/bash
SESSION_MANAGER=local/cyber:@/tmp/.ICE-unix/2371,unix/cyber:/tmp/.ICE-unix/2371
QT_ACCESSIBILITY=1
COLORTERM=truecolor
XDG_CONFIG_DIRS=/etc/xdg/xdg-ubuntu:/etc/xdg
XDG_MENU_PREFIX=gnome-
GNOME_DESKTOP_SESSION_ID=this-is-deprecated
GNOME_SHELL_SESSION_MODE=ubuntu
SSH_AUTH_SOCK=/run/user/1000/keyring/ssh
XMODIFIERS=@im=ibus
DESKTOP_SESSION=ubuntu
SSH_AGENT_PID=2334
GTK_MODULES=gail:atk-bridge
DBUS_STARTER_BUS_TYPE=session
PWD=/home/cyber/Desktop/MP3
XDG_SESSION_DESKTOP=ubuntu
LOGNAME=cyber
XDG_SESSION_TYPE=x11
GPG_AGENT_INFO=/run/user/1000/gnupg/S.gpg-agent:0:1
_=/usr/bin/env
XAUTHORITY=/run/user/1000/gdm/Xauthority
WINDOWPATH=2
HOME=/home/cyber
USERNAME=cyber
IM_CONFIG_PHASE=1
LANG=en_US.UTF-8
LS_COLORS=rs=0:di=01;34:ln=01;36:mh=00:pi=40;33:so=01;35:do=01;35:bd=40;33;01:cd=40;33;01:or=40;31;01:mi=00:su=37;41:sg=30;43:ca=30;41:tw=30;42:ow=34;42:st=37;44:ex=01;32:*.tar=01;31:*.tgz=01;31:*.arc=01
;31:*.arj=01;31:*.taz=01;31:*.lha=01;31:*.lz4=01;31:*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31:*.tzo=01;31:*.t7z=01;31:*.zip=01;31:*.z=01;31:*.dz=01;31:*.gz=01;31:*.lrz=01;31:*.lz=01;31:*.lzo=01;31
:*.xz=01;31:*.zst=01;31:*.tzst=01;31:*.bz2=01;31:*.bz=01;31:*.tbz=01;31:*.tbz2=01;31:*.tz=01;31:*.deb=01;31:*.rpm=01;31:*.jar=01;31:*.war=01;31:*.ear=01;31:*.sar=01;31:*.rar=01;31:*.alz=01;31:*.ace=01;31
:*.zoo=01;31:*.cpio=01;31:*.7z=01;31:*.rz=01;31:*.cab=01;31:*.wim=01;31:*.swm=01;31:*.dwm=01;31:*.esd=01;31:*.jpg=01;35:*.jpeg=01;35:*.mjpg=01;35:*.mjpeg=01;35:*.gif=01;35:*.bmp=01;35:*.pbm=01;35:*.pgm=0
1;35:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.tif=01;35:*.tiff=01;35:*.png=01;35:*.svg=01;35:*.svgz=01;35:*.mng=01;35:*.pcx=01;35:*.mov=01;35:*.mpg=01;35:*.mpeg=01;35:*.m2v=01;35:*.mkv=01;35:*.w
ebm=01;35:*.ogm=01;35:*.mp4=01;35:*.m4v=01;35:*.mp4v=01;35:*.vob=01;35:*.qt=01;35:*.nuv=01;35:*.wmv=01;35:*.asf=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi=01;35:*.fli=01;35:*.flv=01;35:*.gl=01;35:*.
dl=01;35:*.xcf=01;35:*.xwd=01;35:*.yuv=01;35:*.cgm=01;35:*.emf=01;35:*.ogv=01;35:*.ogx=01;35:*.aac=00;36:*.au=00;36:*.flac=00;36:*.m4a=00;36:*.mid=00;36:*.midi=00;36:*.mka=00;36:*.mp3=00;36:*.mpc=00;36:*
.ogg=00;36:*.ra=00;36:*.wav=00;36:*.oga=00;36:*.opus=00;36:*.spx=00;36:*.xspf=00;36:
XDG_CURRENT_DESKTOP=ubuntu:GNOME
VTE_VERSION=6003
GNOME_TERMINAL_SCREEN=/org/gnome/Terminal/screen/5a715891_bba4_4946_85e3_5d1e0b730bf8
INVOCATION_ID=3fb74b73664146bdb29538dcb3946eb2
MANAGERPID=2157
LESSCLOSE=/usr/bin/lesspipe %s %s
XDG_SESSION_CLASS=user
TERM=xterm-256color
LESSOPEN=| /usr/bin/lesspipe %s
USER=cyber
GNOME_TERMINAL_SERVICE=:1.281
DISPLAY=:0
SHLVL=1
QT_IM_MODULE=ibus
DBUS_STARTER_ADDRESS=unix:path=/run/user/1000/bus,guid=61414d34bbbc8c3b40ea1468653694b7
XDG_RUNTIME_DIR=/run/user/1000
JOURNAL_STREAM=8:52710
XDG_DATA_DIRS=/usr/share/ubuntu:/usr/local/share/:/usr/share/:/var/lib/snapd/desktop
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:.
```



```
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:.
GDMSESSION=ubuntu
DBUS_SESSION_BUS_ADDRESS=unix:path=/run/user/1000/bus,guid=61414d34bbbc8c3b40ea1468653694b7
[10/23/23]cyber@cyber:~/.../MP3$ 
```



```
[10/23/23]cyber@cyber:~/.../MP3$ export foo=100
[10/23/23]cyber@cyber:~/.../MP3$ ./mysystem
SHELL=/bin/bash
SESSION_MANAGER=local/cyber:@/tmp/.ICE-unix/2371,unix/cyber:/tmp/.ICE-unix/2371
QT_ACCESSIBILITY=1
COLORTERM=truecolor
XDG_CONFIG_DIRS=/etc/xdg/xdg-ubuntu:/etc/xdg
XDG_MENU_PREFIX=gnome-
GNOME_DESKTOP_SESSION_ID=this-is-deprecated
GNOME_SHELL_SESSION_MODE=ubuntu
SSH_AUTH_SOCK=/run/user/1000/keyring/ssh
XMODIFIERS=@im=ibus
DESKTOP_SESSION=ubuntu
SSH_AGENT_PID=2334
GTK_MODULES=gail:atk-bridge
DBUS_STARTER_BUS_TYPE=session
PWD=/home/cyber/Desktop/MP3
XDG_SESSION_DESKTOP=ubuntu
LOGNAME=cyber
XDG_SESSION_TYPE=x11
GPG_AGENT_INFO=/run/user/1000/gnupg/S.gpg-agent:0:1
_=/usr/bin/env
XAUTHORITY=/run/user/1000/gdm/Xauthority
WINDOWPATH=2
HOME=/home/cyber
USERNAME=cyber
IM_CONFIG_PHASE=1
LANG=en_US.UTF-8
LS_COLORS=rs=0:di=01;34:ln=01;36:mh=00:pi=40;33:so=01;35:do=01;35:bd=40;33;01:cd=40;33;01:or=40;31;01:mi=00:su=37;41:sg=30;43:ca=30;41:tw=30;42:ow=34;42:st=37;44:ex=01;32:*.tar=01;31:*.tgz=01;31:*.arc=01
;31:*.arj=01;31:*.taz=01;31:*.lha=01;31:*.lz4=01;31:*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31:*.tzo=01;31:*.t7z=01;31:*.zip=01;31:*.z=01;31:*.dz=01;31:*.gz=01;31:*.lrz=01;31:*.lz=01;31:*.lzo=01;31
:*.xz=01;31:*.zst=01;31:*.tzst=01;31:*.bz2=01;31:*.bz=01;31:*.tbz=01;31:*.tbz2=01;31:*.tz=01;31:*.deb=01;31:*.rpm=01;31:*.jar=01;31:*.war=01;31:*.ear=01;31:*.sar=01;31:*.rar=01;31:*.alz=01;31:*.ace=01;31
:*.zoo=01;31:*.cpio=01;31:*.7z=01;31:*.rz=01;31:*.cab=01;31:*.wim=01;31:*.swm=01;31:*.dwm=01;31:*.esd=01;31:*.jpg=01;35:*.jpeg=01;35:*.mjpg=01;35:*.mjpeg=01;35:*.gif=01;35:*.bmp=01;35:*.pbm=01;35:*.pgm=0
1;35:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.tif=01;35:*.tiff=01;35:*.png=01;35:*.svg=01;35:*.svgz=01;35:*.mng=01;35:*.pcx=01;35:*.mov=01;35:*.mpg=01;35:*.mpeg=01;35:*.m2v=01;35:*.mkv=01;35:*.w
ebm=01;35:*.ogm=01;35:*.mp4=01;35:*.m4v=01;35:*.mp4v=01;35:*.vob=01;35:*.qt=01;35:*.nuv=01;35:*.wmv=01;35:*.asf=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi=01;35:*.fli=01;35:*.flv=01;35:*.gl=01;35:*.
dl=01;35:*.xcf=01;35:*.xwd=01;35:*.yuv=01;35:*.cgm=01;35:*.emf=01;35:*.ogv=01;35:*.ogx=01;35:*.aac=00;36:*.au=00;36:*.flac=00;36:*.m4a=00;36:*.mid=00;36:*.midi=00;36:*.mka=00;36:*.mp3=00;36:*.mpc=00;36:*
.ogg=00;36:*.ra=00;36:*.wav=00;36:*.oga=00;36:*.opus=00;36:*.spx=00;36:*.xspf=00;36:
XDG_CURRENT_DESKTOP=ubuntu:GNOME
VTE_VERSION=6003
GNOME_TERMINAL_SCREEN=/org/gnome/Terminal/screen/5a715891_bba4_4946_85e3_5d1e0b730bf8
INVOCATION_ID=3fb74b73664146bdb29538dcb3946eb2
MANAGERPID=2157
foo=100
LESSCLOSE=/usr/bin/lesspipe %s %s
XDG_SESSION_CLASS=user
TERM=xterm-256color
LESSOPEN=| /usr/bin/lesspipe %s
USER=cyber
GNOME_TERMINAL_SERVICE=:1.281
DISPLAY=:0
SHLVL=1
QT_IM_MODULE=ibus
DBUS_STARTER_ADDRESS=unix:path=/run/user/1000/bus,guid=61414d34bbbc8c3b40ea1468653694b7
XDG_RUNTIME_DIR=/run/user/1000
JOURNAL_STREAM=8:52710
XDG_DATA_DIRS=/usr/share/ubuntu:/usr/local/share/:/usr/share/:/var/lib/snapd/desktop
```



```
XDG_DATA_DIRS=/usr/share/ubuntu:/usr/local/share/:/usr/share/:/var/lib/snapd/desktop
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:.
GDMSESSION=ubuntu
DBUS_SESSION_BUS_ADDRESS=unix:path=/run/user/1000/bus,guid=61414d34bbbc8c3b40ea1468653694b7
[10/23/23]cyber@cyber:~/.../MP3$ 
```

## **Task 3: Environment Variables and Set-UID Programs**

### 3.1 Use Environment Variables to Affect Set-UID Programs

1. I have compiled printall.c program, changed its ownership to root, and made it a Set-UID Program. The commands and the results are shown on the first 4 screenshots and the sixth screenshot of this task.

2. I have used the export command to set the following environment variables like PATH, LD_LIBRARY_PATH, and foo or my defined variable. The commands and the results are shown on the third and the fourth screenshots of this task.

3. I have run printall.c program after I have finished the first 2 steps. The commands and the results are shown on the first 4 screenshots of this task.

**Question 6. Please check whether all the environment variables you set in the shell process (parent) get into the Set-UID child process. Describe your observation. If there are surprises to you, describe them.**

The environment variables are set in the shell process or the parent process, so they go into the Set-UID child process. I have used the ./printall |grep command to check if the environment variables are added in the child process, and I observe that the LD_LIBRARY_PATH variable is the only environment variable that doesn't exist in the child process since the ./printall | grep LD_LIBRARY_PATH command prints nothing for LD_LIBRARY_PATH. But the remaining environment variables like PATH and foo are added since they print their respective values. The commands and the results are shown on the fifth screenshot of this task.

3.2 The PATH Environment Variable

1. I have copied myls.c program to the /home/seed/ directory by the export command. The commands and the results are shown on the seventh screenshot of this task.

2. I have compiled myls.c program, but it gives me an error of denied permission of this program. So, I have changed its ownership to root and made it a Set-UID Program. I have run myls.c program with the ownership of root, and it is showing me the "shadow" file. The commands and the results are shown on the seventh and the eighth screenshots of this task.

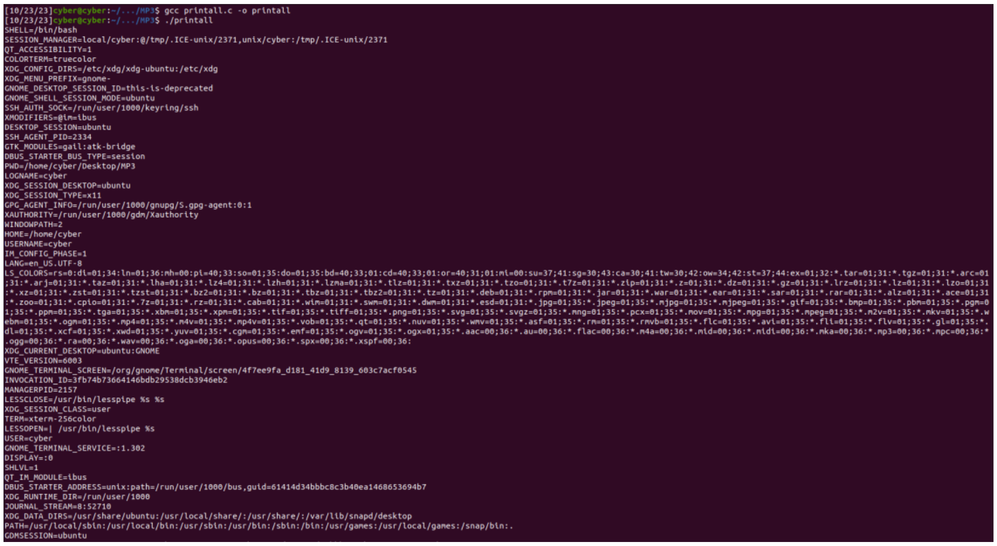
3. I have modified the system() command on myls.c program, added another command that prints the current name of the user, repeated Step 2, and run this program. The commands and the results are shown on the ninth, the tenth, and the eleventh screenshots of this task.

4. I have opened a new terminal, used the sudo ln -sf /bin/zsh /bin/sh command, and run myls.c program from Step 3. I see that the results of the 2 terminals are same. The commands and the results are shown on the last 2 screenshots of this task.

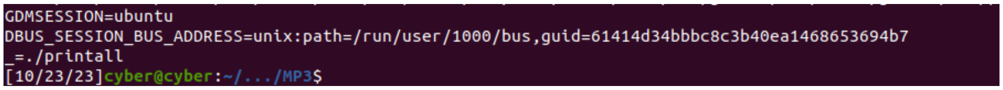
**Question 7. In step 3, can you get the Set-UID program to run a malicious command (such as system("cat /etc/shadow") or other commands of your choice)? Please report your observations (with screenshots). Are the programs running with the root privilege?**

I have gotten the Set-UID program to run a malicious command already, and the programs are running successfully with the ownership/privilege of root. The commands and the results are shown on the ninth, the tenth, and the eleventh screenshots of this task.

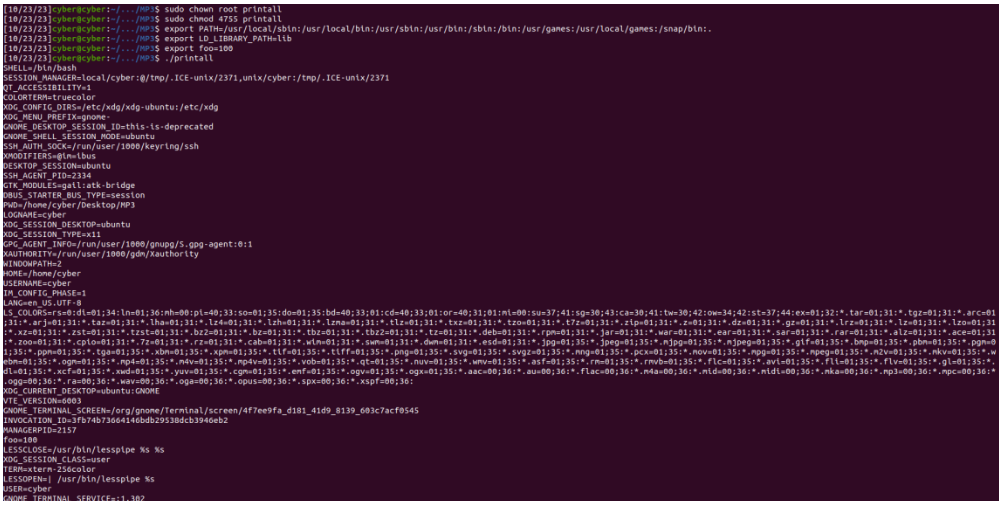
## Screenshots:



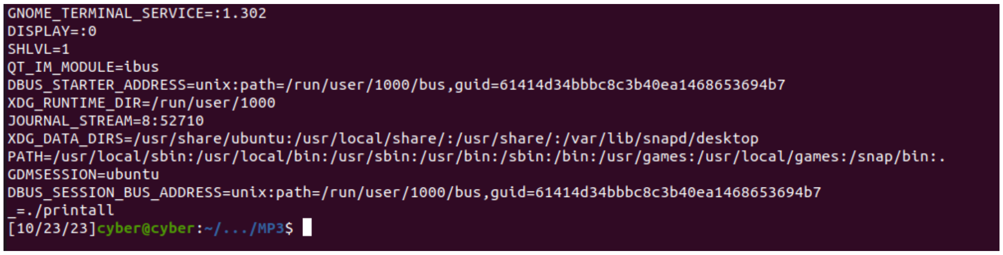
```
[10/23/23]cyber@cyber:~/.../MP3$ gcc printall.c -o printall
[10/23/23]cyber@cyber:~/.../MP3$ ./printall
SHELL=/bin/bash
SESSION_MANAGER=local/cyber:@/tmp/.ICE-unix/2371,unix/cyber:/tmp/.ICE-unix/2371
QT_ACCESSIBILITY=1
COLORTERM=truecolor
XDG_CONFIG_DIRS=/etc/xdg/xdg-ubuntu:/etc/xdg
XDG_MENU_PREFIX=gnome-
GNOME_DESKTOP_SESSION_ID=this-is-deprecated
GNOME_SHELL_SESSION_MODE=ubuntu
SSH_AUTH_SOCK=/run/user/1000/keyring/ssh
XMODIFIERS=@im=ibus
DESKTOP_SESSION=ubuntu
SSH_AGENT_PID=2334
GTK_MODULES=gail:atk-bridge
DBUS_STARTER_BUS_TYPE=session
PWD=/home/cyber/Desktop/MP3
LOGNAME=cyber
XDG_SESSION_DESKTOP=ubuntu
XDG_SESSION_TYPE=x11
GPG_AGENT_INFO=/run/user/1000/gnupg/S.gpg-agent:0:1
XAUTHORITY=/run/user/1000/gdm/Xauthority
WINDOWPATH=2
HOME=/home/cyber
USERNAME=cyber
IM_CONFIG_PHASE=1
LANG=en_US.UTF-8
LS_COLORS=rs=0:di=01;34:ln=01;36:mh=00:pi=40;33:so=01;35:do=01;35:bd=40;33;01:cd=40;33;01:or=40;31;01:mi=00:su=37;41:sg=30;43:ca=30;41:tw=30;42:ow=34;42:st=37;44:ex=01;32:*.tar=01;31:*.tgz=01;31:*.arc=01
;31:*.arj=01;31:*.taz=01;31:*.lha=01;31:*.lz4=01;31:*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31:*.tzo=01;31:*.t7z=01;31:*.zip=01;31:*.z=01;31:*.dz=01;31:*.gz=01;31:*.lrz=01;31:*.lz=01;31:*.lzo=01;31
:*.xz=01;31:*.zst=01;31:*.tzst=01;31:*.bz2=01;31:*.bz=01;31:*.tbz=01;31:*.tbz2=01;31:*.tz=01;31:*.deb=01;31:*.rpm=01;31:*.jar=01;31:*.war=01;31:*.ear=01;31:*.sar=01;31:*.rar=01;31:*.alz=01;31:*.ace=01;31
:*.zoo=01;31:*.cpio=01;31:*.7z=01;31:*.rz=01;31:*.cab=01;31:*.wim=01;31:*.swm=01;31:*.dwm=01;31:*.esd=01;31:*.jpg=01;35:*.jpeg=01;35:*.mjpg=01;35:*.mjpeg=01;35:*.gif=01;35:*.bmp=01;35:*.pbm=01;35:*.pgm=0
1;35:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.tif=01;35:*.tiff=01;35:*.png=01;35:*.svg=01;35:*.svgz=01;35:*.mng=01;35:*.pcx=01;35:*.mov=01;35:*.mpg=01;35:*.mpeg=01;35:*.m2v=01;35:*.mkv=01;35:*.w
ebm=01;35:*.ogm=01;35:*.mp4=01;35:*.m4v=01;35:*.mp4v=01;35:*.vob=01;35:*.qt=01;35:*.nuv=01;35:*.wmv=01;35:*.asf=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi=01;35:*.fli=01;35:*.flv=01;35:*.gl=01;35:*.
dl=01;35:*.xcf=01;35:*.xwd=01;35:*.yuv=01;35:*.cgm=01;35:*.emf=01;35:*.ogv=01;35:*.ogx=01;35:*.aac=00;36:*.au=00;36:*.flac=00;36:*.m4a=00;36:*.mid=00;36:*.midi=00;36:*.mka=00;36:*.mp3=00;36:*.mpc=00;36:*
.ogg=00;36:*.ra=00;36:*.wav=00;36:*.oga=00;36:*.opus=00;36:*.spx=00;36:*.xspf=00;36:
XDG_CURRENT_DESKTOP=ubuntu:GNOME
VTE_VERSION=6003
GNOME_TERMINAL_SCREEN=/org/gnome/Terminal/screen/4f7ee9fa_d181_41d9_8139_603c7acf0545
INVOCATION_ID=3fb74b73664146bdb29538dcb3946eb2
MANAGERPID=2157
LESSCLOSE=/usr/bin/lesspipe %s %s
XDG_SESSION_CLASS=user
TERM=xterm-256color
LESSOPEN=| /usr/bin/lesspipe %s
USER=cyber
GNOME_TERMINAL_SERVICE=:1.302
DISPLAY=:0
SHLVL=1
QT_IM_MODULE=ibus
DBUS_STARTER_ADDRESS=unix:path=/run/user/1000/bus,guid=61414d34bbbc8c3b40ea1468653694b7
XDG_RUNTIME_DIR=/run/user/1000
JOURNAL_STREAM=8:52710
XDG_DATA_DIRS=/usr/share/ubuntu:/usr/local/share/:/usr/share/:/var/lib/snapd/desktop
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:.
GDMSESSION=ubuntu
```



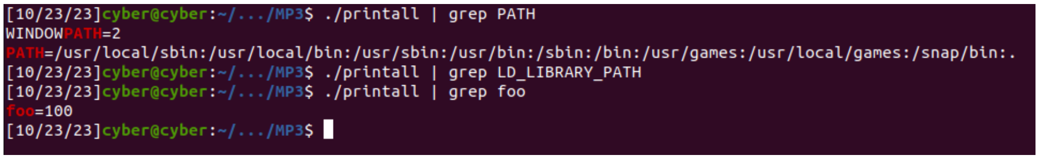
```
GDMSESSION=ubuntu
DBUS_SESSION_BUS_ADDRESS=unix:path=/run/user/1000/bus,guid=61414d34bbbc8c3b40ea1468653694b7
_=./printall
[10/23/23]cyber@cyber:~/.../MP3$
```



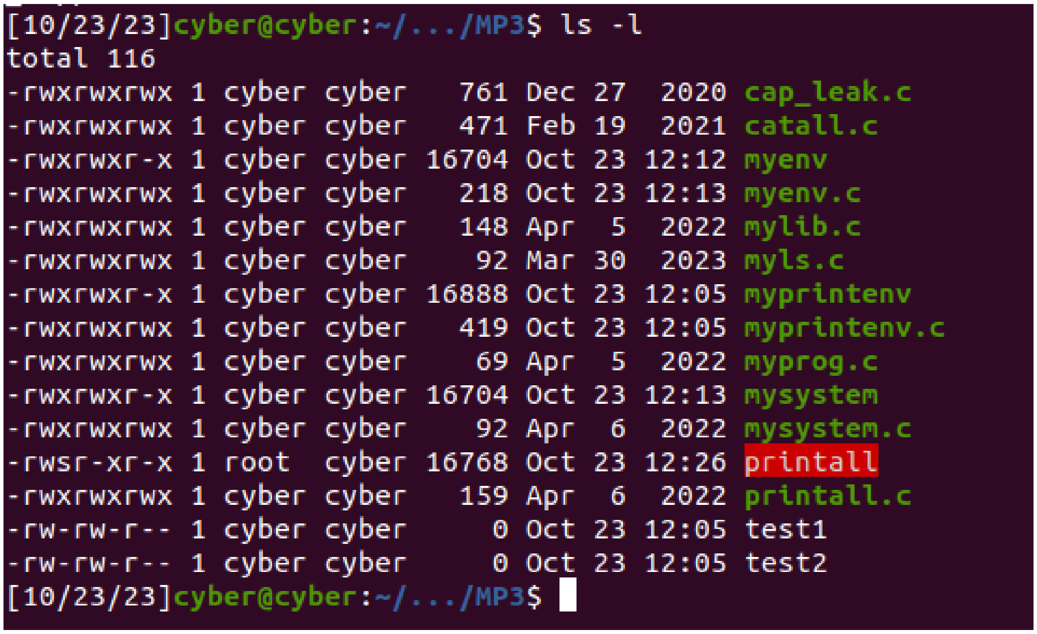
```
[10/23/23]cyber@cyber:~/.../MP3$ sudo chown root printall
[10/23/23]cyber@cyber:~/.../MP3$ sudo chmod 4755 printall
[10/23/23]cyber@cyber:~/.../MP3$ export PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:.
[10/23/23]cyber@cyber:~/.../MP3$ export LD_LIBRARY_PATH=lib
[10/23/23]cyber@cyber:~/.../MP3$ export foo=100
[10/23/23]cyber@cyber:~/.../MP3$ ./printall
SHELL=/bin/bash
SESSION_MANAGER=local/cyber:@/tmp/.ICE-unix/2371,unix/cyber:/tmp/.ICE-unix/2371
QT_ACCESSIBILITY=1
COLORTERM=truecolor
XDG_CONFIG_DIRS=/etc/xdg/xdg-ubuntu:/etc/xdg
XDG_MENU_PREFIX=gnome-
GNOME_DESKTOP_SESSION_ID=this-is-deprecated
GNOME_SHELL_SESSION_MODE=ubuntu
SSH_AUTH_SOCK=/run/user/1000/keyring/ssh
XMODIFIERS=@im=ibus
DESKTOP_SESSION=ubuntu
SSH_AGENT_PID=2334
GTK_MODULES=gail:atk-bridge
DBUS_STARTER_BUS_TYPE=session
PWD=/home/cyber/Desktop/MP3
LOGNAME=cyber
XDG_SESSION_DESKTOP=ubuntu
XDG_SESSION_TYPE=x11
GPG_AGENT_INFO=/run/user/1000/gnupg/S.gpg-agent:0:1
XAUTHORITY=/run/user/1000/gdm/Xauthority
WINDOWPATH=2
HOME=/home/cyber
USERNAME=cyber
IM_CONFIG_PHASE=1
LANG=en_US.UTF-8
LS_COLORS=rs=0:di=01;34:ln=01;36:mh=00:pi=40;33:so=01;35:do=01;35:bd=40;33;01:cd=40;33;01:or=40;31;01:mi=00:su=37;41:sg=30;43:ca=30;41:tw=30;42:ow=34;42:st=37;44:ex=01;32:*.tar=01;31:*.tgz=01;31:*.arc=01
;31:*.arj=01;31:*.taz=01;31:*.lha=01;31:*.lz4=01;31:*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31:*.tzo=01;31:*.t7z=01;31:*.zip=01;31:*.z=01;31:*.dz=01;31:*.gz=01;31:*.lrz=01;31:*.lz=01;31:*.lzo=01;31
:*.xz=01;31:*.zst=01;31:*.tzst=01;31:*.bz2=01;31:*.bz=01;31:*.tbz=01;31:*.tbz2=01;31:*.tz=01;31:*.deb=01;31:*.rpm=01;31:*.jar=01;31:*.war=01;31:*.ear=01;31:*.sar=01;31:*.rar=01;31:*.alz=01;31:*.ace=01;31
:*.zoo=01;31:*.cpio=01;31:*.7z=01;31:*.rz=01;31:*.cab=01;31:*.wim=01;31:*.swm=01;31:*.dwm=01;31:*.esd=01;31:*.jpg=01;35:*.jpeg=01;35:*.mjpg=01;35:*.mjpeg=01;35:*.gif=01;35:*.bmp=01;35:*.pbm=01;35:*.pgm=0
1;35:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.tif=01;35:*.tiff=01;35:*.png=01;35:*.svg=01;35:*.svgz=01;35:*.mng=01;35:*.pcx=01;35:*.mov=01;35:*.mpg=01;35:*.mpeg=01;35:*.m2v=01;35:*.mkv=01;35:*.w
ebm=01;35:*.ogm=01;35:*.mp4=01;35:*.m4v=01;35:*.mp4v=01;35:*.vob=01;35:*.qt=01;35:*.nuv=01;35:*.wmv=01;35:*.asf=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi=01;35:*.fli=01;35:*.flv=01;35:*.gl=01;35:*.
dl=01;35:*.xcf=01;35:*.xwd=01;35:*.yuv=01;35:*.cgm=01;35:*.emf=01;35:*.ogv=01;35:*.ogx=01;35:*.aac=00;36:*.au=00;36:*.flac=00;36:*.m4a=00;36:*.mid=00;36:*.midi=00;36:*.mka=00;36:*.mp3=00;36:*.mpc=00;36:*
.ogg=00;36:*.ra=00;36:*.wav=00;36:*.oga=00;36:*.opus=00;36:*.spx=00;36:*.xspf=00;36:
XDG_CURRENT_DESKTOP=ubuntu:GNOME
VTE_VERSION=6003
GNOME_TERMINAL_SCREEN=/org/gnome/Terminal/screen/4f7ee9fa_d181_41d9_8139_603c7acf0545
INVOCATION_ID=3fb74b73664146bdb29538dcb3946eb2
MANAGERPID=2157
foo=100
LESSCLOSE=/usr/bin/lesspipe %s %s
XDG_SESSION_CLASS=user
TERM=xterm-256color
LESSOPEN=| /usr/bin/lesspipe %s
USER=cyber
GNOME_TERMINAL_SERVICE=:1.302
```



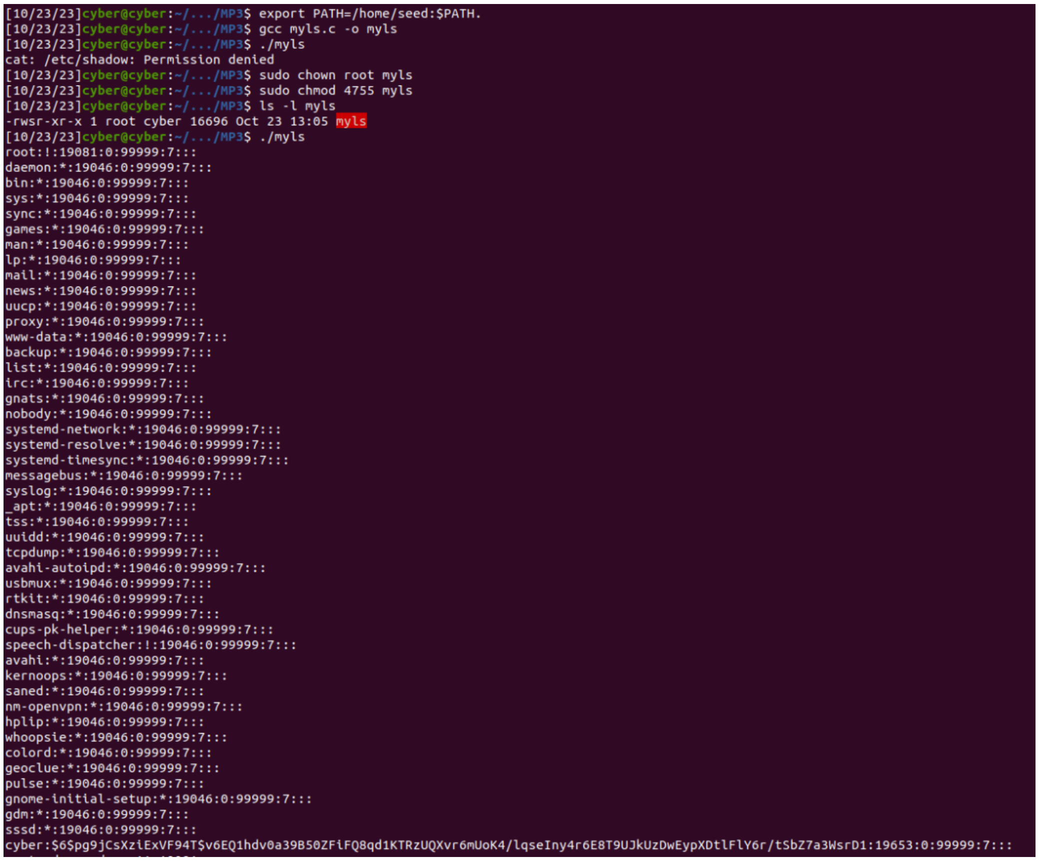
```
GNOME_TERMINAL_SERVICE=:1.302
DISPLAY=:0
SHLVL=1
QT_IM_MODULE=ibus
DBUS_STARTER_ADDRESS=unix:path=/run/user/1000/bus,guid=61414d34bbbc8c3b40ea1468653694b7
XDG_RUNTIME_DIR=/run/user/1000
JOURNAL_STREAM=8:52710
XDG_DATA_DIRS=/usr/share/ubuntu:/usr/local/share/:/usr/share/:/var/lib/snapd/desktop
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:.
GDMSESSION=ubuntu
DBUS_SESSION_BUS_ADDRESS=unix:path=/run/user/1000/bus,guid=61414d34bbbc8c3b40ea1468653694b7
_=./printall
[10/23/23]cyber@cyber:~/.../MP3$
```



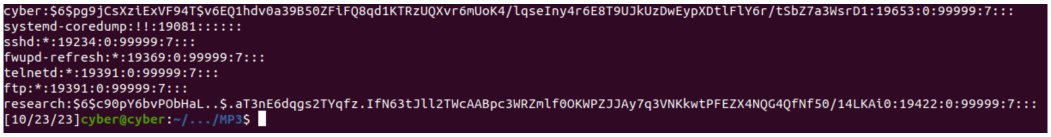
```
[10/23/23]cyber@cyber:~/.../MP3$ ./printall | grep PATH
WINDOWPATH=2
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:.
[10/23/23]cyber@cyber:~/.../MP3$ ./printall | grep LD_LIBRARY_PATH
[10/23/23]cyber@cyber:~/.../MP3$ ./printall | grep foo
foo=100
[10/23/23]cyber@cyber:~/.../MP3$
```



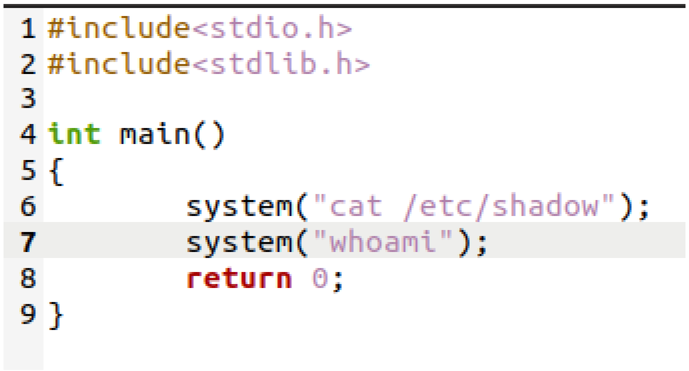
```
[10/23/23]cyber@cyber:~/.../MP3$ ls -l
total 116
-rwxrwxrwx 1 cyber cyber   761 Dec 27  2020 cap_leak.c
-rwxrwxrwx 1 cyber cyber   471 Feb 19  2021 catall.c
-rwxrwxr-x 1 cyber cyber 16704 Oct 23 12:12 myenv
-rwxrwxrwx 1 cyber cyber   218 Oct 23 12:13 myenv.c
-rwxrwxrwx 1 cyber cyber   148 Apr  5  2022 mylib.c
-rwxrwxrwx 1 cyber cyber    92 Mar 30  2023 myls.c
-rwxrwxr-x 1 cyber cyber 16888 Oct 23 12:05 myprintenv
-rwxrwxrwx 1 cyber cyber   419 Oct 23 12:05 myprintenv.c
-rwxrwxrwx 1 cyber cyber    69 Apr  5  2022 myprog.c
-rwxrwxr-x 1 cyber cyber 16704 Oct 23 12:13 mysystem
-rwxrwxrwx 1 cyber cyber    92 Apr  6  2022 mysystem.c
-rwsr-xr-x 1 root  cyber 16768 Oct 23 12:26 printall
-rwxrwxrwx 1 cyber cyber   159 Apr  6  2022 printall.c
-rw-rw-r-- 1 cyber cyber     0 Oct 23 12:05 test1
-rw-rw-r-- 1 cyber cyber     0 Oct 23 12:05 test2
[10/23/23]cyber@cyber:~/.../MP3$ 
```



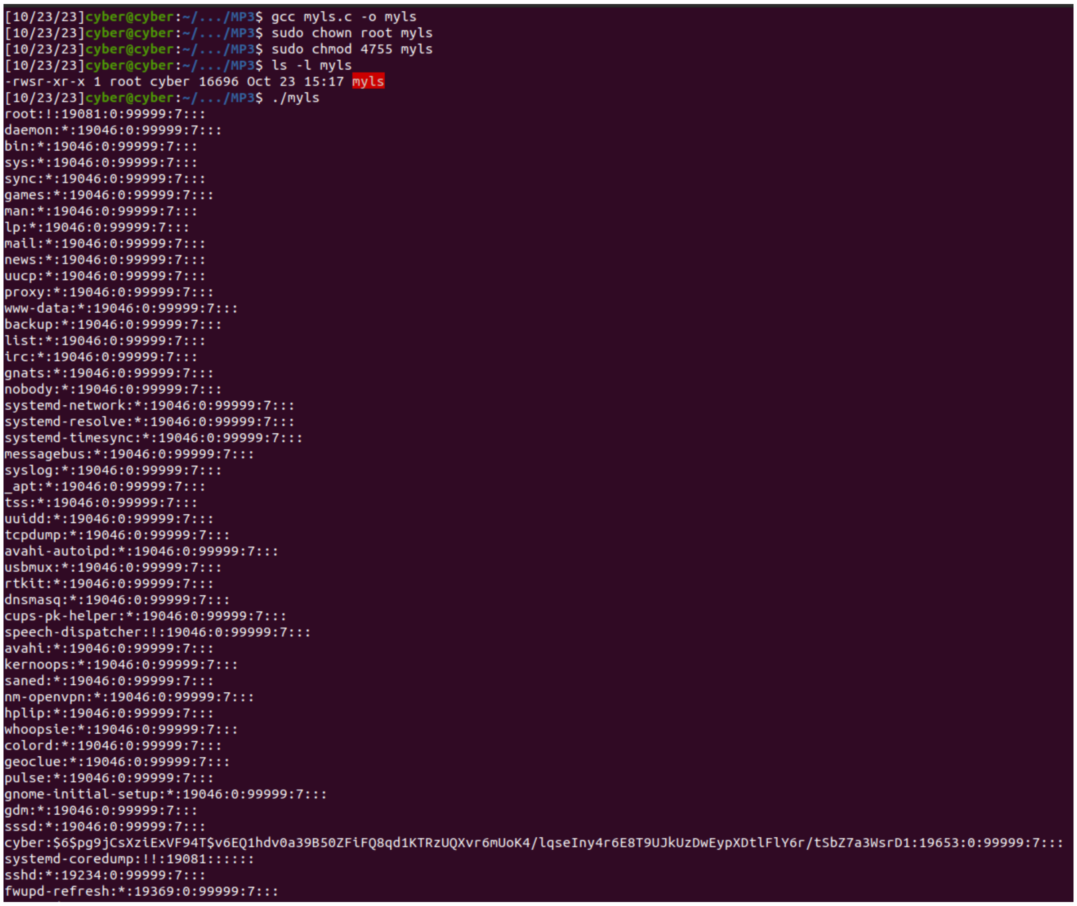
```
[10/23/23]cyber@cyber:~/.../MP3$ export PATH=/home/seed:$PATH.
[10/23/23]cyber@cyber:~/.../MP3$ gcc myls.c -o myls
[10/23/23]cyber@cyber:~/.../MP3$ ./myls
cat: /etc/shadow: Permission denied
[10/23/23]cyber@cyber:~/.../MP3$ sudo chown root myls
[10/23/23]cyber@cyber:~/.../MP3$ sudo chmod 4755 myls
[10/23/23]cyber@cyber:~/.../MP3$ ls -l myls
-rwsr-xr-x 1 root cyber 16696 Oct 23 13:05 myls
[10/23/23]cyber@cyber:~/.../MP3$ ./myls
root:!:19081:0:99999:7:::
daemon:*:19046:0:99999:7:::
bin:*:19046:0:99999:7:::
sys:*:19046:0:99999:7:::
sync:*:19046:0:99999:7:::
games:*:19046:0:99999:7:::
man:*:19046:0:99999:7:::
lp:*:19046:0:99999:7:::
mail:*:19046:0:99999:7:::
news:*:19046:0:99999:7:::
uucp:*:19046:0:99999:7:::
proxy:*:19046:0:99999:7:::
www-data:*:19046:0:99999:7:::
backup:*:19046:0:99999:7:::
list:*:19046:0:99999:7:::
irc:*:19046:0:99999:7:::
gnats:*:19046:0:99999:7:::
nobody:*:19046:0:99999:7:::
systemd-network:*:19046:0:99999:7:::
systemd-resolve:*:19046:0:99999:7:::
systemd-timesync:*:19046:0:99999:7:::
messagebus:*:19046:0:99999:7:::
syslog:*:19046:0:99999:7:::
_apt:*:19046:0:99999:7:::
tss:*:19046:0:99999:7:::
uuidd:*:19046:0:99999:7:::
tcpdump:*:19046:0:99999:7:::
avahi-autoipd:*:19046:0:99999:7:::
usbmux:*:19046:0:99999:7:::
rtkit:*:19046:0:99999:7:::
dnsmasq:*:19046:0:99999:7:::
cups-pk-helper:*:19046:0:99999:7:::
speech-dispatcher:!:19046:0:99999:7:::
avahi:*:19046:0:99999:7:::
kernoops:*:19046:0:99999:7:::
saned:*:19046:0:99999:7:::
nm-openvpn:*:19046:0:99999:7:::
hplip:*:19046:0:99999:7:::
whoopsie:*:19046:0:99999:7:::
colord:*:19046:0:99999:7:::
geoclue:*:19046:0:99999:7:::
pulse:*:19046:0:99999:7:::
gnome-initial-setup:*:19046:0:99999:7:::
gdm:*:19046:0:99999:7:::
sssd:*:19046:0:99999:7:::
cyber:$6$pg9jCsXziExVF94T$v6EQ1hdv0a39B50ZFiFQ8qd1KTRzUQXvr6mUoK4/lqseIny4r6E8T9UJkUzDwEypXDtlFlY6r/tSbZ7a3WsrD1:19653:0:99999:7:::
```



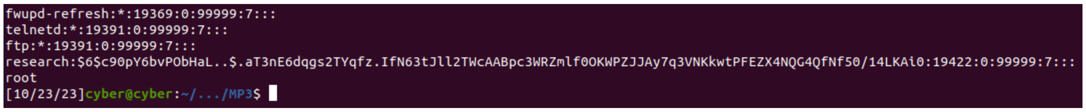
```
cyber:$6$pg9jCsXziExVF94T$v6EQ1hdv0a39B50ZFiFQ8qd1KTRzUQXvr6mUoK4/lqseIny4r6E8T9UJkUzDwEypXDtlFlY6r/tSbZ7a3WsrD1:19653:0:99999:7:::
systemd-coredump:!!:19081::::::
sshd:*:19234:0:99999:7:::
fwupd-refresh:*:19369:0:99999:7:::
telnetd:*:19391:0:99999:7:::
ftp:*:19391:0:99999:7:::
research:$6$c90pY6bvPObHaL..$.aT3nE6dqgs2TYqfz.IfN63tJll2TWcAABpc3WRZmlf0OKWPZJJAy7q3VNKkwtPFEZX4NQG4QfNf50/14LKAi0:19422:0:99999:7:::
[10/23/23]cyber@cyber:~/.../MP3$ 
```



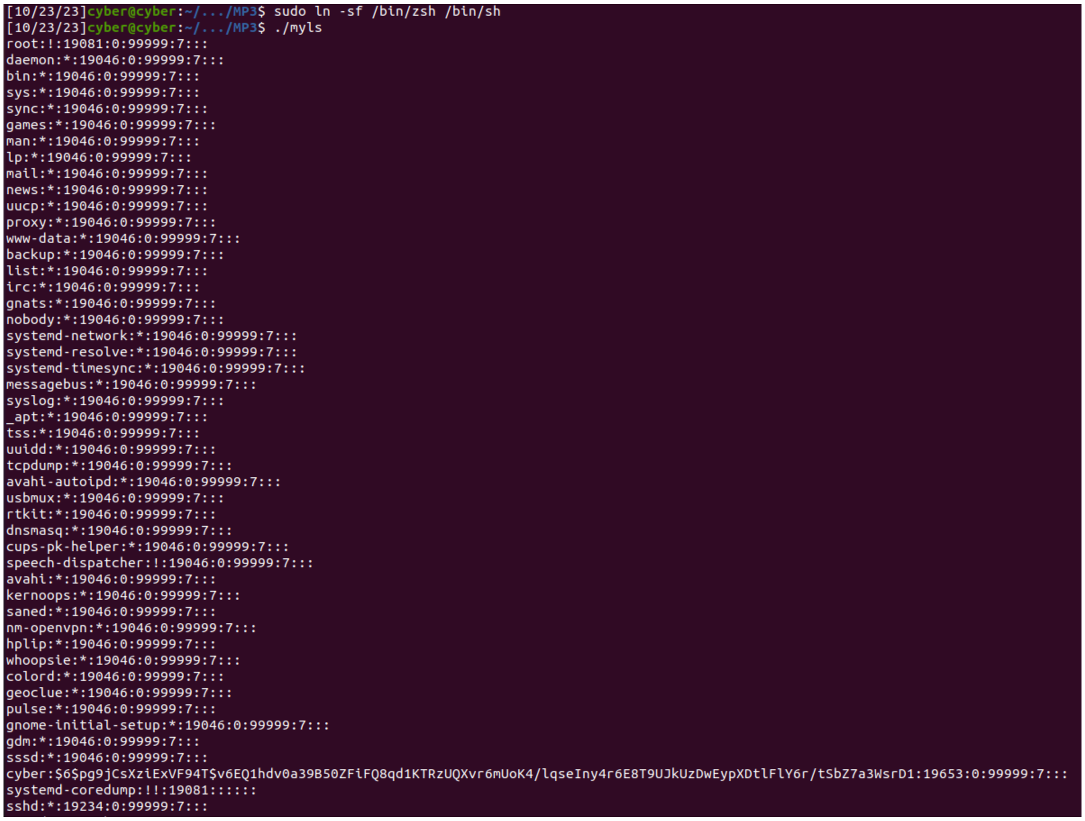
```c
#include<stdio.h>
#include<stdlib.h>

int main()
{
        system("cat /etc/shadow");
        system("whoami");
        return 0;
}
```



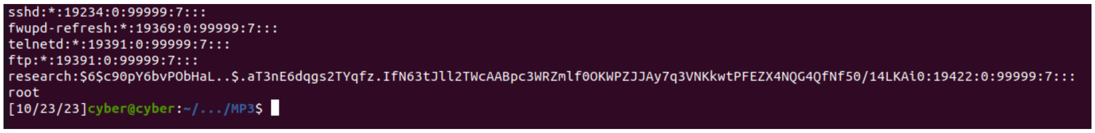
```
[10/23/23]cyber@cyber:~/.../MP3$ gcc myls.c -o myls
[10/23/23]cyber@cyber:~/.../MP3$ sudo chown root myls
[10/23/23]cyber@cyber:~/.../MP3$ sudo chmod 4755 myls
[10/23/23]cyber@cyber:~/.../MP3$ ls -l myls
-rwsr-xr-x 1 root cyber 16696 Oct 23 15:17 myls
[10/23/23]cyber@cyber:~/.../MP3$ ./myls
root:!:19081:0:99999:7:::
daemon:*:19046:0:99999:7:::
bin:*:19046:0:99999:7:::
sys:*:19046:0:99999:7:::
sync:*:19046:0:99999:7:::
games:*:19046:0:99999:7:::
man:*:19046:0:99999:7:::
lp:*:19046:0:99999:7:::
mail:*:19046:0:99999:7:::
news:*:19046:0:99999:7:::
uucp:*:19046:0:99999:7:::
proxy:*:19046:0:99999:7:::
www-data:*:19046:0:99999:7:::
backup:*:19046:0:99999:7:::
list:*:19046:0:99999:7:::
irc:*:19046:0:99999:7:::
gnats:*:19046:0:99999:7:::
nobody:*:19046:0:99999:7:::
systemd-network:*:19046:0:99999:7:::
systemd-resolve:*:19046:0:99999:7:::
systemd-timesync:*:19046:0:99999:7:::
messagebus:*:19046:0:99999:7:::
syslog:*:19046:0:99999:7:::
_apt:*:19046:0:99999:7:::
tss:*:19046:0:99999:7:::
uuidd:*:19046:0:99999:7:::
tcpdump:*:19046:0:99999:7:::
avahi-autoipd:*:19046:0:99999:7:::
usbmux:*:19046:0:99999:7:::
rtkit:*:19046:0:99999:7:::
dnsmasq:*:19046:0:99999:7:::
cups-pk-helper:*:19046:0:99999:7:::
speech-dispatcher:!:19046:0:99999:7:::
avahi:*:19046:0:99999:7:::
kernoops:*:19046:0:99999:7:::
saned:*:19046:0:99999:7:::
nm-openvpn:*:19046:0:99999:7:::
hplip:*:19046:0:99999:7:::
whoopsie:*:19046:0:99999:7:::
colord:*:19046:0:99999:7:::
geoclue:*:19046:0:99999:7:::
pulse:*:19046:0:99999:7:::
gnome-initial-setup:*:19046:0:99999:7:::
gdm:*:19046:0:99999:7:::
sssd:*:19046:0:99999:7:::
cyber:$6$pg9jCsXziExVF94T$v6EQ1hdv0a39B50ZFiFQ8qd1KTRzUQXvr6mUoK4/lqseIny4r6E8T9UJkUzDwEypXDtlFlY6r/tSbZ7a3WsrD1:19653:0:99999:7:::
systemd-coredump:!!:19081::::::
sshd:*:19234:0:99999:7:::
fwupd-refresh:*:19369:0:99999:7:::
```



```
fwupd-refresh:*:19369:0:99999:7:::
telnetd:*:19391:0:99999:7:::
ftp:*:19391:0:99999:7:::
research:$6$c90pY6bvPObHaL..$.aT3nE6dqgs2TYqfz.IfN63tJll2TWcAABpc3WRZmlf0OKWPZJJAy7q3VNKkwtPFEZX4NQG4QfNf50/14LKAi0:19422:0:99999:7:::
root
[10/23/23]cyber@cyber:~/.../MP3$ 
```



```
[10/23/23]cyber@cyber:~/.../MP3$ sudo ln -sf /bin/zsh /bin/sh
[10/23/23]cyber@cyber:~/.../MP3$ ./myls
root:!:19081:0:99999:7:::
daemon:*:19046:0:99999:7:::
bin:*:19046:0:99999:7:::
sys:*:19046:0:99999:7:::
sync:*:19046:0:99999:7:::
games:*:19046:0:99999:7:::
man:*:19046:0:99999:7:::
lp:*:19046:0:99999:7:::
mail:*:19046:0:99999:7:::
news:*:19046:0:99999:7:::
uucp:*:19046:0:99999:7:::
proxy:*:19046:0:99999:7:::
www-data:*:19046:0:99999:7:::
backup:*:19046:0:99999:7:::
list:*:19046:0:99999:7:::
irc:*:19046:0:99999:7:::
gnats:*:19046:0:99999:7:::
nobody:*:19046:0:99999:7:::
systemd-network:*:19046:0:99999:7:::
systemd-resolve:*:19046:0:99999:7:::
systemd-timesync:*:19046:0:99999:7:::
messagebus:*:19046:0:99999:7:::
syslog:*:19046:0:99999:7:::
_apt:*:19046:0:99999:7:::
tss:*:19046:0:99999:7:::
uuidd:*:19046:0:99999:7:::
tcpdump:*:19046:0:99999:7:::
avahi-autoipd:*:19046:0:99999:7:::
usbmux:*:19046:0:99999:7:::
rtkit:*:19046:0:99999:7:::
dnsmasq:*:19046:0:99999:7:::
cups-pk-helper:*:19046:0:99999:7:::
speech-dispatcher:!:19046:0:99999:7:::
avahi:*:19046:0:99999:7:::
kernoops:*:19046:0:99999:7:::
saned:*:19046:0:99999:7:::
nm-openvpn:*:19046:0:99999:7:::
hplip:*:19046:0:99999:7:::
whoopsie:*:19046:0:99999:7:::
colord:*:19046:0:99999:7:::
geoclue:*:19046:0:99999:7:::
pulse:*:19046:0:99999:7:::
gnome-initial-setup:*:19046:0:99999:7:::
gdm:*:19046:0:99999:7:::
sssd:*:19046:0:99999:7:::
cyber:$6$pg9jCsXziExVF94T$v6EQ1hdv0a39B50ZFiFQ8qd1KTRzUQXvr6mUoK4/lqseIny4r6E8T9UJkUzDwEypXDtlFlY6r/tSbZ7a3WsrD1:19653:0:99999:7:::
systemd-coredump:!!:19081::::::
sshd:*:19234:0:99999:7:::
```



```
sshd:*:19234:0:99999:7:::
fwupd-refresh:*:19369:0:99999:7:::
telnetd:*:19391:0:99999:7:::
ftp:*:19391:0:99999:7:::
research:$6$c90pY6bvPObHaL..$.aT3nE6dqgs2TYqfz.IfN63tJll2TWcAABpc3WRZmlf0OKWPZJJAy7q3VNKkwtPFEZX4NQG4QfNf50/14LKAi0:19422:0:99999:7:::
root
[10/23/23]cyber@cyber:~/.../MP3$ 
```