

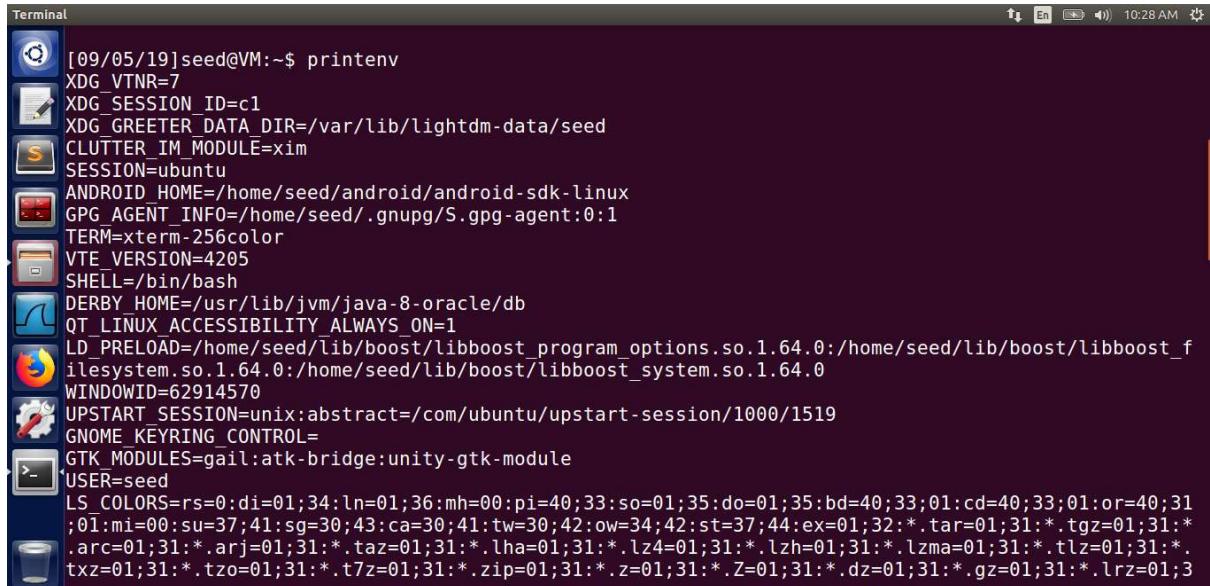
# Assignment 1

NAME: RISHI KUMAR SONI

UTA-ID: 1001774020

## Task 1

### Environment Variable



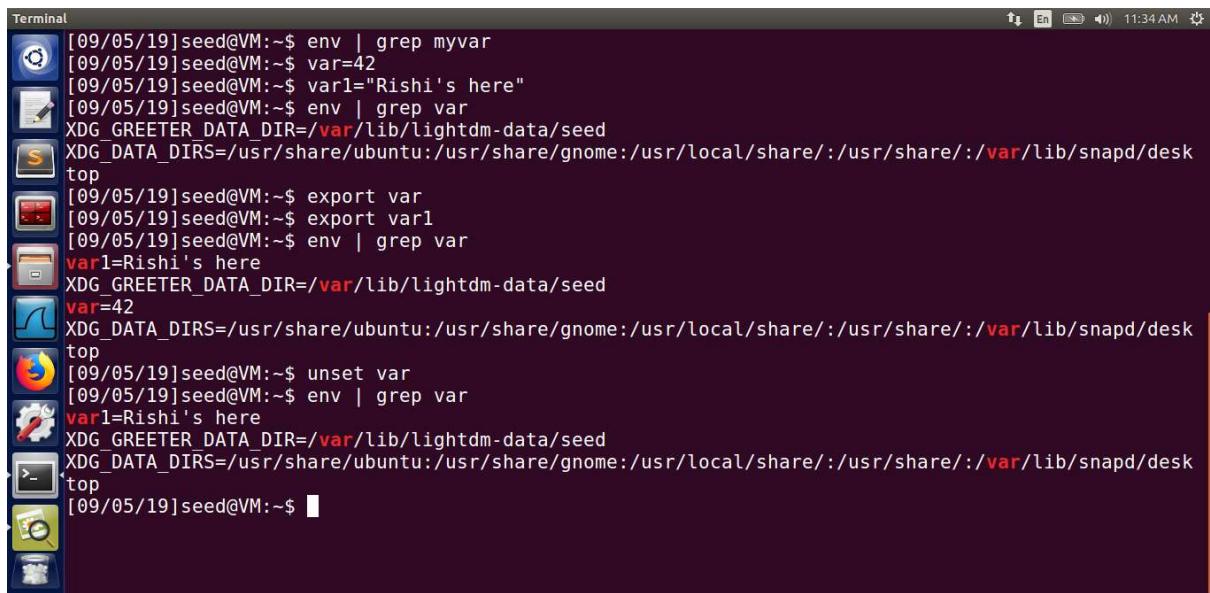
The screenshot shows a terminal window on a Linux desktop. The title bar says "Terminal". The window contains a list of environment variables. At the top, it shows the date and time: [09/05/19]seed@VM:~\$ printenv. Below this is a long list of variables:

```
[09/05/19]seed@VM:~$ printenv
XDG_VTNR=7
XDG_SESSION_ID=c1
XDG_GREETER_DATA_DIR=/var/lib/lightdm-data/seed
CLUTTER_IM_MODULE=xim
SESSION=ubuntu
ANDROID_HOME=/home/seed/android/android-sdk-linux
GPG_AGENT_INFO=/home/seed/.gnupg/S.gpg-agent:0:1
TERM=xterm-256color
VTE_VERSION=4205
SHELL=/bin/bash
DERBY_HOME=/usr/lib/jvm/java-8-oracle/db
QT_LINUX_ACCESSIBILITY_ALWAYS_ON=1
LD_PRELOAD=/home/seed/lib/boost/libboost_program_options.so.1.64.0:/home/seed/lib/boost/libboost_filesystem.so.1.64.0:/home/seed/lib/boost/libboost_system.so.1.64.0
WINDOWID=62914570
UPSTART_SESSION=unix:abstract=/com/ubuntu/upstart-session/1000/1519
GNOME_KEYRING_CONTROL=
GTK_MODULES=gail:atk-bridge:unity-gtk-module
USER=seed
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:*.Z=01;31:*.dz=01;31:*.gz=01;31:*.lrz=01;3
1:*.xz=01;31:*.bz2=01;31:*.bz=01;31:*.tbz=01;31:*.tbz2=01;31:*.xz=01;31:*.bz=01;31:*.bz2=01;31:*
```

```
Terminal
DESKTOP_SESSION=ubuntu
PATH=/home/seed/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:./snap/bin:/usr/lib/jvm/java-8-oracle/bin:/usr/lib/jvm/java-8-oracle/db/bin:/usr/lib/jvm/java-8-oracle/jre/bin:/home/seed/android/android-sdk-linux/tools:/home/seed/android/android-sdk-linux/platform-tools:/home/seed/android/android-ndk/android-ndk-r8d:/home/seed/.local/bin
QT_IM_MODULE=ibus
QT_QPA_PLATFORMTHEME=appmenu-qt5
XDG_SESSION_TYPE=x11
PWD=/home/seed
JOB=unity-settings-daemon
XMODIFIERS=@im=ibus
JAVA_HOME=/usr/lib/jvm/java-8-oracle
GNOME_KEYRING_PID=
LANG=en_US.UTF-8
GDM_LANG=en_US
MANDATORY_PATH=/usr/share/gconf/ubuntu.mandatory.path
COMPIZ_CONFIG_PROFILE=ubuntu-lowgfx
IM_CONFIG_PHASE=1
GDMSESSION=ubuntu
SESSIONTYPE=gnome-session
GTK2_MODULES=overlay-scrollbar
SHLVL=1
HOME=/home/seed
XDG_SEAT=seat0
LANGUAGE=en_US
```

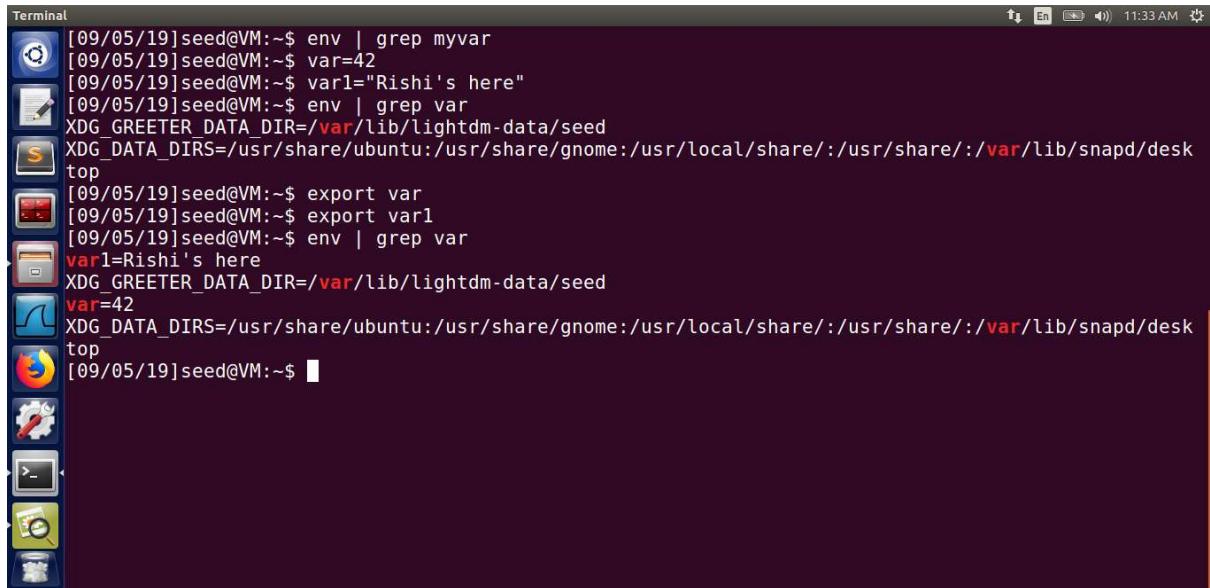
```
Terminal
UPSTART_EVENTS=xsession started
XDG_SESSION_DESKTOP=ubuntu
LOGNAME=seed
COMPIZ_BIN_PATH=/usr/bin/
DBUS_SESSION_BUS_ADDRESS=unix:abstract=/tmp/dbus-wAt2iWsivt
J2SDKDIR=/usr/lib/jvm/java-8-oracle
XDG_DATA_DIRS=/usr/share/ubuntu:/usr/share/gnome:/usr/local/share/:/usr/share/:/var/lib/snapd/desktop
QT4_IM_MODULE=xim
LESSOPEN=| /usr/bin/lesspipe %
INSTANCE=
UPSTART_JOB=unity7
XDG_RUNTIME_DIR=/run/user/1000
DISPLAY=:0
XDG_CURRENT_DESKTOP=Unity
GTK_IM_MODULE=ibus
J2REDIR=/usr/lib/jvm/java-8-oracle/jre
LESSCLOSE=/usr/bin/lesspipe %s %s
XAUTHORITY=/home/seed/.Xauthority
_=~/usr/bin/printenv
OLDPWD=/home/seed/rishi
[09/05/19]seed@VM:~$ printenv pwd
[09/05/19]seed@VM:~$ printenv PWD
/home/seed
[09/05/19]seed@VM:~$ 
```

SET AND UNSET



```
[09/05/19]seed@VM:~$ env | grep myvar
[09/05/19]seed@VM:~$ var=42
[09/05/19]seed@VM:~$ var1="Rishi's here"
[09/05/19]seed@VM:~$ env | grep var
XDG_GREETER_DATA_DIR=/var/lib/lightdm-data/seed
XDG_DATA_DIRS=/usr/share/ubuntu:/usr/share/gnome:/usr/local/share/:/usr/share/:/var/lib/snapd/desktop
[09/05/19]seed@VM:~$ export var
[09/05/19]seed@VM:~$ export var1
[09/05/19]seed@VM:~$ env | grep var
var1=Rishi's here
XDG_GREETER_DATA_DIR=/var/lib/lightdm-data/seed
var=42
XDG_DATA_DIRS=/usr/share/ubuntu:/usr/share/gnome:/usr/local/share/:/usr/share/:/var/lib/snapd/desktop
[09/05/19]seed@VM:~$ unset var
[09/05/19]seed@VM:~$ env | grep var
var1=Rishi's here
XDG_GREETER_DATA_DIR=/var/lib/lightdm-data/seed
XDG_DATA_DIRS=/usr/share/ubuntu:/usr/share/gnome:/usr/local/share/:/usr/share/:/var/lib/snapd/desktop
[09/05/19]seed@VM:~$ █
```

## VARIABLE EXPORT



```
[09/05/19]seed@VM:~$ env | grep myvar
[09/05/19]seed@VM:~$ var=42
[09/05/19]seed@VM:~$ var1="Rishi's here"
[09/05/19]seed@VM:~$ env | grep var
XDG_GREETER_DATA_DIR=/var/lib/lightdm-data/seed
XDG_DATA_DIRS=/usr/share/ubuntu:/usr/share/gnome:/usr/local/share/:/usr/share/:/var/lib/snapd/desktop
[09/05/19]seed@VM:~$ export var
[09/05/19]seed@VM:~$ export var1
[09/05/19]seed@VM:~$ env | grep var
var1=Rishi's here
XDG_GREETER_DATA_DIR=/var/lib/lightdm-data/seed
var=42
XDG_DATA_DIRS=/usr/share/ubuntu:/usr/share/gnome:/usr/local/share/:/usr/share/:/var/lib/snapd/desktop
[09/05/19]seed@VM:~$ █
```

## Task 2

CODE SNIPPET

## -Inheriting Environment Variable from parent

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

extern char **environ;

void printenv()
{
int i = 0;
while(environ[i] != NULL) {
printf("%s\n", environ[i]);
i++;
}
}

void main()
{
pid_t childPid;

switch(childPid = fork()) {
case 0:
printenv();
exit(0);
default:

exit(0);
}
```

CHILD ENV

Terminal

```
[09/05/19]seed@VM:~/Desktop$ gcc Child.c -o Child
[09/05/19]seed@VM:~/Desktop$ ./Child
XDG_VTNR=7
XDG_SESSION_ID=c1
XDG_GREETER_DATA_DIR=/var/lib/lightdm-data/seed
CLUTTER_IM_MODULE=xim
SESSION=ubuntu
ANDROID_HOME=/home/seed/android/android-sdk-linux
GPG_AGENT_INFO=/home/seed/.gnupg/S.gpg-agent:0:1
TERM=xterm-256color
VTE_VERSION=4205
SHELL=/bin/bash
DERBY_HOME=/usr/lib/jvm/java-8-oracle/db
QT_LINUX_ACCESSIBILITY_ALWAYS_ON=1
LD_PRELOAD=/home/seed/lib/boost/libboost_program_options.so.1.64.0:/home/seed/lib/boost/libboost_filesystem.so.1.64.0:/home/seed/lib/boost/libboost_system.so.1.64.0
WINDOWID=62914570
UPSTART_SESSION=unix:abstract=/com/ubuntu/upstart-session/1000/1519
GNOME_KEYRING_CONTROL=
GTK_MODULES=gail:atk-bridge:unity-gtk-module
USER=seed
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;4
```

Terminal

```
0;36;*.oga=00;36;*.opus=00;36;*.spx=00;36;*.xspf=00;36;
QT_ACCESSIBILITY=1
LD_LIBRARY_PATH=/home/seed/source/boost_1_64_0/stage/lib:/home/seed/source/boost_1_64_0/stage/lib:
XDG_SESSION_PATH=/org/freedesktop/DisplayManager/Session0
XDG_SEAT_PATH=/org/freedesktop/DisplayManager/Seat0
SSH_AUTH_SOCK=/run/user/1000/keyring/ssh
DEFAULTS_PATH=/usr/share/gconf/ubuntu.default.path
XDG_CONFIG_DIRS=/etc/xdg/xdg-ubuntu:/usr/share/upstart/xdg:/etc/xdg
DESKTOP_SESSION=ubuntu
PATH=/home/seed/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin
:/usr/games:/usr/local/games:./snap/bin:/usr/lib/jvm/java-8-oracle/bin:/usr/lib/jvm/java-8-oracle/db/bin:/usr/lib/jvm/java-8-oracle/jre/bin:/home/seed/android/android-sdk-linux/tools:/home/seed/android/android-sdk-linux/platform-tools:/home/seed/android/android-ndk/android-ndk-r8d:/home/seed/.local/bin
QT_IM_MODULE=ibus
QT_QPA_PLATFORMTHEME=appmenu-qt5
XDG_SESSION_TYPE=x11
PWD=/home/seed/Desktop
JOB=unity-settings-daemon
XMODIFIERS=@im=ibus
JAVA_HOME=/usr/lib/jvm/java-8-oracle
GNOME_KEYRING_PID=
LANG=en_US.UTF-8
```

Terminal

```
#include <unistd.h>
#include <stdio.h>
#include <stdlib.h>
extern char **environ;
void printenv()
{
    int i = 0;
    while (environ[i] != NULL)
    {
        printf("%s\n", environ[i]);
        i++;
    }
}
void main()
{
    pid_t childPid;
    switch(childPid = fork())
    {
        case 0: /* child process */
        printenv();
        exit(0);
        default:/* parent process */
        //printenv();
        exit(0); }
}
```

GNOME\_DESKTOP\_SESSION\_ID=this-is-deprecated  
UPSTART\_INSTANCE=  
UPSTART\_EVENTS=xsession started  
XDG\_SESSION\_DESKTOP=ubuntu  
LOGNAME=seed  
COMPIZ\_BIN\_PATH=/usr/bin/  
DBUS\_SESSION\_BUS\_ADDRESS=unix:abstract=/tmp/dbus-wAt2iWsivt  
J2SDKDIR=/usr/lib/jvm/java-8-oracle  
XDG\_DATA\_DIRS=/usr/share/ubuntu:/usr/share/gnome:/usr/local/share/:/usr/share/:/var/lib/snapd/desktop  
QT4\_IM\_MODULE=xim  
LESSOPEN=| /usr/bin/lesspipe %s  
INSTANCE=  
UPSTART\_JOB=unity7  
XDG\_RUNTIME\_DIR=/run/user/1000  
DISPLAY=:0  
XDG\_CURRENT\_DESKTOP=Unity  
GTK\_IM\_MODULE=ibus  
J2REDIR=/usr/lib/jvm/java-8-oracle/jre  
LESSCLOSE=/usr/bin/lesspipe %s %s  
XAUTHORITY=/home/seed/.Xauthority  
OLDPWD=/home/seed  
./Child  
[09/05/19]seed@VM:~/Desktop\$

## PARENT ENV

Terminal

```
#include <unistd.h>
#include <stdio.h>
#include <stdlib.h>
extern char **environ;
void printenv()
{
    int i = 0;
    while (environ[i] != NULL)
    {
        printf("%s\n", environ[i]);
        i++;
    }
}
void main()
{
    pid_t childPid;
    switch(childPid = fork())
    {
        case 0: /* child process */
        //printenv();
        exit(0);
        default:/* parent process */
        printenv();
        exit(0); }
```

[09/05/19]seed@VM:~/Desktop\$ gcc Parent.c -o Parent  
[09/05/19]seed@VM:~/Desktop\$ ./Parent  
XDG\_VTNR=7  
XDG\_SESSION\_ID=c1  
XDG\_GREETER\_DATA\_DIR=/var/lib/lightdm-data/seed  
CLUTTER\_IM\_MODULE=xim  
SESSION=ubuntu  
ANDROID\_HOME=/home/seed/android/android-sdk-linux  
GPG\_AGENT\_INFO=/home/seed/.gnupg/S.gpg-agent:0:1  
TERM=xterm-256color  
VTE\_VERSION=4205  
SHELL=/bin/bash  
DERBY\_HOME=/usr/lib/jvm/java-8-oracle/db  
QT\_LINUX\_ACCESSIBILITY\_ALWAYS\_ON=1  
LD\_PRELOAD=/home/seed/lib/boost/libboost\_program\_options.so.1.64.0:/home/seed/lib/boost/libboost\_filesystem.so.1.64.0:/home/seed/lib/boost/libboost\_system.so.1.64.0  
WINDOWID=62914570  
UPSTART\_SESSION=unix:abstract=/com/ubuntu/upstart-session/1000/1519  
GNOME\_KEYRING\_CONTROL=  
GTK\_MODULES=gail:atk-bridge:unity-gtk-module  
USER=seed  
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;4

```

Terminal
# include <unistd.h>
# include <stdio.h>
# include <stdlib.h>
extern char **environ;
void printenv()
{
    int i = 0;
    while (environ[i] != NULL)
    {
        printf("%s\n", environ[i]);
        i++;
    }
}
void main()
{
    pid_t childPid;
    switch(childPid = fork())
    {
        case 0: /* child process */
        //printenv();
        exit(0);
        default: /* parent process */
        printenv();
        exit(0);
    }
}

```

```

1_64 0/stage/lib:
XDG_SESSION_PATH=/org/freedesktop/DisplayManager/Session0
XDG_SEAT_PATH=/org/freedesktop/DisplayManager/Seat0
SSH_AUTH_SOCK=/run/user/1000/keyring/ssh
DEFAULTS_PATH=/usr/share/gconf/ubuntu.default.path
XDG_CONFIG_DIRS=/etc/xdg/xdg-ubuntu:/usr/share/upstart/xdg:/etc/xdg
DESKTOP_SESSION=ubuntu
PATH=/home/seed/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin
:/usr/games:/usr/local/games:::/snap/bin:/usr/lib/jvm/java-8-oracle/bin:/usr/lib
/jvm/java-8-oracle/db/bin:/usr/lib/jvm/java-8-oracle/jre/bin:/home/seed/android/
android-sdk-linux/tools:/home/seed/android/android-sdk-linux/platform-tools:/hom
e/seed/android/android-ndk/android-ndk-r8d:/home/seed/.local/bin
QT_IM_MODULE=ibus
QT_QPA_PLATFORMTHEME=appmenu-qt5
XDG_SESSION_TYPE=x11
PWD=/home/seed/Desktop
JOB=unity-settings-daemon
XMODIFIERS=@im=ibus
JAVA_HOME=/usr/lib/jvm/java-8-oracle
GNOME_KEYRING_PID=
LANG=en_US.UTF-8
GDM_LANG=en_US
MANDATORY_PATH=/usr/share/gconf/ubuntu.mandatory.path
COMPIZ_CONFIG_PROFILE=ubuntu-lowgfx

```

```

Terminal
# include <unistd.h>
# include <stdio.h>
# include <stdlib.h>
extern char **environ;
void printenv()
{
    int i = 0;
    while (environ[i] != NULL)
    {
        printf("%s\n", environ[i]);
        i++;
    }
}
void main()
{
    pid_t childPid;
    switch(childPid = fork())
    {
        case 0: /* child process */
        //printenv();
        exit(0);
        default: /* parent process */
        printenv();
        exit(0);
    }
}

```

```

GNOME_DESKTOP_SESSION_ID=this-is-deprecated
UPSTART_INSTANCE=
UPSTART_EVENTS=xsession started
XDG_SESSION_DESKTOP=ubuntu
LOGNAME=seed
COMPIZ_BIN_PATH=/usr/bin/
DBUS_SESSION_BUS_ADDRESS=unix:abstract=/tmp/dbus-wAt2iWsivt
J2SDKDIR=/usr/lib/jvm/java-8-oracle
XDG_DATA_DIRS=/usr/share/ubuntu:/usr/share/gnome:/usr/local/share/:/usr/share/:
var/lib/snap/desktop
QT4_IM_MODULE=xim
LESSOPEN=| /usr/bin/lesspipe %
INSTANCE=
UPSTART_JOB=unity7
XDG_RUNTIME_DIR=/run/user/1000
DISPLAY=:0
XDG_CURRENT_DESKTOP=Unity
GTK_IM_MODULE=ibus
J2REDIR=/usr/lib/jvm/java-8-oracle/jre
LESSCLOSE=/usr/bin/lesspipe %s %s
XAUTHORITY=/home/seed/.Xauthority
OLDPWD=/home/seed
_=./Parent
[09/05/19]seed@VM:~/Desktop$ 

```

## DIFFERENCE BETWEEN PARENT AND CHILD ENV

difference child nd parent op.txt - Notepad  
File Edit Format View Help  
**Script started on Sat 07 Sep 2019 10:49:48 AM CDT**[09/07/19]seed@VM:-/.../Task2\$ diff ChildOutput ParentOutput  
1.3c1.3  
< **Script started on Thu 05 Sep 2019 03:46:16 PM CDT**  
< [09/05/19]seed@VM:-/Desktop\$ exit[0][KParent][Knt]  
< [09/05/19]seed@VM:-/Desktop\$ ./Child  
---  
> **Script started on Thu 05 Sep 2019 03:52:09 PM CDT**  
> [09/05/19]seed@VM:-/Desktop\$ exit[0][KParent][Knt]  
> [09/05/19]seed@VM:-/Desktop\$ gcc Child.c -o Child[0][KParent][Knt]  
> [09/05/19]seed@VM:-/Desktop\$ ./Child  
73c73  
< \_./Child  
---  
> \_./Parent  
77c77  
< **Script done on Thu 05 Sep 2019 03:47:10 PM CDT**  
---  
> **Script done on Thu 05 Sep 2019 03:52:52 PM CDT**  
[09/07/19]seed@VM:-/.../Task2\$ exit  
exit  
**Script done on Sat 07 Sep 2019 10:51:01 AM CDT**

# Observation

Child and Parent uses the different address spaces.

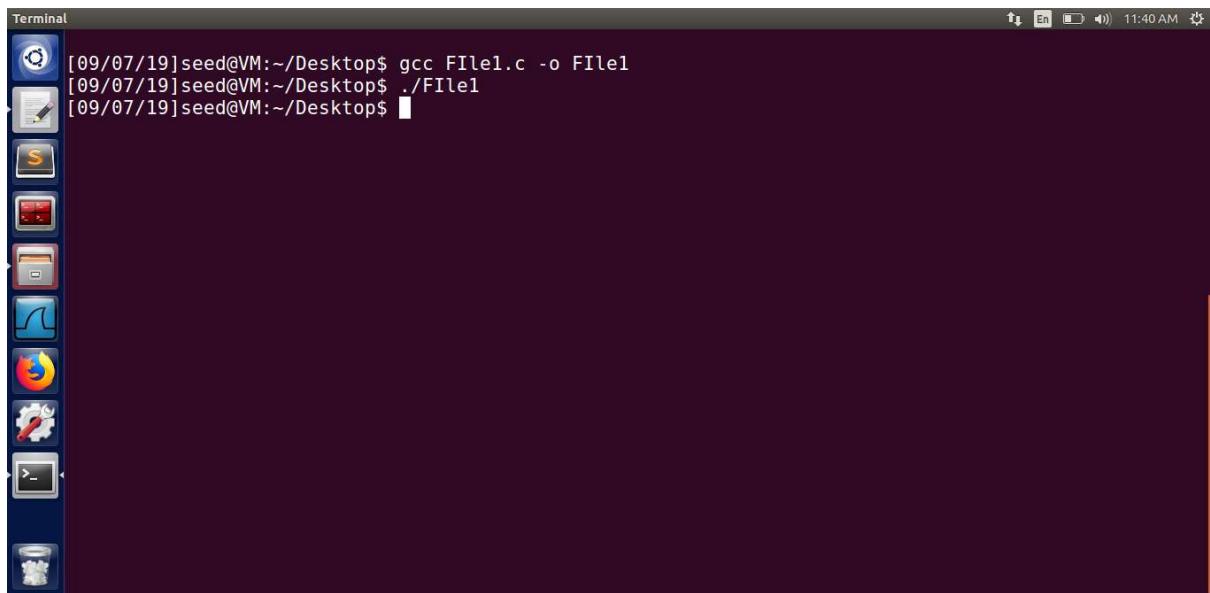
# Task3

## ENVIRONMENT VARIABLE

```
Terminal [09/07/19]seed@VM:~/Desktop$ ./File
XDG_VTNR=7
XDG_SESSION_ID=c1
XDG_GREETER_DATA_DIR=/var/lib/lightdm-data/seed
CLUTTER_IM_MODULE=xim
SESSION=ubuntu
ANDROID_HOME=/home/seed/android/android-sdk-linux
GPG_AGENT_INFO=/home/seed/.gnupg/S.gpg-agent:0:1
TERM=xterm-256color
VTE_VERSION=4205
SHELL=/bin/bash
DERBY_HOME=/usr/lib/jvm/java-8-oracle/db
QT_LINUX_ACCESSIBILITY_ALWAYS_ON=1
LD_PRELOAD=/home/seed/lib/boost/libboost_program_options.so.1.64.0:/home/seed/lib/boost/libboost_filesystem.so.1.64.0:/home/seed/lib/boost/libboost_system.so.1.64.0
WINDOWID=65011722
UPSTART_SESSION=unix:abstract=/com/ubuntu/upstart-session/1000/1519
GNOME_KEYRING_CONTROL=
GTK_MODULES=gail:atk-bridge:unity-gtk-module
USER=seed
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:*.Z=01;31:*.dz=01;31:*.gz=01;31:*.lrz=01;3
[09/07/19]seed@VM:~/Desktop$
```

```
Terminal LIBGL_ALWAYS_SOFTWARE=1
GNOME_DESKTOP_SESSION_ID=this-is-deprecated
UPSTART_INSTANCE=
UPSTART_EVENTS=xsession started
XDG_SESSION_DESKTOP=ubuntu
LOGNAME=seed
COMPIZ_BIN_PATH=/usr/bin/
DBUS_SESSION_BUS_ADDRESS=unix:abstract=/tmp/dbus-wAt2iWsivt
J2SDKDIR=/usr/lib/jvm/java-8-oracle
XDG_DATA_DIRS=/usr/share/ubuntu:/usr/share/gnome:/usr/local/share/:/usr/share/:/var/lib/snapd/desktop
QT4_IM_MODULE=xim
LESSOPEN=| /usr/bin/lesspipe %
INSTANCE=
UPSTART_JOB=unity7
XDG_RUNTIME_DIR=/run/user/1000
DISPLAY=:0
XDG_CURRENT_DESKTOP=Unity
GTK_IM_MODULE=ibus
J2REDIR=/usr/lib/jvm/java-8-oracle/jre
LESSCLOSE=/usr/bin/lesspipe %s %s
XAUTHORITY=/home/seed/.Xauthority
./File
OLDPWD=/home/seed
[09/07/19]seed@VM:~/Desktop$ ./File
```

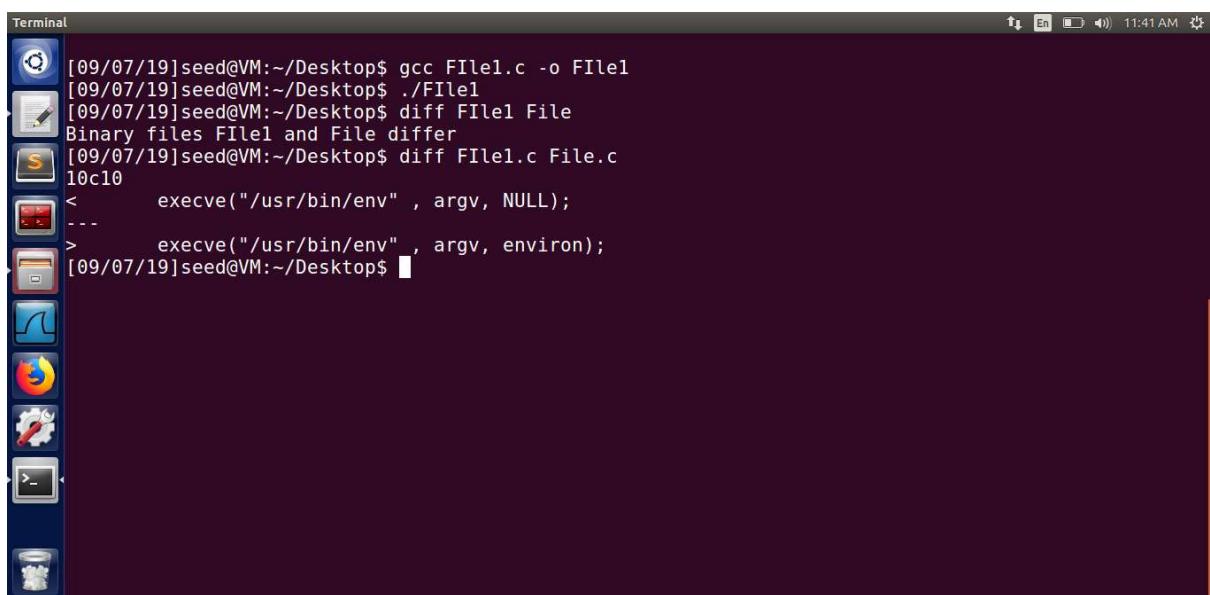
NULLARGUMENT



A screenshot of a Linux desktop environment, likely Ubuntu, showing a terminal window titled "Terminal". The terminal window contains the following command-line session:

```
[09/07/19]seed@VM:~/Desktop$ gcc File1.c -o File1
[09/07/19]seed@VM:~/Desktop$ ./File1
[09/07/19]seed@VM:~/Desktop$
```

### DIFFERENCE BETWEEN NULL AND ENVIRONMENT VARIABLE



A screenshot of a Linux desktop environment, likely Ubuntu, showing a terminal window titled "Terminal". The terminal window contains the following command-line session, demonstrating the difference between using NULL and environ as arguments for execve:

```
[09/07/19]seed@VM:~/Desktop$ gcc File1.c -o File1
[09/07/19]seed@VM:~/Desktop$ ./File1
[09/07/19]seed@VM:~/Desktop$ diff File1 File
Binary files File1 and File differ
[09/07/19]seed@VM:~/Desktop$ diff File1.c File.c
10c10
<     execve("/usr/bin/env" , argv, NULL);
---
>     execve("/usr/bin/env" , argv, environ);
[09/07/19]seed@VM:~/Desktop$
```

### CODE SNIPPET

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

extern char **environ;

int main()
{
char *argv[2];
```

```

argv[0] = "/usr/bin/env";
argv[1] = NULL;

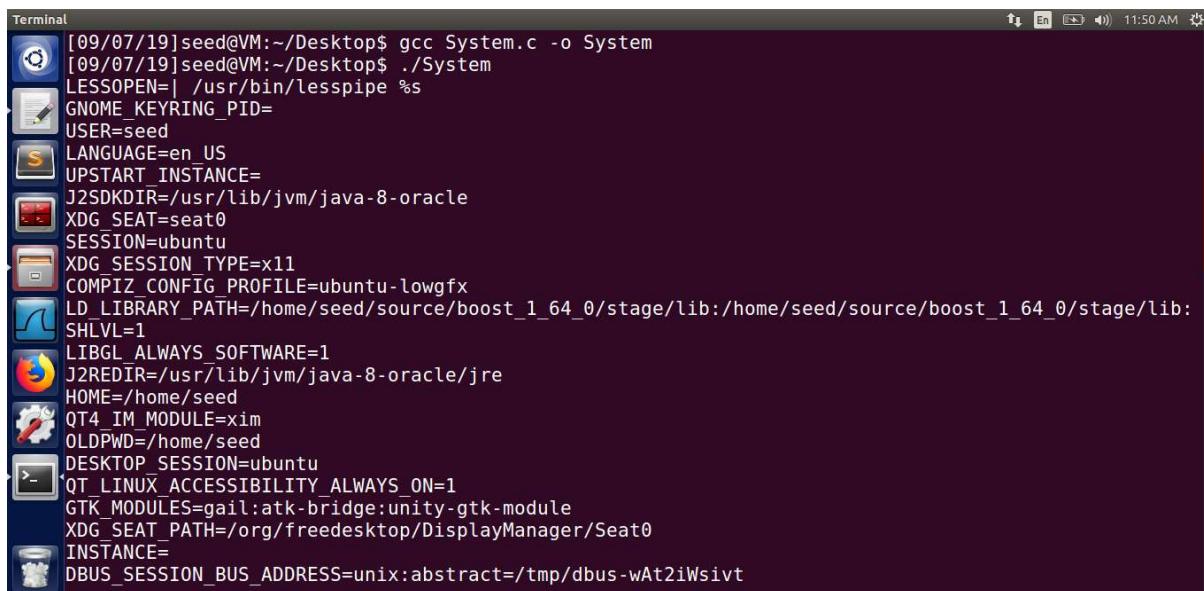
execve("/usr/bin/env", argv, NULL);

return 0;
}

```

## Task 4

### Environment Variable and System

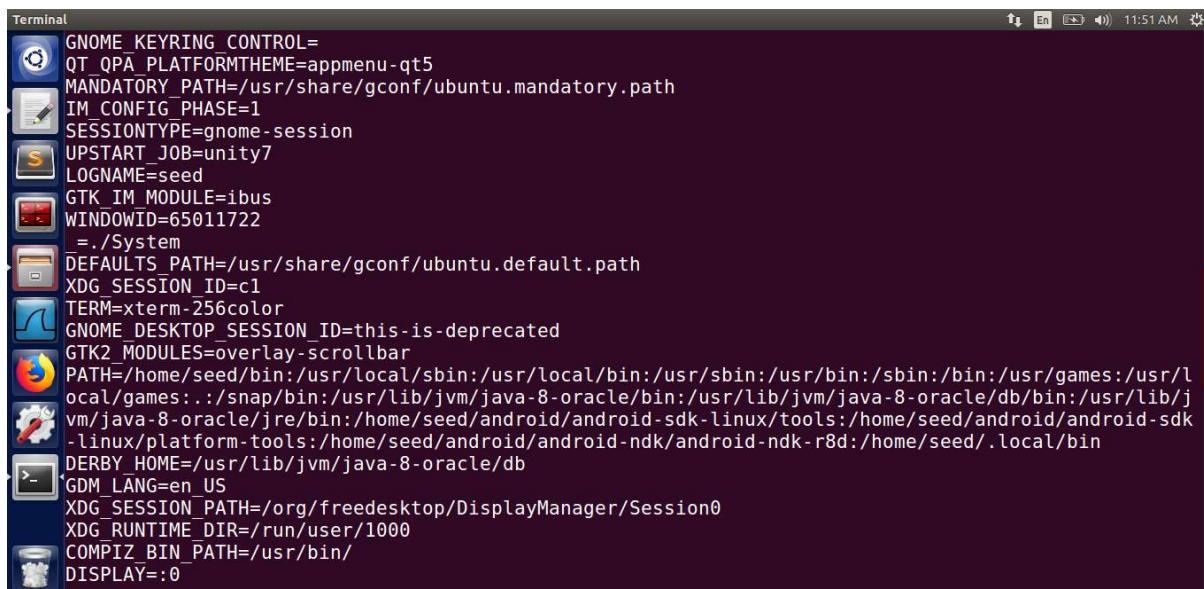


Terminal

```

[09/07/19]seed@VM:~/Desktop$ gcc System.c -o System
[09/07/19]seed@VM:~/Desktop$ ./System
LESSOPEN=| /usr/bin/lesspipe %s
GNOME_KEYRING_PID=
USER=seed
LANGUAGE=en_US
UPSTART_INSTANCE=
J2SDKDIR=/usr/lib/jvm/java-8-oracle
XDG_SEAT=seat0
SESSION=ubuntu
XDG_SESSION_TYPE=x11
COMPIZ_CONFIG_PROFILE=ubuntu-lowgfx
LD_LIBRARY_PATH=/home/seed/source/boost_1_64_0/stage/lib:/home/seed/source/boost_1_64_0/stage/lib:
SHLVL=1
LIBGL_ALWAYS_SOFTWARE=1
J2REDIR=/usr/lib/jvm/java-8-oracle/jre
HOME=/home/seed
QT_IM_MODULE=xim
OLDPWD=/home/seed
DESKTOP_SESSION=ubuntu
QT_LINUX_ACCESSIBILITY_ALWAYS_ON=1
GTK_MODULES=gail:atk-bridge:unity-gtk-module
XDG_SEAT_PATH=/org/freedesktop/DisplayManager/Seat0
INSTANCE=
DBUS_SESSION_BUS_ADDRESS=unix:abstract=/tmp/dbus-wAt2iWsivt

```



Terminal

```

GNOME_KEYRING_CONTROL=
QT_QPA_PLATFORMTHEME=appmenu-qt5
MANDATORY_PATH=/usr/share/gconf/ubuntu.mandatory.path
IM_CONFIG_PHASE=1
SESSIONTYPE=gnome-session
UPSTART_JOB=unity7
LOGNAME=seed
GTK_IM_MODULE=ibus
WINDOWID=65011722
./System
DEFAULTS_PATH=/usr/share/gconf/ubuntu.default.path
XDG_SESSION_ID=c1
TERM=xterm-256color
GNOME_DESKTOP_SESSION_ID=this-is-deprecated
GTK2_MODULES=overlay-scrollbar
PATH=/home/seed/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:../snap/bin:/usr/lib/jvm/java-8-oracle/bin:/usr/lib/jvm/java-8-oracle/db/bin:/usr/lib/jvm/java-8-oracle/jre/bin:/home/seed/android/android-sdk-linux/tools:/home/seed/android/android-sdk-linux/platform-tools:/home/seed/android/android-ndk/android-ndk-r8d:/home/seed/.local/bin
DERBY_HOME=/usr/lib/jvm/java-8-oracle/db
GDM_LANG=en_US
XDG_SESSION_PATH=/org/freedesktop/DisplayManager/Session0
XDG_RUNTIME_DIR=/run/user/1000
COMPIZ_BIN_PATH=/usr/bin/
DISPLAY=:0

```

```
Terminal ;01:mi=00:su=37;41:sg=30;43:ca=30;41:tw=30;42:ow=34;42:st=37;44:ex=01;31:*.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:*.Z=01;31:*.dz=01;31:*.gz=01;31:*.lrz=01;31:*.lz=01;31:*.lzo=01;31:*.xz=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:*.jpg=01;35:*.jpeg=01;35:*.gif=01;35:*.bmp=01;35:*.pbm=01;35:*.pgm=01;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:*.webm=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:*.gm=01;35:*.emf=01;35:*.ovg=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:*.ogg=00;36:*.mpc=00;36:*.ra=00;36:*.wav=00;36:*.oga=00;36:*.opus=00;36:*.spx=00;36:*.xspf=00;36: XMODIFIERS=@im=ibus XDG_SESSION_DESKTOP=ubuntu XAUTHORITY=/home/seed/.Xauthority XDG_GREETER_DATA_DIR=/var/lib/lightdm-data/seed SSH_AUTH_SOCK=/run/user/1000/keyring/ssh SHELL=/bin/bash QT_ACCESSIBILITY=1 GDMSESSION=ubuntu LESSCLOSE=/usr/bin/lesspipe %s %s UPSTART_EVENTS=xsession started GPG_AGENT_INFO=/home/seed/.gnupg/S.gpg-agent:0:1
```

# CODE SNIPPET

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

int main()
{
    system("/usr/bin/env");

    return 0;
}
```

## Task 5

## -Environment and Set UID

## CODE SNIPPET

```

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

extern char **environ;

void main()
{
int i = 0;
while(environ[i] != NULL) {
printf("%s\n", environ[i]);
i++;
}
}

root@VM: /home/seed
root@VM:/home/seed# vim task5.c
root@VM:/home/seed# gcc -o task5 task5.c
root@VM:/home/seed# chmod u+s task5
root@VM:/home/seed# exit
logout
[09/08/19]seed@VM:/home$ cd ..
[09/08/19]seed@VM:$ cd ..
[09/08/19]seed@VM:$ ls
bin dev initrd.img media proc sbin sys var
boot etc lib mnt root snap tmp vmlinuz
cdrom home lost+found opt run srv usr
[09/08/19]seed@VM:$ cd ..
[09/08/19]seed@VM:$ cd ~
[09/08/19]seed@VM:~$ export MY_Env="task5"
[09/08/19]seed@VM:~$ export PATH=$task5:$PATH
[09/08/19]seed@VM:~$ ./task5 | grep "task5"
PATH=task5:foo.c:foo:my env:/home/seed/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin
:/bin:/usr/games:/usr/local/games:./snap/bin:/usr/lib/jvm/java-8-oracle/bin:/usr/lib/jvm/java-8-o
racle/db/bin:/usr/lib/jvm/java-8-oracle/jre/bin:/home/seed/android/android-sdk-linux/tools:/home/s
eed/android/android-sdk-linux/platform-tools:/home/seed/android/android-ndk/android-ndk-r8d:/home/
seed/.local/bin
MY_Env=task5
= ./task5
[09/08/19]seed@VM:~$ 

```

## Task6

-The Path Environment Variable and Set-UID

CODE SNIPPET

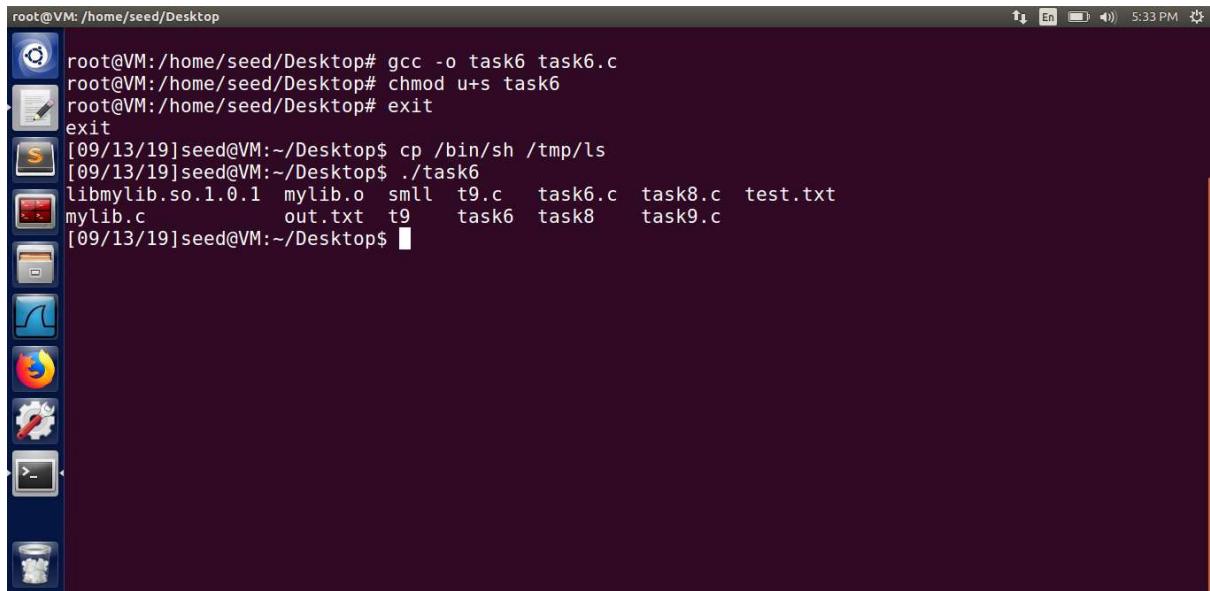
```

int main()
{
system("ls");
return 0;
}

```

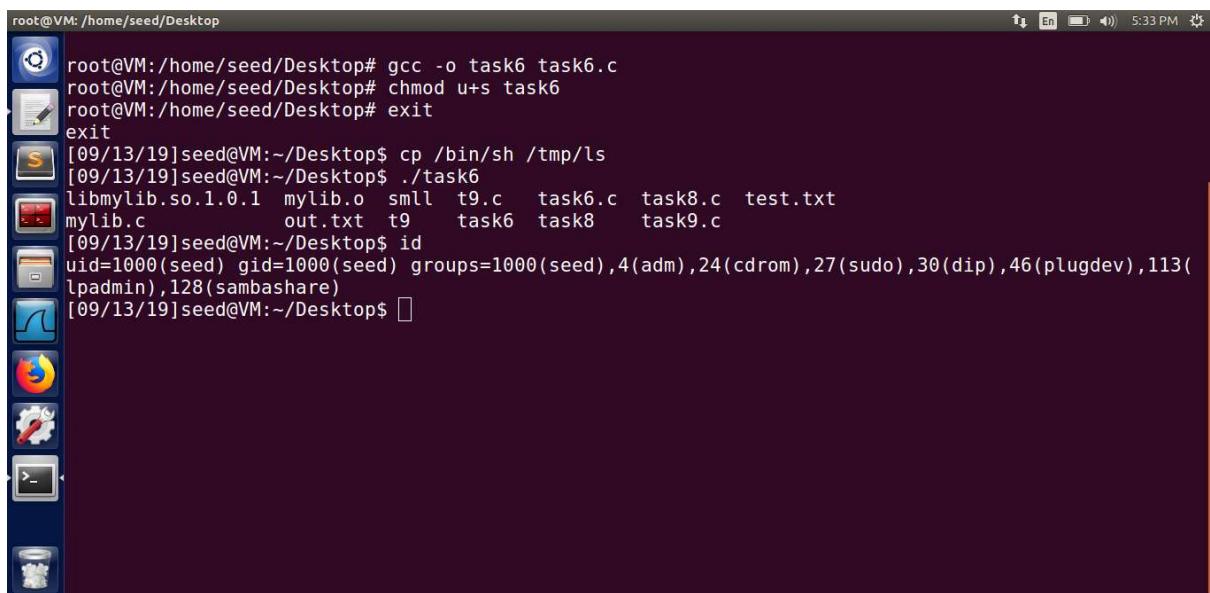
```
root@VM:/home/seed# vim task6.c
root@VM:/home/seed# gcc -o task6 task6.c
root@VM:/home/seed# chmod u+s task6
root@VM:/home/seed# exit
logout
[09/08/19]seed@VM:~$ ./task6
android      Desktop    examples.desktop  Music      source   Templates
bin          Documents  get-pip.py       Pictures  task6    typescript
Customization Downloads lib           Public    task6.c Videos
[09/08/19]seed@VM:~$ 
```

```
root@VM:/home/seed# vim task6.c
root@VM:/home/seed# gcc -o task6 task6.c
root@VM:/home/seed# chmod u+s task6
root@VM:/home/seed# exit
logout
[09/08/19]seed@VM:~$ ./task6
android      Desktop    examples.desktop  Music      source   Templates
bin          Documents  get-pip.py       Pictures  task6    typescript
Customization Downloads lib           Public    task6.c Videos
[09/08/19]seed@VM:~$ 
```



A screenshot of an Ubuntu desktop environment. On the left is a vertical dock with icons for Dash, Home, Applications, and Settings. A terminal window is open in the center, showing the following command-line session:

```
root@VM:/home/seed/Desktop#
root@VM:/home/seed/Desktop# gcc -o task6 task6.c
root@VM:/home/seed/Desktop# chmod u+s task6
root@VM:/home/seed/Desktop# exit
exit
[09/13/19]seed@VM:~/Desktop$ cp /bin/sh /tmp/ls
[09/13/19]seed@VM:~/Desktop$ ./task6
libmylib.so.1.0.1 mylib.o smll t9.c task6.c task8.c test.txt
mylib.c          out.txt t9  task6 task8  task9.c
[09/13/19]seed@VM:~/Desktop$
```



A second screenshot of the same Ubuntu desktop environment, showing the terminal window again with the same command-line session. The output shows the creation of a shell file and its execution.

### Observation

It can have root privilege, copy `/bin/sh` to `/tmp/ls`. Then compile and run system program and we will get root privilege.

## Task7

## CODE SNIPPET

```
#include<stdio.h>
void sleep(int s)
{
printf("I am not sleeping!\n");
}
root@VM: /home/seed
[09/09/19]seed@VM:~$ export PATH=/home/seed:$PATH
[09/09/19]seed@VM:~$ vim mylib.c
[09/09/19]seed@VM:~$ gcc -fPIC -g -c mylib.c
[09/09/19]seed@VM:~$ gcc -shared -o libmylib.so.1.0.1 mylib.o -lc
[09/09/19]seed@VM:~$ export LD_PRELOAD=./libmylib.so.1.0.1
[09/09/19]seed@VM:~$ vim myprog.c
[09/09/19]seed@VM:~$ gcc -o myprog myprog.c
[09/09/19]seed@VM:~$ ./myprog
i am not sleeping!
[09/09/19]seed@VM:~$ sudo chmod u+s myprog
[09/09/19]seed@VM:~$ ./myprog
i am not sleeping!
[09/09/19]seed@VM:~$ sudo su
root@VM:/home/seed# export LD_PRELOAD=./libmylib.so.1.0.1
root@VM:/home/seed# ./myprog
root@VM:/home/seed# exit
exit
[09/09/19]seed@VM:~$ ./myprog
i am not sleeping!
[09/09/19]seed@VM:~$ sudo su
root@VM:/home/seed# useradd -d /usr/user1 -m user1
root@VM:/home/seed# chown user1 myprog
root@VM:/home/seed# chgrp user1 myprog
root@VM:/home/seed# eixt
```

```
//myprog.c
int main()
{
sleep(1);
return 0;
}
```

The screenshot shows a terminal window with a dark background and light-colored text. At the top, it says 'root@VM:/home/seed'. The user runs several commands to add a user, change ownership, and change group. They then attempt to run 'eixt' which fails because it's not found. They exit the terminal and then run 'myprog' with the environment variable LD\_PRELOAD set to point to a library named 'libmylib.so.1.0.1'. The program outputs 'i am not sleeping!' before exiting. The desktop environment visible in the background includes icons for a terminal, file manager, browser, and system settings.

```
root@VM:/home/seed# useradd -d /usr/user1 -m user1
root@VM:/home/seed# chown user1 myprog
root@VM:/home/seed# chgrp user1 myprog
root@VM:/home/seed# eixt
eixt: command not found
root@VM:/home/seed#
root@VM:/home/seed#
root@VM:/home/seed#
root@VM:/home/seed#
root@VM:/home/seed#
root@VM:/home/seed#
root@VM:/home/seed#
root@VM:/home/seed# exit
[09/09/19]seed@VM:~$ export LD_PRELOAD=./libmylib.so.1.0.1
[09/09/19]seed@VM:~$ ./myprog
i am not sleeping!
[09/09/19]seed@VM:~$
```

### Observation

From the four conditions, we know that only a user run the program created by himself, LD\_PRELOAD environment variable can be used and sleep () function can be override.

## Task 8

### CODE SNIPPET

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

int main(int argc, char *argv[])
{
char *v[3];
char *command;

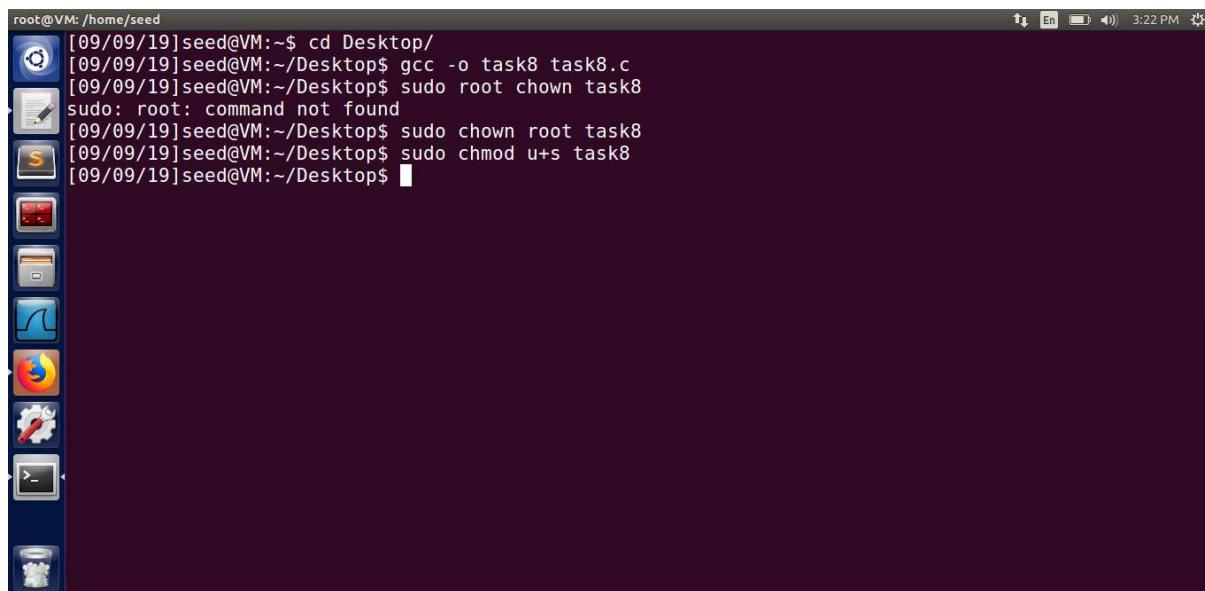
if(argc < 2) {
printf("Please type a file name.\n");
return 1;
}
```

```
v[0] = "/bin/cat"; v[1] = argv[1]; v[2] = NULL;

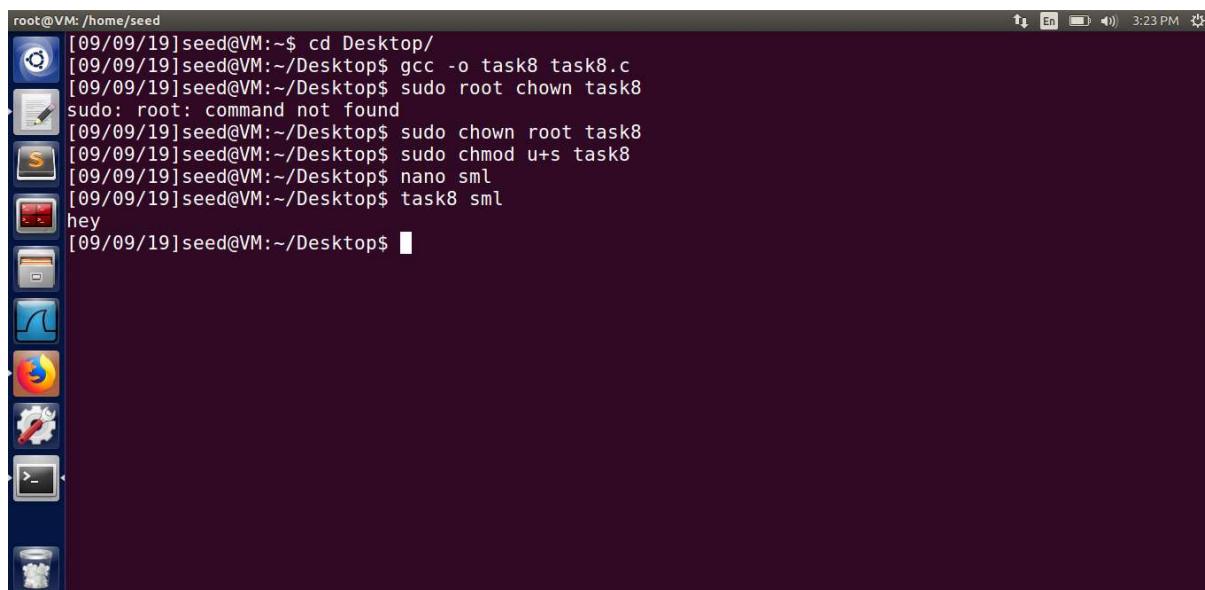
command = malloc(strlen(v[0]) + strlen(v[1]) + 2);
sprintf(command, "%s %s", v[0], v[1]);

// Use only one of the followings.
system(command);
// execve(v[0], v, NULL);

return 0;
}
```



```
root@VM: /home/seed
[09/09/19]seed@VM:~$ cd Desktop/
[09/09/19]seed@VM:~/Desktop$ gcc -o task8 task8.c
[09/09/19]seed@VM:~/Desktop$ sudo root chown task8
sudo: root: command not found
[09/09/19]seed@VM:~/Desktop$ sudo chown root task8
[09/09/19]seed@VM:~/Desktop$ sudo chmod u+s task8
[09/09/19]seed@VM:~/Desktop$
```



```
root@VM: /home/seed
[09/09/19]seed@VM:~$ cd Desktop/
[09/09/19]seed@VM:~/Desktop$ gcc -o task8 task8.c
[09/09/19]seed@VM:~/Desktop$ sudo root chown task8
sudo: root: command not found
[09/09/19]seed@VM:~/Desktop$ sudo chown root task8
[09/09/19]seed@VM:~/Desktop$ sudo chmod u+s task8
[09/09/19]seed@VM:~/Desktop$ nano sml
[09/09/19]seed@VM:~/Desktop$ task8 sml
hey
[09/09/19]seed@VM:~/Desktop$
```

```
root@VM: /home/seed
[09/09/19]seed@VM:~$ cd Desktop/
[09/09/19]seed@VM:~/Desktop$ gcc -o task8 task8.c
[09/09/19]seed@VM:~/Desktop$ sudo root chown task8
sudo: root: command not found
[09/09/19]seed@VM:~/Desktop$ sudo chown root task8
[09/09/19]seed@VM:~/Desktop$ sudo chmod u+s task8
[09/09/19]seed@VM:~/Desktop$ nano sml
[09/09/19]seed@VM:~/Desktop$ task8 sml
hey
[09/09/19]seed@VM:~/Desktop$ rm sml
[09/09/19]seed@VM:~/Desktop$ nano sl
[09/09/19]seed@VM:~/Desktop$ task8 sl
/bin/cat: sml: No such file or directory
[09/09/19]seed@VM:~/Desktop$ task8 sl
hey
[09/09/19]seed@VM:~/Desktop$ task8 "sl;rm sl"
hey
[09/09/19]seed@VM:~/Desktop$ ls
libmylib.so.1.0.1 mylib.c mylib.o task8 task8.c
[09/09/19]seed@VM:~/Desktop$ 
```

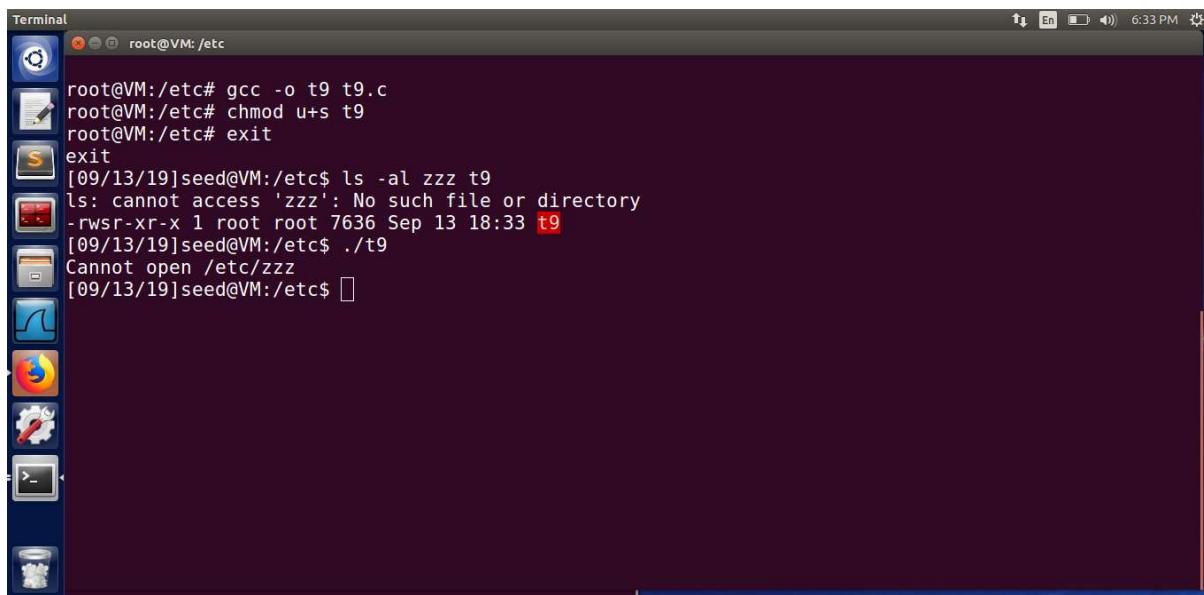
```
root@VM: /home/seed
hey
[09/09/19]seed@VM:~/Desktop$ ls
libmylib.so.1.0.1 mylib.c mylib.o task8 task8.c
[09/09/19]seed@VM:~/Desktop$ nano task8.c
[09/09/19]seed@VM:~/Desktop$ gcc -o task8 task8.c
task8.c: In function ‘main’:
task8.c:20:2: warning: implicit declaration of function ‘execve’ [-Wimplicit-function-declaration]
    execve(v[0], v, NULL);
 ^
[09/09/19]seed@VM:~/Desktop$ nano task8.c
[09/09/19]seed@VM:~/Desktop$ gcc -o task8 task8.c
[09/09/19]seed@VM:~/Desktop$ ./task8
Please type a file name.
[09/09/19]seed@VM:~/Desktop$ nano smll
[09/09/19]seed@VM:~/Desktop$ ./task8
Please type a file name.
[09/09/19]seed@VM:~/Desktop$ ./task8 smll
Please type a file name.
[09/09/19]seed@VM:~/Desktop$ ./task8 smll
hello
[09/09/19]seed@VM:~/Desktop$ task8 "smll;rm smll"
/bin/cat: 'smll;rm smll': No such file or directory
[09/09/19]seed@VM:~/Desktop$ ls
libmylib.so.1.0.1 mylib.c mylib.o smll task8 task8.c
[09/09/19]seed@VM:~/Desktop$ 
```

### Observation

The task8 file is not safe, Bob can read, write or move files which only root user can run.

## Task 9

## CODE SNIPPET



```
Terminal root@VM:/etc
root@VM:/etc# gcc -o t9 t9.c
root@VM:/etc# chmod u+s t9
root@VM:/etc# exit
exit
[09/13/19]seed@VM:/etc$ ls -al zzz t9
ls: cannot access 'zzz': No such file or directory
-rwsr-xr-x 1 root root 7636 Sep 13 18:33 t9
[09/13/19]seed@VM:/etc$ ./t9
Cannot open /etc/zzz
[09/13/19]seed@VM:/etc$ 
```

As we can see, the file hasn't been modified, the reason is file zzz can't be opened after the set uid.