

LAB 4: Unixland

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COMP-232: Programming Languages
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To say there are a lot of commands in Unixland is an understatement. To view your PATH, type:

```
% echo $PATH
```

When you type **ls**, your PATH environment variable is used to locate the **ls** executable command to run. The commands in the PATH can be binary executables or executable shell scripts.

On my system, there are 40 directories defined in my PATH which are searched in order. The first 9 directories found in the \$PATH are listed below:

```
/usr/local/sbin  
/usr/local/bin  
/usr/sbin  
/usr/bin  
/sbin  
/bin
```

```
/usr/games  
/usr/local/games  
/mnt/c/Program
```

As seen above, Unix will first search for and use `/usr/local/bin/ls` if found, next `/usr/local/bin/ls` is searched for, `/usr/sbin/ls`, and finally `/usr/bin/ls`, which is where the `ls` command executable actually resides.

We can check this by running:

```
john@oho:~$ ls -l /usr/local/sbin/ls /usr/local/bin/ls /usr/sbin/ls /usr/bin/ls  
ls: cannot access '/usr/local/sbin/ls': No such file or directory  
ls: cannot access '/usr/local/bin/ls': No such file or directory  
ls: cannot access '/usr/sbin/ls': No such file or directory  
-rwxr-xr-x 1 root root 142144 Sep 5 2019 /usr/bin/ls
```

So, when you type the **ls** command, the executable you are running is found in the `/usr/bin/ls` directory. The **which** command tells us the location of the `ls` command that is used.

```
john@oho: which ls  
/usr/bin/ls
```

There can be multiple **ls** commands found in the different PATH directories. The first **ls** command found in the PATH is used. A hacker could place a **ls** script in `/usr/local/sbin` directory if they somehow had access rights to do so, which would run using the user's permissions to do some dastardly deed and then run `/usr/bin/ls` to show the output the user expected. This is why if you want to add your current directory to your PATH variable, it should be the very last directory searched by adding the `'.'` character to your PATH, which represents your current directory.

There are 1079 binary files found in the `/bin` directory alone. Don't worry, we don't need to learn them all!

```
john@oho:~$ ls /bin | wc -l  
1079
```

The more common Unix commands are provided below.

Unixland Exercise

To start this exercise, you need to first create two files: hi.txt and hello.txt.

hi.txt contains two lines: Hi and Bye. hello.txt contains: Hello and Bye.

Let's record what we type using the script command:

```
% script unixland.txt
```

The commands we are learning about are bolded below.

```
Script started on 2021-09-12 09:47:43-07:00 [TERM="xterm-256color" TTY="/dev/tty2" COLUMNS="110" LINES="56"]
```

```
john@oho: ls -l  
total 16  
-rw-r--r-- 1 john john 10 Sep 12 09:48 hello.txt  
-rw-r--r-- 1 john john 7 Sep 12 09:48 hi.txt  
-rw-r--r-- 1 john john 8192 Sep 12 09:48 unixland.txt
```

```
john@oho: more hello.txt
```

```
.....  
hello.txt  
.....  
Hello  
Bye
```

```
john@oho: more hi.txt
```

```
hi.txt  
.....  
Hi  
Bye
```

arch

```
john@oho: arch  
x86_64
```

```
john@oho: file /bin/ls
```

```
/bin/ls: ELF 64-bit LSB shared object, x86-64, version 1 (SYSV), dynamically linked, interpreter /lib64/ld-linux-x86-64.so.2,  
BuildID[sha1]=2f15ad836be3339dec0e2e6a3c637e08e48aacbd, for GNU/Linux 3.2.0, stripped
```

cal

john@oho: **cal**

```
September 2021
Su Mo Tu We Th Fr Sa
      1  2  3  4
 5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29 30
```

cat

john@oho: **cat hi.txt**

```
Hi
Bye
```

john@oho: **cat hi.txt hello.txt**

```
Hi
Bye
Hello
Bye
```

john@oho: **cat hi.txt hello.txt > both.txt**

john@oho: **cat both.txt**

```
Hi
Bye
Hello
Bye
```

chgrp

john@oho: **ls -l**

```
total 16
-rw-r--r-- 1 john john 17 Sep 12 09:49 both.txt
-rw-r--r-- 1 john john 10 Sep 12 09:48 hello.txt
-rw-r--r-- 1 john john  7 Sep 12 09:48 hi.txt
-rw-r--r-- 1 john john 8192 Sep 12 09:48 unixland.txt
```

john@oho: **grep netdev /etc/group**

```
netdev:x:117:john
```

john@oho: **chgrp netdev both.txt**

john@oho: **ls -l both.txt**

```
-rw-r--r-- 1 john netdev 17 Sep 12 09:49 both.txt
```

```
john@oho: ls -l
total 16
-rw-r--r-- 1 john netdev 17 Sep 12 09:49 both.txt
-rw-r--r-- 1 john john 10 Sep 12 09:48 hello.txt
-rw-r--r-- 1 john john 7 Sep 12 09:48 hi.txt
-rw-r--r-- 1 john john 8192 Sep 12 09:48 unixland.txt
```

chmod

```
john@oho: chmod 000 both.txt
```

```
john@oho: more both.txt
more: cannot open both.txt: Permission denied
```

```
john@oho: ls -l both.txt
----- 1 john netdev 17 Sep 12 09:49 both.txt
```

```
john@oho: chmod 777 both.txt
```

```
john@oho: ls -l both.txt
-rwxrwxrwx 1 john netdev 17 Sep 12 09:49 both.txt
```

```
john@oho: more both.txt
Hi
Bye
Hello
Bye
```

```
john@oho: chmod 644 both.txt
```

```
john@oho: ls -l both.txt
-rw-r--r-- 1 john netdev 17 Sep 12 09:49 both.txt
```

```
john@oho: more both.txt
Hi
Bye
Hello
Bye
```

```
john@oho: chmod 600 both.txt
```

```
john@oho: more both.txt
Hi
Bye
Hello
Bye
```

```
john@oho: ls -l both.txt  
-rw----- 1 john netdev 17 Sep 12 09:49 both.txt
```

```
john@oho: mkdir mydir
```

```
john@oho: ls -ld mydir  
drwxr-xr-x 1 john john 4096 Sep 12 09:52 mydir
```

```
john@oho: ls -l mydir  
total 0
```

```
john@oho: chmod 750 mydir
```

```
john@oho: cd mydir
```

```
john@oho: touch test.txt
```

```
john@oho: ls -l  
total 0  
-rw-r--r-- 1 john john 0 Sep 12 09:54 test.txt
```

```
john@oho: ls -ld mydir  
drwxr-x--- 1 john john 4096 Sep 12 09:54 mydir
```

```
john@oho: cd mydir
```

```
john@oho: ls -l  
total 0  
-rw-r--r-- 1 john john 0 Sep 12 09:54 test.txt
```

```
john@oho: touch nexttest.txt
```

```
john@oho: ls -l  
total 0  
-rw-r--r-- 1 john john 0 Sep 12 09:55 nexttest.txt  
-rw-r--r-- 1 john john 0 Sep 12 09:54 test.txt
```

```
john@oho: cd ..
```

```
john@oho: chmod 644 mydir
```

```
john@oho: ls -ld mydir  
drw-r--r-- 1 john john 4096 Sep 12 09:55 mydir
```

```
john@oho: cd mydir  
bash: cd: mydir: Permission denied
```

john@oho: **chmod 500 mydir**

john@oho: **ls -l mydir**

total 0

-rw-r--r-- 1 john john 0 Sep 12 09:55 nexttest.txt

-rw-r--r-- 1 john john 0 Sep 12 09:54 test.txt

john@oho: **ls -ld mydir**

dr-x----- 1 john john 4096 Sep 12 09:55 mydir

john@oho: **cd mydir**

john@oho: **touch texas.txt**

touch: cannot touch 'texas.txt': Permission denied

john@oho: **cd ..**

john@oho: **ls -ld mydir**

dr-x----- 1 john john 4096 Sep 12 09:55 mydir

john@oho: **chmod 750 mydir**

john@oho: **ls -ld mydir**

drwxr-x--- 1 john john 4096 Sep 12 09:55 mydir

john@oho: **cd mydir**

john@oho: **touch texas.txt**

john@oho: **ls -l**

total 0

-rw-r--r-- 1 john john 0 Sep 12 09:55 nexttest.txt

-rw-r--r-- 1 john john 0 Sep 12 09:54 test.txt

-rw-r--r-- 1 john john 0 Sep 12 09:57 texas.txt

cut

john@oho:~\$ **grep john /etc/passwd**

john:x:1000:1000:,,,:/home/john:/bin/bash

john@oho:~\$ **grep john /etc/passwd | cut -f6 -d:**
/home/john

← Cut field 6, delimiter is : from /etc/passwd entry for john.

date

john@oho: **date**

Sun Sep 12 09:57:46 PDT 2021

diff

john@oho: **cd ..**

john@oho: **ls -l**

```
total 16
-rw----- 1 john netdev    17 Sep 12 09:49 both.txt
-rw-r--r-- 1 john john     10 Sep 12 09:48 hello.txt
-rw-r--r-- 1 john john      7 Sep 12 09:48 hi.txt
drwxr-x--- 1 john john   4096 Sep 12 09:57 [0m[01;34mmydir[0m
-rw-r--r-- 1 john john  16384 Sep 12 09:57 unixland.txt
```

john@oho: **diff hi.txt hello.txt**

1c1

< Hi

> Hello

df

john@oho: **df**

Filesystem	1K-blocks	Used	Available	Use%	Mounted on
rootfs	1951597728	1252705560	698892168	65%	/
none	1951597728	1252705560	698892168	65%	/dev
none	1951597728	1252705560	698892168	65%	/run
none	1951597728	1252705560	698892168	65%	/run/lock
none	1951597728	1252705560	698892168	65%	/run/shm
none	1951597728	1252705560	698892168	65%	/run/user
tmpfs	1951597728	1252705560	698892168	65%	/sys/fs/cgroup
C:\	1951597728	1252705560	698892168	65%	/mnt/c

env

john@oho: **env**

SHELL=/bin/bash

WSL_DISTRO_NAME=Ubuntu

NAME=oho

PWD=/home/john/LAB4

LOGNAME=john

HOME=/home/john

LANG=C.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=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:*.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:
```

```
LESSCLOSE=/usr/bin/lesspipe %s %s
```

```
TERM=xterm-256color
```

```
LESSOPEN=| /usr/bin/lesspipe %s
```

```
USER=john
```

```
SHLVL=2
```

```
WSLENV=
```

```
XDG_DATA_DIRS=/usr/local/share:/usr/share:/var/lib/flatpak/desktop
```

```
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/mnt/c/Program
```

```
Files/WindowsApps/CanonicalGroupLimited.UbuntuonWindows_2004.2021.825.0_x64__79rhkp1fndgsc:/mnt/c/ORACLE/WINDOWS
```

```
.X64_193000_db_home/bin:/mnt/c/Windows/system32:/mnt/c/Windows:/mnt/c/Windows/System32/Wbem:/mnt/c/Windows/Sy
```

```
stem32/WindowsPowerShell/v1.0:/mnt/c/Windows/System32/OpenSSH:/mnt/c/Program Files/PuTTY:/mnt/c/Program
```

```
Files/dotnet:/mnt/c/Program Files/Microsoft SQL Server/120/DTS/Binn:/mnt/c/Program Files/Microsoft SQL Server/Client
```

```
SDK/ODBC/110/Tools/Binn:/mnt/c/Program Files (x86)/Microsoft SQL Server/120/Tools/Binn:/mnt/c/Program Files/Microsoft SQL
```

```
Server/120/Tools/Binn:/mnt/c/Program Files (x86)/Microsoft SQL Server/120/Tools/Binn/ManagementStudio:/mnt/c/Program
```

```
Files (x86)/Microsoft SQL Server/120/DTS/Binn:/mnt/c/Program Files/Microsoft SQL Server/Client
```

```
SDK/ODBC/170/Tools/Binn:/mnt/c/Program Files (x86)/Microsoft SQL Server/150/Tools/Binn:/mnt/c/Program Files/Microsoft SQL
```

```
Server/150/Tools/Binn:/mnt/c/Program Files/Microsoft SQL Server/150/DTS/Binn:/mnt/c/Program Files (x86)/Microsoft SQL
```

```
Server/150/DTS/Binn:/mnt/c/Program Files/Azure Data Studio/bin:/mnt/c/Program Files/Microsoft SQL
```

```
Server/130/Tools/Binn:/mnt/c/Program Files
```

```
(x86)/dotnet:/mnt/c/Users/openh/Python39/Scripts:/mnt/c/Users/openh/Python39:/mnt/c/Users/openh/AppData/Local/Micros
```

```
oft/WindowsApps:/mnt/c/cywin64/bin:/mnt/c/Users/openh/.dotnet/tools:/mnt/c/Program Files/JetBrains/CLion
```

```
2021.2/bin:/mnt/c/Users/openh/AppData/Local/GitHubDesktop/bin:/snap/bin:.
```

```
HOSTTYPE=x86_64
```

```
OLDPWD=/home/john/LAB4/mydir
```

```
_=/usr/bin/env
```

```
john@oho: env | grep SHELL
```

```
SHELL=/bin/bash
```

```
john@oho: echo $SHELL
```

```
/bin/bash
```

```
john@opo: env | grep USER
```

```
USER=john
```

```
john@oho: echo $USER
```

```
john
```

file

john@oho: **file /bin/ls**

/bin/ls: ELF 64-bit LSB shared object, x86-64, version 1 (SYSV), dynamically linked, interpreter /lib64/ld-linux-x86-64.so.2, BuildID[sha1]=2f15ad836be3339dec0e2e6a3c637e08e48aacbd, for GNU/Linux 3.2.0, stripped

john@oho: **file hi.txt**

hi.txt: ASCII text

find

john@oho: **find /usr -name stdio.h -print**

/usr/include/stdio.h

/usr/include/x86_64-linux-gnu/bits/stdio.h

gcc

john@oho: **gcc -v**

<left out some lines here>

gcc version 9.3.0 (Ubuntu 9.3.0-17ubuntu1~20.04)

gdb

john@oho: **gdb -v**

[mGNU gdb (Ubuntu 9.2-0ubuntu1~20.04) 9.2

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grep

john@oho: **grep john /etc/passwd**

john:x:1000:1000:,,,:/home:/bin/bash

john@oho: **ifconfig -a | grep inet**

inet 169.254.36.36 netmask 255.255.0.0

inet fe80::ec81:97e7:28ab:2424 prefixlen 64 scopeid 0xfd<compat,link,site,host>

inet 127.0.0.1 netmask 255.0.0.0

inet6 ::1 prefixlen 128 scopeid 0xfe<compat,link,site,host>

inet 192.168.1.185 netmask 255.255.255.0 broadcast 192.168.1.255

inet6 2603:8000:1a01:c8c2:1c51:67ad:7a41:b1cb prefixlen 64 scopeid 0x0<global>

inet6 2603:8000:1a01:c8c2::1d88 prefixlen 128 scopeid 0x0<global>

inet6 2603:8000:1a01:c8c2:9414:9df6:8768:9109 prefixlen 128 scopeid 0x0<global>

inet6 fe80::1c51:67ad:7a41:b1cb prefixlen 64 scopeid 0xfd<compat,link,site,host>

```
inet 169.254.32.159 netmask 255.255.0.0
inet6 fe80::2db7:d219:5462:209f prefixlen 64 scopeid 0xfd<compat,link,site,host>
inet 169.254.212.235 netmask 255.255.0.0
inet6 fe80::c497:5a3e:a41:d4eb prefixlen 64 scopeid 0xfd<compat,link,site,host>
```

john@oho: **ifconfig -a | grep inet | grep -v inet6**

```
inet 169.254.36.36 netmask 255.255.0.0
inet 127.0.0.1 netmask 255.0.0.0
inet 192.168.1.185 netmask 255.255.255.0 broadcast 192.168.1.255
inet 169.254.32.159 netmask 255.255.0.0
inet 169.254.212.235 netmask 255.255.0.0
```

gzip

john@oho: **cp /etc/passwd .** ← Don't forget the '.' at the end. Copies passwd file into your current directory.

john@oho: **ls -l passwd /etc/passwd**

```
-rw-r--r-- 1 root root 1635 Aug 14 16:22 /etc/passwd
-rw-r--r-- 1 john john 1635 Sep 12 10:00 passwd
```

john@oho: **gzip passwd**

john@oho: **ls -l**

```
total 36
-rw----- 1 john netdev 17 Sep 12 09:49 both.txt
-rw-r--r-- 1 john john 10 Sep 12 09:48 hello.txt
-rw-r--r-- 1 john john 7 Sep 12 09:48 hi.txt
drwxr-x--- 1 john john 4096 Sep 12 09:57 mydir
-rw-r--r-- 1 john john 617 Sep 12 10:00 passwd.gz
-rw-r--r-- 1 john john 24576 Sep 12 09:59 unixland.txt
```

john@oho: **ls -l passwd.gz /etc/passwd**

```
-rw-r--r-- 1 root root 1635 Aug 14 16:22 /etc/passwd
-rw-r--r-- 1 john john 617 Sep 12 10:00 passwd.gz ← Notice the size. This file is compressed to save disk space.
```

john@oho: **gunzip passwd.gz**

john@oho: **ls -l passwd**

```
-rw-r--r-- 1 john john 1635 Sep 12 10:00 passwd
```

john@oho:~\$ **head /etc/passwd**

```
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
```

```
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
```

hostid

```
john@oho: hostid
007f0101
```

```
john@oho: pwd
/home/john/LAB4
```

hostname

```
john@oho: hostname
oho
```

id

```
john@oho:~$ grep john /etc/group
```

```
adm:x:4:syslog,john
dialout:x:20:john
cdrom:x:24:john
floppy:x:25:john
sudo:x:27:john
audio:x:29:john
dip:x:30:john
video:x:44:john
plugdev:x:46:john
netdev:x:117:john
john:x:1000:
```

```
john@oho: id
```

```
uid=1000(john) gid=1000(john)
groups=1000(john),4(adm),20(dialout),24(cdrom),25(floppy),27(sudo),29(audio),30(dip),44(video),46(plugdev),117(netdev)
```

In

```
john@oho: ln -s /usr/include inc
```

```
john@oho: ls -l
```

```
total 36
-rw----- 1 john netdev 17 Sep 12 09:49 both.txt
-rw-r--r-- 1 john john 10 Sep 12 09:48 hello.txt
-rw-r--r-- 1 john john 7 Sep 12 09:48 hi.txt
lrwxrwxrwx 1 john john 12 Sep 12 10:02 inc -> /usr/include
```

```
drwxr-x--- 1 john john    4096 Sep 12 09:57 mydir
-rw-r--r-- 1 john john    1635 Sep 12 10:00 passwd
-rw-r--r-- 1 john john   28672 Sep 12 10:01 unixland.txt
```

john@oho:~\$ **ls -l /usr/include/signal.h**

```
-rw-r--r-- 1 root root 12309 Dec 16 2020 /usr/include/signal.h
```

john@oho:~\$ **ls -l inc/signal.h**

```
-rw-r--r-- 1 root root 12309 Dec 16 2020 inc/signal.h
```

ls

john@oho: **ls -lR mydir**

mydir:

total 0

```
-rw-r--r-- 1 john john 0 Sep 12 09:55 nexttest.txt
```

```
-rw-r--r-- 1 john john 0 Sep 12 09:54 test.txt
```

```
-rw-r--r-- 1 john john 0 Sep 12 09:57 texas.txt
```

john@oho: **ls**

```
both.txt hello.txt hi.txt mydir passwd unixland.txt
```

make

john@oho:~/LAB4\$ **make -v**

GNU Make 4.2.1

Built for x86_64-pc-linux-gnu

Copyright (C) 1988-2016 Free Software Foundation, Inc.

License GPLv3+: GNU GPL version 3 or later <<http://gnu.org/licenses/gpl.html>>

This is free software: you are free to change and redistribute it.

There is NO WARRANTY, to the extent permitted by law.

md5sum

john@oho: **md5sum passwd**

```
0a694909e131aa1635798b82734fc7a0 passwd
```

mkdir

john@oho: **mkdir -p sun/moon/earth**

← -p will create all directories that don't exist in one command.

john@oho: **ls -lR sun**

sun:

total 0

```
drwxr-xr-x 1 john john 4096 Sep 12 10:04 moon
```

```
sun/moon:  
total 0  
drwxr-xr-x 1 john john 4096 earth
```

```
sun/moon/earth:  
total 0
```

mv

```
john@oho: mv both.txt newname.txt
```

nohup

```
john@oho: nohup ls &  
[1] 443  
john@oho: nohup: ignoring input and appending output to 'nohup.out'  
[1]+ Done          nohup ls
```

```
john@oho: ls -l nohup.out  
-rw----- 1 john john 73 Sep 12 10:05 nohup.out
```

```
john@oho: more nohup.out  
hello.txt  
hi.txt  
inc  
mydir  
newname.txt  
nohup.out  
passwd  
sun  
unixland.txt
```

od

```
john@oho: pwd  
/home/john/LAB4
```

```
john@oho: od -ax hi.txt  
0000000 H i n l B y e n l  
        6948 420a 6579 000a  
0000007
```

```
john@oho: od -ax hello.txt  
0000000 H e l l o n l B y e n l  
        6548 6c6c 0a6f 7942 0a65  
0000012
```

ps

john@oho: ps

```
PID TTY    TIME CMD
346 pts/0 00:00:00 bash
449 pts/0 00:00:00 ps
```

john@oho: ps -ef

```
UID      PID  PPID  C  STIME TTY          TIME CMD
root         1    0  0  08:51 ?            00:00:00 /init
root         6    1  0  08:51 tty1        00:00:00 /init
john        7    6  0  08:51 tty1        00:00:00 -bash
root        67   1  0  09:09 tty2        00:00:00 /init
john        68  67  0  09:09 tty2        00:00:00 -bash
john       345  68  0  09:47 tty2        00:00:00 script unixland.txt
john       346 345  0  09:47 pts/0      00:00:00 bash -i
john       450 346  0 10:06 pts/0      00:00:00 ps -ef
```

rmdir

john@oho: mkdir toremove.dir

john@oho: touch toremove.dir/test.txt

john@oho: ls -lR toremove.dir

```
toremove.dir:
total 0
-rw-r--r-- 1 john john 0 Sep 12 12:43 test.txt
```

john@oho: ls -ld toremove.dir

```
drwxr-xr-x 1 john john 4096 Sep 12 12:43 toremove.dir
```

john@oho: rmdir toremove.dir

```
rmdir: failed to remove 'toremove.dir': Directory not empty
```

john@oho: rm toremove.dir/test.txt

john@oho: rmdir toremove.dir

john@oho: ls -ld toremove.dir

```
ls: cannot access 'toremove.dir': No such file or directory
```

sftp

```
john@oho: cd ~/LAB4
```

```
john@oho: ls
```

```
copy.txt hello.txt hi.txt inc mydir newname.txt nohup.out passwd sun unixland.dos.txt unixland.txt
```

```
john@oho: ls -l
```

```
total 112
```

```
-rw-r--r-- 1 john john 41258 Sep 12 10:26 copy.txt
-rw-r--r-- 1 john john 10 Sep 12 09:48 hello.txt
-rw-r--r-- 1 john john 7 Sep 12 09:48 hi.txt
lrwxrwxrwx 1 john john 12 Sep 12 10:02 inc -> /usr/include
drwxr-x--- 1 john john 4096 Sep 12 09:57 mydir
-rw----- 1 john netdev 17 Sep 12 09:49 newname.txt
-rw----- 1 john john 73 Sep 12 10:05 nohup.out
-rw-r--r-- 1 john john 1635 Sep 12 10:00 passwd
drwxr-xr-x 1 john john 4096 Sep 12 10:11 sun
-rw-r--r-- 1 john john 0 Sep 12 10:25 unixland.dos.txt
-rw-r--r-- 1 john john 34036 Sep 12 10:29 unixland.txt
```

```
john@oho: sftp comp232.com
```

← Could also use: **sftp 143.198.238.179**

```
john@comp232.com's password: <enter user password>
```

```
Connected to comp232.com.
```

sftp> help

Available commands:

bye	Quit sftp
cd path	Change remote directory to 'path'
chgrp [-h] grp path	Change group of file 'path' to 'grp'
chmod [-h] mode path	Change permissions of file 'path' to 'mode'
chown [-h] own path	Change owner of file 'path' to 'own'
df [-hi] [path]	Display statistics for current directory or filesystem containing 'path'
exit	Quit sftp
get [-afpR] remote [local]	Download file
help	Display this help text
lcd path	Change local directory to 'path'
lls [ls-options [path]]	Display local directory listing
lmkdir path	Create local directory
ln [-s] oldpath newpath	Link remote file (-s for symlink)
lpwd	Print local working directory
ls [-lafhlNrSt] [path]	Display remote directory listing
lumask umask	Set local umask to 'umask'
mkdir path	Create remote directory
progress	Toggle display of progress meter
put [-afpR] local [remote]	Upload file
pwd	Display remote working directory
quit	Quit sftp
reget [-fpR] remote [local]	Resume download file
rename oldpath newpath	Rename remote file


```
reput [-fpR] local [remote]      Resume upload file
rm path                          Delete remote file
rmdir path                        Remove remote directory
symlink oldpath newpath          Symlink remote file
version                           Show SFTP version
!command                          Execute 'command' in local shell
!                                  Escape to local shell
?                                  Synonym for help
```

sftp> ls

LAB1

sftp> mkdir LAB4

sftp> ls

LAB1 LAB4

sftp> cd LAB4

sftp> ls

sftp> ll

copy.txt hello.txt hi.txt inc mydir newname.txt nohup.out passwd sun unixland.dos.txt unixland.txt

sftp> mput *.txt

```
Uploading copy.txt to /home/john/LAB4/copy.txt
copy.txt                                100%   40KB
366.7KB/s   00:00
Uploading hello.txt to /home/john/LAB4/hello.txt
hello.txt                                100%    10
0.3KB/s   00:00
Uploading hi.txt to /home/john/LAB4/hi.txt
hi.txt                                    100%     7
0.3KB/s   00:00
Uploading newname.txt to /home/john/LAB4/newname.txt
newname.txt                              100%    17
0.6KB/s   00:00
Uploading unixland.dos.txt to /home/john/LAB4/unixland.dos.txt
unixland.dos.txt                         100%     0
0.0KB/s   00:00
Uploading unixland.txt to /home/john/LAB4/unixland.txt
unixland.txt                              100%   33KB
452.2KB/s   00:00
```

sftp> ls

copy.txt hello.txt hi.txt newname.txt unixland.dos.txt unixland.txt

sftp> pwd

Remote working directory: /home/john/LAB4

sftp> lpwd

Local working directory: /home/john/LAB4

sftp> quit

sleep

john@oho: sleep 5

sort

john@oho: cut -f7 -d: /etc/passwd

/bin/bash

/usr/sbin/nologin

/usr/sbin/nologin

/usr/sbin/nologin

/bin/sync

/usr/sbin/nologin

/usr/sbin/nologin

/usr/sbin/nologin

/usr/sbin/nologin

/usr/sbin/nologin

/usr/sbin/nologin

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/usr/sbin/nologin

/usr/sbin/nologin

/usr/sbin/nologin

/usr/sbin/nologin

/usr/sbin/nologin

john@oho: cut -f7 -d: /etc/passwd | sort

/bin/bash

/bin/bash

/bin/false

/bin/false

```
/bin/sync
/usr/sbin/nologin
/usr/sbin/nologin
/usr/sbin/nologin
/usr/sbin/nologin
/usr/sbin/nologin
/usr/sbin/nologin
/usr/sbin/nologin
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/usr/sbin/nologin
/usr/sbin/nologin
/usr/sbin/nologin
/usr/sbin/nologin
/usr/sbin/nologin
```

```
john@oho: cut -f7 -d: /etc/passwd | sort -u
/bin/bash
/bin/false
/bin/sync
/usr/sbin/nologin
```

ssh

```
john@oho: ssh john@comp232.com
john@comp232.com's password:
Welcome to Ubuntu 20.04.2 LTS (GNU/Linux 5.4.0-73-generic x86_64)
Last login: Wed Sep  8 21:23:39 2021 from 143.198.238.179
```

```
john@comp232:~$ pwd
/home/john
```

```
john@comp232:~$ uname -a
Linux comp232 5.4.0-73-generic #82-Ubuntu SMP Wed Apr 14 17:39:42 UTC 2021 x86_64 x86_64 x86_64 GNU/Linux
```

```
john@comp232: exit  
logout  
Connection to comp232.com closed.
```

```
john@oho: ssh john@143.198.238.179  
john@143.198.238.179's password:  
Welcome to Ubuntu 20.04.2 LTS (GNU/Linux 5.4.0-73-generic x86_64)  
Last login: Sun Sep 12 17:08:44 2021 from 23.241.58.212
```

```
john@comp232:~$ pwd  
/home/john
```

```
john@comp232:~$ uname -a  
Linux comp232 5.4.0-73-generic #82-Ubuntu SMP Wed Apr 14 17:39:42 UTC 2021 x86_64 x86_64 x86_64 GNU/Linux
```

```
john@comp232:~$ exit  
logout  
Connection to 143.198.238.179 closed.
```

stty

```
john@oho: stty  
speed 38400 baud; line = 0;  
eol = M-^?; eol2 = M-^?; swtch = M-^?;  
ixany iutf8
```

sudo

```
john@oho: ls -l /etc/shadow
```

```
-rw-r----- 1 root shadow 973 Aug 14 16:22 /etc/shadow
```

```
john@oho: cat /etc/shadow  
cat: /etc/shadow: Permission denied
```

```
john@oho: sudo cat /etc/shadow | tail
```

```
[sudo] password for john:  
messagebus:*:18677:0:99999:7::  
syslog:*:18677:0:99999:7::  
_apt:*:18677:0:99999:7::  
tss:*:18677:0:99999:7::  
uidd:*:18677:0:99999:7::  
tcpdump:*:18677:0:99999:7::  
sshd:*:18677:0:99999:7::  
landscape:*:18677:0:99999:7::  
pollinate:*:18677:0:99999:7::  

```

```
john:$6$NiKId9M7f/ss7XGt$bmp4QIPpP4UJedv2GK5Y.n3BXDrw5X0TS4f3SUhXiKesfVlwW2qYwgyT0Yb2ZVbx6WAVWKP4  
wjrq9KilylWS01:18853:0:99999:7:::
```

sync

```
john@oho: sync
```

```
john@oho: sync ← Anyone know the difference between typing “sync” and “sync; sync”?
```

tar

```
john@oho: pwd  
/home/john/LAB4
```

```
john@oho: cd ..
```

```
john@oho: tar cvf lab4.tar ./LAB4
```

```
./LAB4/  
./LAB4/hello.txt  
./LAB4/hi.txt  
./LAB4/inc  
./LAB4/mydir/  
./LAB4/mydir/nexttest.txt  
./LAB4/mydir/test.txt  
./LAB4/mydir/texas.txt  
./LAB4/newname.txt  
./LAB4/nohup.out  
./LAB4/passwd  
./LAB4/sun/  
./LAB4/sun/moon/  
./LAB4/sun/moon/earth/  
./LAB4/unixland.txt
```

```
john@oho: ls -l lab4.tar
```

```
-rw-r--r-- 1 john john 61440 Sep 12 10:10 lab4.tar
```

```
john@oho:~$ tar tvf lab4.tar
```

← Displays what files are in the lab4.tar file.

```
drwxr-xr-x john/john      0 2021-09-12 10:06 ./LAB4/  
-rw-r--r-- john/john    10 2021-09-12 09:48 ./LAB4/hello.txt  
-rw-r--r-- john/john      7 2021-09-12 09:48 ./LAB4/hi.txt  
lrwxrwxrwx john/john      0 2021-09-12 10:02 ./LAB4/inc -> /usr/include  
drwxr-x--- john/john      0 2021-09-12 09:57 ./LAB4/mydir/  
-rw-r--r-- john/john      0 2021-09-12 09:55 ./LAB4/mydir/nexttest.txt  
-rw-r--r-- john/john      0 2021-09-12 09:54 ./LAB4/mydir/test.txt  
-rw-r--r-- john/john      0 2021-09-12 09:57 ./LAB4/mydir/texas.txt  
-rw----- john/netdev   17 2021-09-12 09:49 ./LAB4/newname.txt  
-rw----- john/john     73 2021-09-12 10:05 ./LAB4/nohup.out  
-rw-r--r-- john/john  1635 2021-09-12 10:00 ./LAB4/passwd
```

```
drwxr-xr-x john/john          0 2021-09-12 10:04 ./LAB4/sun/
drwxr-xr-x john/john          0 2021-09-12 10:04 ./LAB4/sun/moon/
drwxr-xr-x john/john          0 2021-09-12 10:04 ./LAB4/sun/moon/earth/
-rw-r--r-- john/john      40960 2021-09-12 10:09 ./LAB4/unixland.txt
```

john@oho: **cd LAB4**

john@oho: **cd sun**

john@oho: **ls**
moon

john@oho: **tar xvf lab4.tar** ← x for extract

```
./LAB4/
./LAB4/hello.txt
./LAB4/hi.txt
./LAB4/inc
./LAB4/mydir/
./LAB4/mydir/nexttest.txt
./LAB4/mydir/test.txt
./LAB4/mydir/texas.txt
./LAB4/newname.txt
./LAB4/nohup.out
./LAB4/passwd
./LAB4/sun/
./LAB4/sun/moon/
./LAB4/sun/moon/earth/
./LAB4/unixland.txt
```

john@oho: **ls**
moon LAB4

john@oho: **ls LAB4**
hello.txt hi.txt mydir newname.txt nohup.out passwd unixland.txt

john@oho: **cd ..**

john@oho: **ls**
hello.txt hi.txt newname.txt nohup.out passwd sun unixland.txt

john@oho: **ls sun**
moon

john@oho: **pwd**
/home/john/LAB4

uptime

john@oho: **uptime**

10:12:10 up 1:20, 0 users, load average: 0.52, 0.58, 0.59

which

john@oho: **which gzip**

/usr/bin/gzip

whoami

john@oho: **whoami**

john

john@oho: **exit**

← Exits running the **script unixland.txt** command.

exit

After exiting the script command, you should now have a `unixland.txt` file ready to upload to `comp232.com`.

To turn in your work to receive full credit for this assignment, please:

```
% sftp <username>@comp232.com
```

```
sftp> cd LAB4
```

```
sftp> put unixland.txt
```

```
sftp> ls -l
```

```
sftp> quit
```

```
% exit
```