



## K. J. Somaiya College of Engineering, Mumbai-77

**Batch:A4              Roll No.:1821001**

**Experiment No. 01**

**Grade: AA / AB / BB / BC / CC / CD /DD**

**Signature of the Staff In-charge with date**

### **TITLE: Exploring basic Commands of UNIX: Shell, Processes, Files**

**AIM:** To Explore basic commands for handling File system under Unix/Linux using shell scripts.(Creating groups, chown , chmod , directory name, tty , diff, umask).

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#### **Expected Outcome of Experiment:**

**CO 1.** Explain the fundamental concepts of operating system with extension to Unix and Mobile OS.

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#### **Books/ Journals/ Websites referred:**

1. Silberschatz A., Galvin P., Gagne G. "Operating Systems Principles", Willey Eight edition.
2. Achyut S. Godbole , Atul Kahate "Operating Systems", McGraw Hill Third Edition.
3. Sumitabha Das " UNIX Concepts & Applications", McGraw Hill Second Edition.

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#### **Pre Lab/ Prior Concepts:**

An operating system (OS) is a resource manager. It takes the form of a set of software routines that allow users and application programs to access system resources (e.g. the CPU, memory, disks, modems, printers network cards etc.) in safe efficient and abstract way.

- The operating system kernel is in direct control of the underlying hardware. The kernel provides low-level device, memory and processor management functions (e.g. dealing with interrupts from hardware devices, sharing the processor among multiple programs, allocating memory for programs etc.)
- Basic hardware-independent kernel services are exposed to higher-level programs through a library of system calls (e.g. services to create a file, begin execution of a program, or open a logical network connection to another computer).
- Application programs (e.g. word processors, spreadsheets) and system utility programs (simple but useful application programs that come with the operating system, e.g. programs which find text inside a group of files) make use of system calls. Applications and



system utilities are launched using a shell (a textual command line interface) or a graphical user interface that provides direct user interaction.

Operating systems can be distinguished from one another by the system calls, system utilities and user interface they provide, as well as by the resource scheduling policies implemented by the kernel.

UNIX has been a popular OS for more than two decades because of its multi-user, multi-tasking environment, stability, portability and powerful networking capabilities.

Linux is a free open source UNIX OS for PCs.

Linux has all of the components of a typical OS :

- **Kernel**

The Linux kernel includes device driver support for a large number of PC hardware devices (graphics cards, network cards, hard disks etc.), advanced processor and memory management features, and support for many different types of file systems. In terms of the services that it provides to application programs and system utilities, the kernel implements most BSD and SYSV system calls, as well as the system calls described in the POSIX.1 specification.

The kernel (in raw binary form that is loaded directly into memory at system startup time) is typically found in the file /boot/vmlinuz, while the source files can usually be found in /usr/src/linux.

- **Shells and GUIs**

Linux supports two forms of command input: through textual command line shells similar to those found on most UNIX systems (e.g. sh - the Bourne shell, bash - the Bourne again shell and csh - the C shell) and through graphical interfaces (GUIs) such as the KDE and GNOME window managers.

- **System Utilities**

Virtually every system utility that you would expect to find on standard implementations of UNIX has been ported to Linux. This includes commands such as ls, cp, grep, awk, sed, bc, wc, more, and so on. These system utilities are designed to be powerful tools that do a single task extremely well (e.g. grep finds text inside files while wc counts the number of words, lines and bytes inside a file). Users can often solve problems by interconnecting these tools instead of writing a large monolithic application program.

- **Application programs**

Linux distributions typically come with several useful application programs as standard. Examples include the emacseditor, xv (an image viewer), gcc (a C compiler), g++ (a C++ compiler), xfig (a drawing package), latex (a powerful typesetting language) and soffice (StarOffice, which is an MS-Office style clone that can read and write Word, Excel and PowerPoint files).

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Description of Commands and options:

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**Implementation details:** -



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### 1. File Handling Commands:-

#### a. *mkdir*

**Description:-** Create the DIRECTORY(ies), if they do not already exist.

**Syntax:-** `mkdir [OPTION]... DIRECTORY...`

**Options:-** `-m, --mode=MODE`

set file mode (as in chmod), not a=rwx - umask

`-p, --parents`

no error if existing, make parent directories as needed

`-v, --verbose`

print a message for each created directory

`-Z` set SELinux security context of each created directory to the default type

`--context[=CTX]`

like `-Z`, or if CTX is specified then set the SELinux or SMACK security context to CTX

`--help` display this help and exit

`--version`

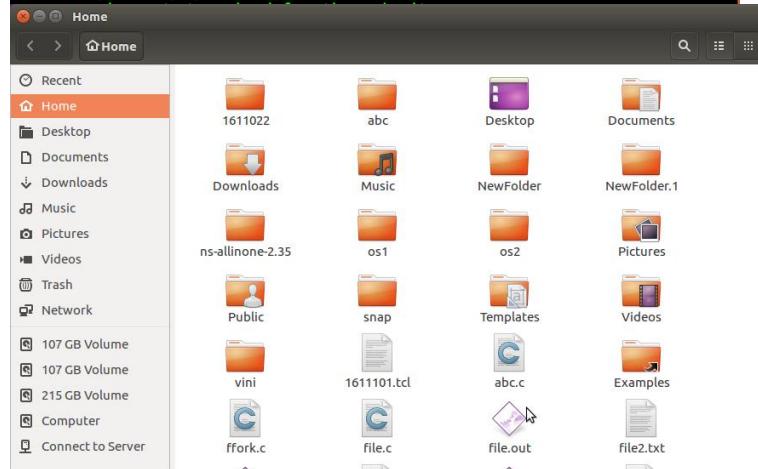
output version information and exit

### Output:-

```
kjse@ROB-04: ~
kjse@ROB-04:~$ mkdir --version
mkdir (GNU coreutils) 8.25
Copyright (C) 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.

Written by David MacKenzie.
kjse@ROB-04:~$ mkdir -v abc
mkdir: created directory 'abc'
kjse@ROB-04:~$ mkdir -v mkdir -p first/second/third
mkdir: created directory 'mkdir'
mkdir: created directory 'first'
mkdir: created directory 'first/second'
mkdir: created directory 'first/second/third'
kjse@ROB-04:~$ mkdir -p first/second/third
kjse@ROB-04:~$ mkdir -m a=rwx [directories]
kjse@ROB-04:~$ mkdir -m a=rwx def
kjse@ROB-04:~$ mkdir --help
Usage: mkdir [OPTION]... DIRECTORY...
Create the DIRECTORY(ies), if they do not already exist.

Mandatory arguments to long options are mandatory for short options too.
-m, --mode=MODE    set file mode (as in chmod), not a=rwx - umask
-p, --parents      no error if existing, make parent directories as needed
-v, --verbose      print a message for each created directory
-Z                 set SELinux security context of each created directory
                  to the default type
--context[=CTX]    like -Z, or if CTX is specified then set the SELinux
                  or SMACK security context to CTX
--help, --display this help and exit
```





```
kjsce@ROB-04:~$ mkdir -m 777 abcd  
kjsce@ROB-04:~$ |
```

### b. rmdir

**Description:-** Remove the DIRECTORY(ies), if they are empty.

**Syntax:-** `mkdir [OPTION]... DIRECTORY...`

**Options:-** `--ignore-fail-on-non-empty`

ignore each failure that is solely because a directory  
is non-empty

`-p, --parents`

remove DIRECTORY and its ancestors; e.g., '`rmdir -p a/b/c`' is  
similar to '`rmdir a/b/c a/b a`'

`-v, --verbose`

output a diagnostic for every directory processed

`--help`

display this help and exit

`--version`

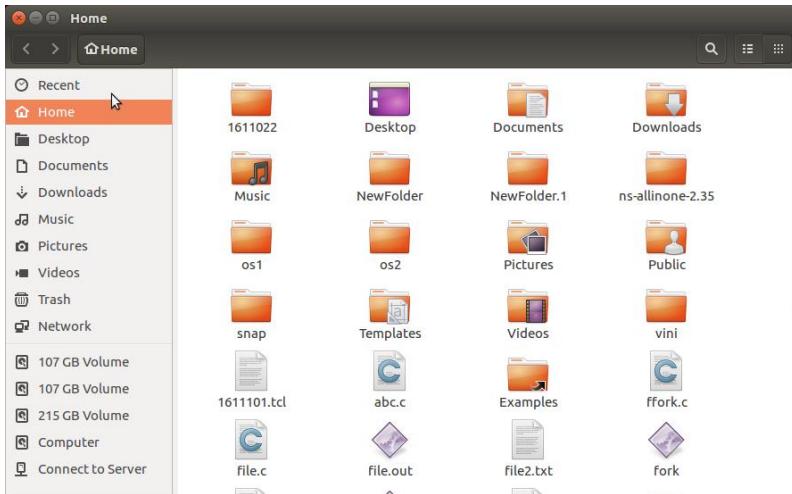
output version information and exit

### Output:-

```
○ ⊞ ⊞ kjsce@ROB-04:~  
kjsce@ROB-04:~$ mkdir aaa  
kjsce@ROB-04:~$ cd aaa  
kjsce@ROB-04:~/aaa$ mkdir bbb  
kjsce@ROB-04:~/aaa$ cd ..  
kjsce@ROB-04:~$ rmdir -p aaa/bbb  
kjsce@ROB-04:~$ rmdir -version  
rmdir: invalid option `e'  
Try `rmdir --help' for more information.  
kjsce@ROB-04:~$ rmdir --version  
rmdir (GNU coreutils) 8.25  
Copyright (C) 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.  
  
Written by David MacKenzie.  
kjsce@ROB-04:~$ rmdir -v abc/def  
rmdir: removing directory, 'abc/def'  
kjsce@ROB-04:~$ rm -help  
rm: invalid option `l'  
Try `rm --help' for more information.  
kjsce@ROB-04:~$ rmdir --help  
Usage: rmdir [OPTION]... DIRECTORY...  
Remove the DIRECTORY(ies), if they are empty.  
  
--ignore-fail-on-non-empty  
          ignore each failure that is solely because a directory  
          is non-empty  
-p, --parents  remove DIRECTORY and its ancestors; e.g., 'rmdir -p a/b/c' is  
          similar to 'rmdir a/b/c a/b a'  
-v, --verbose   output a diagnostic for every directory processed  
--help        display this help and exit  
--version     output version information and exit  
  
GNU coreutils online help: <http://www.gnu.org/software/coreutils/>  
Full documentation at: <http://www.gnu.org/software/coreutils/rmdir>  
or available locally via: info '(coreutils) rmdir invocation'
```



```
ubuntu@ubuntu:~$ rmdir -v aaa
rmdir: removing directory, 'aaa'
```



### c. rm

**Description:-** rm removes each specified file. By default, it does not remove directories.

If the -I or --interactive=once option is given, and there are more than three files or the -r, -R, or --recursive are given, then rm prompts the user for whether to proceed with the entire operation. If the response is not affirmative, the entire command is aborted.

Otherwise, if a file is unwritable, standard input is a terminal, and the -f or --force option is not given, or the -i or --interactive=always option is given, rm prompts the user for whether to remove the file. If the response is not affirmative, the file is skipped.

**Syntax:-** rm [OPTION]... [FILE]...

**Options:-** -f, --force

ignore nonexistent files and arguments, never prompt

-i prompt before every removal

-I prompt once before removing more than three files, or when removing recursively; less intrusive than -i, while still giving protection against most mistakes

--interactive[=WHEN]

prompt according to WHEN: never, once (-I), or always (-i); without WHEN, prompt always

--one-file-system

when removing a hierarchy recursively, skip any directory that



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is on a file system different from that of the corresponding command line argument

--no-preserve-root  
do not treat '/' specially

### **Output:-**

```
kjsece@ROB-04:~/D
kjsece@ROB-04:~$ rm -i a.txt
rm: remove regular empty file 'a.txt'? y
kjsece@ROB-04:~$ rm -f b.txt
kjsece@ROB-04:~$ rm --version
rm (GNU coreutils) 8.25
Copyright (C) 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.

Written by Paul Rubin, David MacKenzie, Richard M. Stallman,
and Jim Meyering.
kjsece@ROB-04:~$ cd D
kjsece@ROB-04:~/D$ ls
A  B
kjsece@ROB-04:~/D$ ls A
a.txt
kjsece@ROB-04:~/D$ ls B
b.txt
kjsece@ROB-04:~/D$ rm *
rm: cannot remove 'A': Is a directory
rm: cannot remove 'B': Is a directory
kjsece@ROB-04:~/D$ rm -r *
kjsece@ROB-04:~/D$ |
```

### d. touch

**Description:-** Update the access and modification times of each FILE to the current time. A FILE argument that does not exist is created empty, unless -c or -h is supplied.

A FILE argument string of - is handled specially and causes touch to change the times of the file associated with standard output.

**Syntax:-** touch [OPTION]... FILE...

**Options:-** -a change only the access time

-c, --no-create  
do not create any files

-d, --date=STRING  
parse STRING and use it instead of current time



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-f (ignored)

-h, --no-dereference

affect each symbolic link instead of any referenced file (useful only on systems that can change the timestamps of a symlink)

-m change only the modification time

-r, --reference=FILE

use this file's times instead of current time

-t STAMP

use [[CC]YY]MMDDhhmm[.ss] instead of current time

### Output:-

```
ubuntu@ubuntu:~$ touch -a aaa
ubuntu@ubuntu:~$ ll
total 36
drwxr-xr-x 16 ubuntu ubuntu 480 Aug 12 12:46 .
drwxr-xr-x 1 root  root 60 Aug 12 12:17 ..
-rw----- 1 ubuntu ubuntu 318 Aug 12 12:18 .ICEauthority
-rw----- 1 ubuntu ubuntu 22 Aug 12 12:25 .bash_history
-rw-r--r-- 1 ubuntu ubuntu 220 Aug 12 12:17 .bash_logout
-rw-r--r-- 1 ubuntu ubuntu 3771 Aug 12 12:17 .bashrc
drwx----- 13 ubuntu ubuntu 280 Aug 12 12:26 .cache/
drwxr-xr-x 16 ubuntu ubuntu 380 Aug 12 12:45 .config/
drwx----- 3 ubuntu ubuntu 100 Aug 12 12:24 .gnupg/
drwx----- 2 ubuntu ubuntu 40 Aug 12 12:17 .gvfs/
drwx----- 3 ubuntu ubuntu 60 Aug 12 12:17 .local/
-rw-r--r-- 1 ubuntu ubuntu 807 Aug 12 12:17 .profile
drwx----- 2 ubuntu ubuntu 40 Aug 12 12:24 .ssh/
drwxr-xr-x 2 ubuntu ubuntu 100 Aug 12 12:37 Desktop/
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Documents/
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Downloads/
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Music/
drwxr-xr-x 2 ubuntu ubuntu 60 Aug 12 12:25 Pictures/
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Public/
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Templates/
ubuntu@ubuntu:~$ touch -m aaa.txt
ubuntu@ubuntu:~$ ll
total 36
drwxr-xr-x 16 ubuntu ubuntu 480 Aug 12 12:46 .
drwxr-xr-x 1 root  root 60 Aug 12 12:17 ..
-rw----- 1 ubuntu ubuntu 318 Aug 12 12:18 .ICEauthority
-rw----- 1 ubuntu ubuntu 22 Aug 12 12:25 .bash_history
-rw-r--r-- 1 ubuntu ubuntu 220 Aug 12 12:17 .bash_logout
-rw-r--r-- 1 ubuntu ubuntu 3771 Aug 12 12:17 .bashrc
drwx----- 13 ubuntu ubuntu 280 Aug 12 12:26 .cache/
drwxr-xr-x 16 ubuntu ubuntu 380 Aug 12 12:45 .config/
drwx----- 3 ubuntu ubuntu 100 Aug 12 12:24 .gnupg/
drwx----- 2 ubuntu ubuntu 40 Aug 12 12:17 .gvfs/
drwx----- 3 ubuntu ubuntu 60 Aug 12 12:17 .local/
-rw-r--r-- 1 ubuntu ubuntu 807 Aug 12 12:17 .profile
drwx----- 2 ubuntu ubuntu 40 Aug 12 12:24 .ssh/
drwxr-xr-x 2 ubuntu ubuntu 100 Aug 12 12:37 Desktop/
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Documents/
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Downloads/
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Music/
drwxr-xr-x 2 ubuntu ubuntu 100 Aug 12 12:59 Pictures/
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Public/
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Templates/
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Videos/
-rw-r--r-- 1 ubuntu ubuntu 0 Aug 12 12:59 aaa
-rw-rw-r-- 1 ubuntu ubuntu 18 Aug 12 13:00 aaa.txt
-rw-r--r-- 1 ubuntu ubuntu 8980 Aug 12 12:17 examples.desktop
```



```
ubuntu@ubuntu:~$ touch -t 201810290630 Dare
ubuntu@ubuntu:~$ ls
Dare Desktop Documents Downloads Music Pictures Public Templates Videos aaa aaa.txt examples.desktop
```

e. chmod

**Description:-** chmod changes the file mode bits of each given file according to mode, which can be either a symbolic representation of changes to make, or an octal number representing the bit pattern for the new mode bits.

**Syntax:-** chmod [OPTION]... MODE[,MODE]... FILE...

**Options:-**

- c, --changes  
like verbose but report only when a change is made

- f, --silent, --quiet  
suppress most error messages

- v, --verbose  
output a diagnostic for every file processed

- no-preserve-root  
do not treat '/' specially (the default)

- preserve-root  
fail to operate recursively on '/'

- reference=FILE  
use FILE's mode instead of MODE values

- R, --recursive  
change files and directories recursively

- help display this help and exit



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--version

output version information and exit

### Output:-

```
Activities Terminal Mon 13:10
ubuntu@ubuntu:~$ chmod 754 aaa.txt
ubuntu@ubuntu:~$ ls
Dare Desktop Documents Downloads Music Pictures Public Templates Videos aaa aaa.txt examples.desktop
ubuntu@ubuntu:~$ ls -l
total 16
-rw-r--r-- 1 ubuntu ubuntu 0 Oct 29 2018 Dare
drwxr-xr-x 2 ubuntu ubuntu 100 Aug 12 12:37 Desktop
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Documents
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Downloads
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Music
drwxr-xr-x 2 ubuntu ubuntu 140 Aug 12 13:02 Pictures
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Public
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Templates
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Videos
-rw-r--r-- 1 ubuntu ubuntu 0 Aug 12 12:59 aaa
-rw-r--r-- 1 ubuntu ubuntu 18 Aug 12 13:00 aaa.txt
ubuntu@ubuntu:~$ chmod u=rw aaa.txt
ubuntu@ubuntu:~$ ls -l
total 16
-rw-r--r-- 1 ubuntu ubuntu 0 Oct 29 2018 Dare
drwxr-xr-x 2 ubuntu ubuntu 100 Aug 12 12:37 Desktop
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Documents
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Downloads
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Music
drwxr-xr-x 2 ubuntu ubuntu 140 Aug 12 13:02 Pictures
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Public
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Templates
drwxr-xr-x 2 ubuntu ubuntu 40 Aug 12 12:18 Videos
-rw-r--r-- 1 ubuntu ubuntu 0 Aug 12 12:59 aaa
-rw-r--r-- 1 ubuntu ubuntu 18 Aug 12 13:00 aaa.txt
ubuntu@ubuntu:~$
```

## 2. Network Handling Commands:-

### a. ifconfig

Description:- Ifconfig is used to configure the kernel-resident network interfaces. It is used at boot time to set up interfaces as necessary. After that, it is usually only needed when debugging or when system tuning is needed.

If no arguments are given, ifconfig displays the status of the currently active interfaces. If a single interface argument is given, it displays the status of the given interface only; if a single -a argument is given, it displays the status of all interfaces, even those that are down. Otherwise, it configures an interface.

Syntax:- ifconfig [-v] [-a] [-s] [interface][up][down]



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### Options:-

-a display all interfaces which are currently available, even if down

-s display a short list (like netstat -i)

-v be more verbose for some error conditions

#### interface

The name of the interface. This is usually a driver name followed by a unit number, for example eth0 for the first Ethernet interface. If your kernel supports alias interfaces, you can specify them with eth0:0 for the first alias of eth0. You can use them to assign a second address. To delete an alias interface use ifconfig eth0:0 down. Note: for every scope (i.e. same net with address/netmask combination) all aliases are deleted, if you delete the first (primary).

up This flag causes the interface to be activated. It is implicitly specified if an address is assigned to the interface.

down This flag causes the driver for this interface to be shut down.

[+]arp Enable or disable the use of the ARP protocol on this interface.

#### [+]promisc

Enable or disable the promiscuous mode of the interface. If selected, all packets on the network will be received by the interface.

#### [+]allmulti

Enable or disable all-multicast mode. If selected, all multicast packets on the network will be received by the interface.

#### metric N

This parameter sets the interface metric.

mtu N This parameter sets the Maximum Transfer Unit (MTU) of an interface.

#### dstaddr addr

Set the remote IP address for a point-to-point link (such as PPP). This keyword is now obsolete; use the pointopoint keyword instead.

#### netmask addr

Set the IP network mask for this interface. This value defaults to the usual class A, B or C network mask (as derived from the interface IP address), but it can be set to any value.

#### add addr/prefixlen

Add an IPv6 address to an interface.



del addr/prefixlen

Remove an IPv6 address from an interface.

tunnel aa.bb.cc.dd

Create a new SIT (IPv6-in-IPv4) device, tunnelling to the given destination.

irq addr

Set the interrupt line used by this device. Not all devices can dynamically change their IRQ setting.

io\_addr addr

Set the start address in I/O space for this device.

mem\_start addr

Set the start address for shared memory used by this device. Only a few devices need this.

### Output:-

```

Hrvtviks-MacBook-Pro:~ hrvtvikdesso$ ifconfig -a
lo0: flags=8049<UP,LOOPBACK,RUNNING,MULTICAST> mtu 16384
    options=1283<RXCSUM,TXCSUM,TXSTATUS,SW_TIMESTAMP>
    inet 127.0.0.1 netmask 0xffffffff
        inet6 ::1 prefixlen 128
    inet6 fe80::1%lo0 prefixlen 64 scopeid 0x1
        nd6 options=201<PERFORMNUD,DAD>
gfe0: flags=804<POINTOPOINT,MULTICAST> mtu 1280
stf0: flags=<> mtu 1280
XHC0: flags=<> mtu 0
XHC20: flags=<> mtu 0
en0: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    ether 02:18:98:2d:69:50
    inet 192.168.0.100 netmask 0xffffffff broadcast 192.168.0.255
        inet6 fe80::418:98ff%en0 prefixlen 64 scopeid 0x1
            nd6 options=201<PERFORMNUD,DAD>
        media: autoselect
        status: active
p2p0: flags=B843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 2304
    ether 02:18:98:2d:69:50
    media: autoselect
    status: inactive
awd10: flags=B843<UP,BROADCAST,RUNNING,PROMISC,SIMPLEX,MULTICAST> mtu 1484
    ether a6:c1:cd:46
    inet6 fe80::4a1c:2ff%awd10 prefixlen 64 scopeid 0x8
        nd6 options=201<PERFORMNUD,DAD>
    media: autoselect
    status: active
en1: flags=8863<UP,BROADCAST,SMART,RUNNING,PROMISC,SIMPLEX,MULTICAST> mtu 1500
    options=60<TS04,TS06>
    ether 00:00:00:49:22:01
    media: autoselect <full-duplex>
    status: inactive
en2: flags=8863<UP,BROADCAST,SMART,RUNNING,PROMISC,SIMPLEX,MULTICAST> mtu 1500
    options=60<TS04,TS06>
    ether 00:00:00:49:22:01
    media: autoselect <full-duplex>
    status: inactive
bridge0: flags=B843<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    options=63<RXCSUM,TXCSUM,TS04,TS06>
    ether 00:00:00:49:22:01
    Configuration:
        id 0 priority 0 hellotime 0 fwddelay 0
        message_aging 0 holdmin 0 proto stp maxaddr 100 timeout 1200
        cost 0 port 0 priority 0 path cost 0
        ipfilter disabled flags 0x2
    member: en1 flags=3<LEARNING,DISCOVER>
        ifmaxaddr 0 port 9 priority 0 path cost 0
    member: en2 flags=3<LEARNING,DISCOVER>
        ifmaxaddr 0 port 10 priority 0 path cost 0
        nd6 options=201<PERFORMNUD,DAD>
        media: autoselect
        link-layer-type<none>
        status: inactive
utun0: flags=8051<UP,POINTOPOINT,RUNNING,MULTICAST> mtu 2000
    inet6 fe80::3f1c:29bc:7d6d:534a%utun0 prefixlen 64 scopeid 0xc
        nd6 options=201<PERFORMNUD,DAD>

```



```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ ifconfig en2 down
ifconfig: down: permission denied
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ sudo ifconfig en2 down
[Password:
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ sudo ifconfig en2 up
```

```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ ifconfig en2
en2: flags=8963<UP,BROADCAST,SMART,RUNNING,PROMISC,SIMPLEX,MULTICAST> mtu 1500
    options=60<TS04,TS06>
    ether 0a:00:59:69:22:00
    media: autoselect <full-duplex>
    status: inactive
```

b. traceroute

**Description:-** The Internet is a large and complex aggregation of network hardware, connected together by gateways. Tracking the route one's packets follow (or finding the miscreant gateway that's discarding your packets) can be difficult. **traceroute** utilizes the IP protocol `time to live' field and attempts to elicit an ICMP TIME\_EXCEEDED response from each gateway along the path to some host.

**Syntax:-** **traceroute** [-f first\_ttl] [-g gateway] [-F Do not fragment packet] [-p port] [-q nqueries]

**Options:-** **-a** Turn on AS# lookups for each hop encountered.

**-A as\_server**

Turn on AS# lookups and use the given server instead of the default.

**-d** Enable socket level debugging.

**-D** When an ICMP response to our probe datagram is received, print the differences between the transmitted packet and the packet quoted by the ICMP response. A key showing the location of fields within the transmitted packet is printed, followed by the original packet in hex, followed by the quoted packet in hex. Bytes that are unchanged in the quoted packet are shown as underscores. Note, the IP checksum and the TTL of the quoted packet are not expected to match. By default, only one probe per hop is sent with this option.



**-e** Firewall evasion mode. Use fixed destination ports for UDP and TCP probes. The destination port does NOT increment with each packet sent.

**-f first\_ttl**

Set the initial time-to-live used in the first outgoing probe packet.

**-F** Set the "don't fragment" bit.

**-g gateway**

Specify a loose source route gateway (8 maximum).

**-i iface**

Specify a network interface to obtain the source IP address for outgoing probe packets. This is normally only useful on a multi-homed host. (See the **-s** flag for another way to do this.)

**-I** Use ICMP ECHO instead of UDP datagrams. (A synonym for "-P icmp").

**-M first\_ttl**

Set the initial time-to-live value used in outgoing probe packets. The default is 1, i.e., start with the first hop.

**-m max\_ttl**

Set the max time-to-live (max number of hops) used in outgoing probe packets. The default is net.inet.ip.ttl hops (the same default used for TCP connections).

**-n** Print hop addresses numerically rather than symbolically and numerically (saves a nameserver address-to-name lookup for each gateway found on the path).

**-P proto**

Send packets of specified IP protocol. The currently supported protocols are: UDP , TCP , GRE and ICMP Other protocols may also be specified (either by name or by number), though **traceroute** does not implement any special knowledge of their packet formats. This option is useful for determining which router along a path may be blocking packets based on IP protocol number. But see BUGS below.

**-p port**

Protocol specific. For UDP and TCP, sets the base port number used in probes (default is 33434). **traceroute** hopes that nothing is listening on UDP ports base to base+nhops-1 at the destination host (so an ICMP PORT\_UNREACHABLE message will be returned to terminate the route tracing). If something is listening on a port in the default range, this option can be used to pick an unused port range.

**-q nqueries**



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Set the number of probes per ``ttl'' to nqueries (default is three probes).

**-r** Bypass the normal routing tables and send directly to a host on an attached network. If the host is not on a directly-attached network, an error is returned. This option can be used to ping a local host through an interface that has no route through it (e.g., after the interface was dropped by routed(8)).

**-s src\_addr**

Use the following IP address (which must be given as an IP number, not a hostname) as the source address in outgoing probe packets. On hosts with more than one IP address, this option can be used to force the source address to be something other than the IP address of the interface the probe packet is sent on. If the IP address is not one of this machine's interface addresses, an error is returned and nothing is sent. (See the **-i** flag for another way to do this.)

**-S** Print a summary of how many probes were not answered for each hop.

**-t tos** Set the type-of-service in probe packets to the following value (default zero). The value must be a decimal integer in the range 0 to 255. This option can be used to see if different types-of-service result in different paths. (If you are not running a 4.4BSD or later system, this may be academic since the normal network services like telnet and ftp don't let you control the TOS). Not all values of TOS are legal or meaningful - see the IP spec for definitions. Useful values are probably `‐t 16' (low delay) and `‐t 8' (high throughput).

**-v** Verbose output. Received ICMP packets other than TIME\_EXCEEDED and UNREACHABLEs are listed.

**-w** Set the time (in seconds) to wait for a response to a probe (default 5 sec.).

**-x** Toggle IP checksums. Normally, this prevents **traceroute** from calculating IP checksums. In some cases, the operating system can overwrite parts of the outgoing packet but not recalculate the checksum (so in some cases the default is to not calculate checksums and using **-x** causes them to be calculated). Note that checksums are usually required for the last hop when using ICMP ECHO probes ( **-I** ). So they are always calculated when using ICMP.

**-z pausemsecs**

Set the time (in milliseconds) to pause between probes (default 0). Some systems such as Solaris and routers such as Ciscos rate limit ICMP messages. A good value to use with this is 500 (e.g. 1/2 second).



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### Output:-

```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ traceroute -F google.com
traceroute to google.com (172.217.166.46), 64 hops max, 52 byte packets
 1  22-199-119-111.mysipl.com (111.119.199.22)  5.631 ms  2.278 ms  3.762 ms
 2  * * *
 3  * * *
 4  72.14.196.213 (72.14.196.213)  5.726 ms  3.501 ms  3.380 ms
 5  * * *
 6  209.85.255.208 (209.85.255.208)  4.729 ms
 209.85.142.120 (209.85.142.120)  3.787 ms
 216.239.57.188 (216.239.57.188)  5.684 ms
 7  108.170.248.170 (108.170.248.170)  3.825 ms
 108.170.248.163 (108.170.248.163)  4.540 ms
 108.170.248.186 (108.170.248.186)  3.832 ms
 8  216.239.48.65 (216.239.48.65)  4.750 ms
 64.233.174.27 (64.233.174.27)  4.582 ms
 64.233.174.160 (64.233.174.160)  4.875 ms
 9  108.170.248.193 (108.170.248.193)  4.693 ms
 64.233.174.27 (64.233.174.27)  5.691 ms  5.612 ms
10  108.170.235.51 (108.170.235.51)  7.846 ms
 108.170.234.209 (108.170.234.209)  6.336 ms
 108.170.248.209 (108.170.248.209)  6.401 ms
11  bom07s18-in-f14.1e100.net (172.217.166.46)  3.642 ms  3.800 ms  3.520 ms
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ traceroute -f 10 google.com
traceroute to google.com (172.217.166.46), 64 hops max, 52 byte packets
10  108.170.235.51 (108.170.235.51)  5.351 ms
  bom07s18-in-f14.1e100.net (172.217.166.46)  3.408 ms
 108.170.248.209 (108.170.248.209)  4.528 ms
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ traceroute -g 192.168.43.45
Version 1.4a12+Darwin
Usage: traceroute [-adDeFInrSvx] [-A as_server] [-f first_ttl] [-g gateway] [-i iface]
                  [-M first_ttl] [-m max_ttl] [-p port] [-P proto] [-q nqueries] [-s src_addr]
                  [-t tos] [-w waittime] [-z pausesecs] host [packetlen]
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ traceroute -g 192.168.43.45 google.com
traceroute to google.com (172.217.166.46), 64 hops max, 60 byte packets
 1  * * *
 2  * * *
 3  * * *
 4  * * *
 5  * * *
 6  * * *
 7  * * *
 8  * * *
 9  * * *
10  * * *
11  * * *
12  * * *
```

```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ traceroute -q 1 google.com
traceroute to google.com (172.217.166.46), 64 hops max, 52 byte packets
 1  22-199-119-111.mysipl.com (111.119.199.22)  2.942 ms
 2  *
 3  *
 4  72.14.196.213 (72.14.196.213)  5.408 ms
 5  *
 6  209.85.255.208 (209.85.255.208)  6.117 ms
 7  108.170.248.186 (108.170.248.186)  4.017 ms
 8  216.239.48.65 (216.239.48.65)  4.895 ms
 9  108.170.248.209 (108.170.248.209)  5.455 ms
10  108.170.234.209 (108.170.234.209)  6.060 ms
11  bom07s18-in-f14.1e100.net (172.217.166.46)  4.043 ms
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ traceroute -p 20292 google.com
traceroute to google.com (172.217.166.46), 64 hops max, 52 byte packets
 1  22-199-119-111.mysipl.com (111.119.199.22)  4.641 ms  2.785 ms  2.324 ms
 2  * * *
 3  * *
```



c. nslookup

**Description:-** **Nslookup** is a program to query Internet domain name servers.

**Nslookup** has two modes: interactive and non-interactive. Interactive mode allows the user to query name servers for information about various hosts and domains or to print a list of hosts in a domain. Non-interactive mode is used to print just the name and requested information for a host or domain.

**Syntax:-** **nslookup [-option] [name | -] [server]**

**Options:-** **host [server]**

Look up information for host using the current default server or using server, if specified. If host is an Internet address and the query type is A or PTR, the name of the host is returned. If host is a name and does not have a trailing period, the search list is used to qualify the name.

To look up a host not in the current domain, append a period to the name.

**server domain**

**lserver domain**

Change the default server to domain; **lserver** uses the initial server to look up information about domain, while **server** uses the current default server. If an authoritative answer can't be found, the names of servers that might have the answer are returned.

**root**

not implemented

**finger**

not implemented

**ls**

not implemented

**view**

not implemented



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### **help**

not implemented

### **?**

not implemented

### **exit**

Exits the program.

### **set keyword[=value]**

This command is used to change state information that affects the lookups. Valid keywords are:

#### **all**

Prints the current values of the frequently used options to **set**. Information about the current default server and host is also printed.

#### **class=value**

Change the query class to one of:

#### **IN**

the Internet class

#### **CH**

the Chaos class

#### **HS**

the Hesiod class

#### **ANY**

wildcard

The class specifies the protocol group of the information.

(Default = IN; abbreviation = cl)

### **[no]debug**

Turn on or off the display of the full response packet and any intermediate response packets when searching.

(Default = nodebug; abbreviation = [no]deb)

### **[no]d2**

Turn debugging mode on or off. This displays more about what nslookup is doing.

(Default = nod2)

### **domain=name**



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Sets the search list to name.

### [no]search

If the lookup request contains at least one period but doesn't end with a trailing period, append the domain names in the domain search list to the request until an answer is received.

(Default = search)

### port=value

Change the default TCP/UDP name server port to value.

(Default = 53; abbreviation = po)

### querytype=value

#### type=value

Change the type of the information query.

(Default = A; abbreviations = q, ty)

### [no]recurse

Tell the name server to query other servers if it does not have the information.

(Default = recurse; abbreviation = [no]rec)

### ndots=number

Set the number of dots (label separators) in a domain that will disable searching. Absolute names always stop searching.

### retry=number

Set the number of retries to number.

### timeout=number

Change the initial timeout interval for waiting for a reply to number seconds.

### [no]vc

Always use a virtual circuit when sending requests to the server.

### [no]fail

Try the next nameserver if a nameserver responds with SERVFAIL or a referral (nofail) or terminate query (fail) on such a response.

(Default = nofail)



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### Output:-

```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ nslookup -query=mx redhat.com
Server:      192.168.0.1
Address:     192.168.0.1#53

Non-authoritative answer:
redhat.com      mail exchanger = 10 mx2.redhat.com.
redhat.com      mail exchanger = 5 mx1.redhat.com.

Authoritative answers can be found from:
redhat.com      nameserver = a1-68.akam.net.
redhat.com      nameserver = a16-67.akam.net.
redhat.com      nameserver = a10-65.akam.net.
redhat.com      nameserver = a9-65.akam.net.
redhat.com      nameserver = a13-66.akam.net.
redhat.com      nameserver = a28-64.akam.net.
mx1.redhat.com  internet address = 209.132.183.28
mx2.redhat.com  internet address = 66.187.233.71
a13-66.akam.net internet address = 2.22.230.66
a13-66.akam.net has AAAA address 2600:1480:800::42
a10-65.akam.net internet address = 96.7.50.65
a9-65.akam.net  internet address = 184.85.248.65
a9-65.akam.net  has AAAA address 2a02:26f0:117::41
a1-68.akam.net  internet address = 193.108.91.68
a1-68.akam.net  has AAAA address 2600:1401:2::44
a28-64.akam.net internet address = 95.100.173.64
a16-67.akam.net internet address = 23.211.132.67
a16-67.akam.net has AAAA address 2600:1406:1b::43

[Hrutviks-MacBook-Pro:~ hrutvikdesai$ nslookup -type=ns redhat.com
Server:      192.168.0.1
Address:     192.168.0.1#53

Non-authoritative answer:
redhat.com      nameserver = a10-65.akam.net.
redhat.com      nameserver = a1-68.akam.net.
redhat.com      nameserver = a16-67.akam.net.
redhat.com      nameserver = a28-64.akam.net.
redhat.com      nameserver = a9-65.akam.net.
redhat.com      nameserver = a13-66.akam.net.

Authoritative answers can be found from:
a28-64.akam.net internet address = 95.100.173.64
a10-65.akam.net internet address = 96.7.50.65
a13-66.akam.net internet address = 2.22.230.66
a13-66.akam.net has AAAA address 2600:1480:800::42
a1-68.akam.net  internet address = 193.108.91.68
a1-68.akam.net  has AAAA address 2600:1401:2::44
a9-65.akam.net  internet address = 184.85.248.65
a9-65.akam.net  has AAAA address 2a02:26f0:117::41
a16-67.akam.net internet address = 23.211.132.67
a16-67.akam.net has AAAA address 2600:1406:1b::43

[Hrutviks-MacBook-Pro:~ hrutvikdesai$ nslookup 209.132.183.181
Server:      192.168.0.1
Address:     192.168.0.1#53

Non-authoritative answer:
181.183.132.209.in-addr.arpa  name = origin-www2.redhat.com.

Authoritative answers can be found from:
183.132.209.in-addr.arpa      nameserver = ns1.redhat.com.
183.132.209.in-addr.arpa      nameserver = ns4.redhat.com.
```

d. netstat



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**Description:-** The netstat command symbolically displays the contents of various network-related data structures. There are a number of output formats, depending on the options for the information presented. The first form of the command displays a list of active sockets for each protocol. The second form presents the contents of one of the other network data structures according to the option selected. Using the third form, with a wait interval specified, netstat will continuously display the information regarding packet traffic on the configured network interfaces. The fourth form displays statistics for the specified protocol or address family. If a wait interval is specified, the protocol information over the last interval seconds will be displayed. The fifth form displays per-interface statistics for the specified protocol or address family. The sixth form displays mbuf(9) statistics. The seventh form displays routing table for the specified address family. The eighth form displays routing statistics.

**Syntax:-** netstat [-AaLlnW] [-f address\_family | -p protocol]  
netstat [-gilns] [-v] [-f address\_family] [-I interface]  
netstat -i | -I interface [-w wait] [-c queue] [-abdgqRtS]  
netstat -s [-s] [-f address\_family | -p protocol] [-w wait]  
netstat -i | -I interface -s [-f address\_family | -p protocol]  
netstat -m [-m]  
netstat -r [-Aaln] [-f address\_family]  
netstat -rs [-s]

**Options:-** **-A** With the default display, show the address of any protocol control blocks associated with sockets and the flow hash; used for debugging.

**-a** With the default display, show the state of all sockets; normally sockets used by server processes are not shown. With the routing table display (option **-r**, as described below), show protocol-cloned routes (routes generated by a RTF\_PRCLONING parent route); normally these routes are not shown.

**-b** With the interface display (option **-i**, as described below), show the number of bytes in and out.

**-c queue**

With the queue statistics (option **-q**, as described below), show only those for the specified queue.

**-d** With either interface display (option **-i** or an interval, as described below), show the number of dropped packets.

**-f address\_family**

Limit statistics or address control block reports to those of the specified address family. The following address families are recognized: inet, for AF\_INET, inet6, for AF\_INET6 and unix, for AF\_UNIX.

**-g** Show information related to multicast (group address) membership. If the **-s** option is also present, show extended interface group management statistics. If the **-v** option is specified, show link-layer memberships; they are suppressed by default. Source lists for each group will also be printed. Specifying **-v** twice will print the control



plane timers for each interface and the source list counters for each group. If the **-i** is specified, only that interface will be shown. If the **-f** is specified, only information for the address family will be displayed.

**-I interface**

Show information about the specified interface; used with a wait interval as described below. If the **-s** option is present, show per-interface protocol statistics on the interface for the specified address family or protocol, or for all protocol families.

**-i** Show the state of interfaces which have been auto-configured (interfaces statically configured into a system, but not located at boot time are not shown). If the **-a** options is also present, multicast addresses currently in use are shown for each Ethernet interface and for each IP interface address. Multicast addresses are shown on separate lines following the interface address with which they are associated. If the **-s** option is present, show per-interface statistics on all interfaces for the specified address family or protocol, or for all protocol families.

**-L** Show the size of the various listen queues. The first count shows the number of unaccepted connections. The second count shows the amount of unaccepted incomplete connections. The third count is the maximum number of queued connections.

**-I** Print full IPv6 address.

**-m** Show statistics recorded by the memory management routines (the network stack manages a private pool of memory buffers). More detailed information about the buffers, which includes their cache related statistics, can be obtained by using **-mm** or **-m -m** option.

**-n** Show network addresses as numbers (normally **netstat** interprets addresses and attempts to display them symbolically). This option may be used with any of the display formats.

**-p protocol**

Show statistics about protocol, which is either a well-known name for a protocol or an alias for it. Some protocol names and aliases are listed in the file /etc/protocols.

The special protocol name ``bdg'' is used to show bridging statistics. A null response typically means that there are no interesting numbers to report. The program will complain if protocol is unknown or if there is no statistics routine for it.

**-q** Show network interface send queue statistics. By default all queues are displayed, unless specified with **-c**. This option requires specifying an interface with **-I** option.

More detailed information about the queues, which includes their queueing algorithm related statistics, can be obtained by using **-qq** or **-q -q** option.

**-r** Show the routing tables. Use with **-a** to show protocol-cloned routes. When **-s** is also present, show routing statistics instead. When **-I** is also present, **netstat** assumes more columns are there and the maximum transmission unit. More detailed information about the route metrics are displayed with **-ll** for TCP round trip times **-lll** for all metrics. Use the **-z** flags to display only entries with non-zero RTT values. (``mtu'') are also displayed.



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**-R** Show reachability information. Use with **-i** to show link-layer reachability information for a given interface.

**-s** Show per-protocol statistics. If this option is repeated, counters with a value of zero are suppressed. For security reasons, root privileges are required to read TCP statistics and in the absence of such privileges all TCP counters will be reported as zero.

**-S** Show interface link status and interface state information about the specified interface. This option requires specifying an interface with **-I** option.

**-v** Increase verbosity level.

**-W** In certain displays, avoid truncating addresses even if this causes some fields to overflow.

**-w** wait

Show network interface or protocol statistics at intervals of wait seconds.

**-x** Show extended link-layer reachability information in addition to that shown by the **-R** flag.

### Output:-

```
[Hrutviks-MacBook-Pro:~ hrvtvikdesai$ netstat -a
Active Internet connections (including servers)
Proto Recv-Q Send-Q Local Address          Foreign Address        (state)
tcp4      0      0 192.168.0.160.50772    kul01s09-in-f66..https ESTABLISHED
tcp4      0      0 192.168.0.160.50293    sg-sgp-ibm-r001..5938 ESTABLISHED
tcp4      0      0 192.168.0.160.50025    17.242.12.75.https ESTABLISHED
tcp4      0      0 localhost.15292           *.*                  LISTEN
tcp4      0      0 localhost.5941           localhost.49220       ESTABLISHED
tcp4      0      0 localhost.49220          localhost.5941       ESTABLISHED
tcp4      0      0 localhost.5941           localhost.49181       ESTABLISHED
tcp4      0      0 localhost.49181          localhost.5941       ESTABLISHED
tcp4      0      0 localhost.ndmp          *.*                  LISTEN
tcp6      0      0 *.26085              *.*                  LISTEN
tcp4      0      0 *.26085              *.*                  LISTEN
tcp4      0      0 localhost.5941           *.*                  LISTEN
tcp4      0      0 localhost.5941           *.*                  LISTEN
tcp6      0      0 *.postgresql         *.*                  LISTEN
tcp4      0      0 *.postgresql         *.*                  LISTEN
```

```
[Hrutviks-MacBook-Pro:~ hrvtvikdesai$ netstat -l
Active Internet connections
Proto Recv-Q Send-Q Local Address          Foreign Address        (state)
tcp4      0      0 192.168.0.160.50772    kul01s09-in-f66..https ESTABLISHED
tcp4      0      0 192.168.0.160.50293    sg-sgp-ibm-r001..5938 ESTABLISHED
tcp4      0      0 192.168.0.160.50025    17.242.12.75.https ESTABLISHED
tcp4      0      0 localhost.5941           localhost.49220       ESTABLISHED
tcp4      0      0 localhost.49220          localhost.5941       ESTABLISHED
tcp4      0      0 localhost.5941           localhost.49181       ESTABLISHED
tcp4      0      0 localhost.49181          localhost.5941       ESTABLISHED
udp4      0      0 *.*                  *.*                  *
udp4      0      0 *.61810              *.*                  *
udp6      0      0 *.64370              *.*                  *
udp4      0      0 *.64370              *.*                  *
udp6      0      0 *.54325              *.*                  *
udp4      0      0 *.54325              *.*                  *
udp6      0      0 *.59143              *.*                  *
udp4      0      0 *.59143              *.*                  *
udp4      0      0 *.plysrv-https       *.*                  *
```



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```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ netstat -s
tcp:
    0 packet sent
        0 data packet (0 byte)
        0 data packet (0 byte) retransmitted
        0 resend initiated by MTU discovery
        0 ack-only packet (0 delayed)
        0 URG only packet
        0 window probe packet
        0 window update packet
        0 control packet
        0 data packet sent after flow control
        0 challenge ACK sent due to unexpected SYN
        0 challenge ACK sent due to unexpected RST
        0 checksummed in software
            0 segment (0 byte) over IPv4
            0 segment (0 byte) over IPv6
    0 packet received
        0 ack (for 0 byte)
        0 duplicate ack
```

```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ netstat -r
Routing tables

Internet:
Destination      Gateway          Flags   Refs      Use     Netif Expire
default         dlinkrouter      UGSc    347       0       en0
127             localhost        UCS     0        0       lo0
localhost       localhost        UH      5      1723     lo0
169.254         link#6          UCS     0        0       en0      !
192.168.0        link#6          UCS     1        0       en0      !
192.168.0.1/32   link#6          UCS     1        0       en0      !
dlinkrouter      c0:a0:bb:f4:e9:e8 UHLWlir  293      618     en0    1171
192.168.0.155   link#6          UHLWii   1        16      en0      !
192.168.0.160/32 link#6          UCS     1        0       en0      !
192.168.0.160   f0:18:98:2d:69:50 UHLWI    0        24      lo0
224.0.0/4        link#6          UmCS    2        0       en0      !
224.0.0.251     1:0:5e:0:0:fb   UHmLWI   0        0       en0
239.255.255.250 1:0:5e:7f:ff:fa UHmLWI   0        8       en0
255.255.255.252 link#6          UCS     0        0       en0      !

Internet6:
Destination      Gateway          Flags   Netif Expire
default         fe80::%utun0     UGcI    utun0
localhost       localhost        UHL     lo0
fe80::%lo0      fe80::1%lo0     UcI     lo0
fe80::1%lo0     link#1          UHLI    lo0
fe80::%en0      link#6          UCI     en0
fe80::1c5a:53da:25 f0:18:98:2d:69:50 UHLI    lo0
fe80::%awdl0     link#8          UCI     awdl0
fe80::741f:40ff:fe 76:1f:40:41:14:57 UHLI    lo0
fe80::%utun0     fe80::53d3:109:3a3 UcI     utun0
fe80::53d3:109:3a3 link#12         UHLI    lo0
ff01::%lo0      localhost        UmCI    lo0
ff01::%en0      link#6          UmCI    en0
ff01::%awdl0     link#8          UmCI    awdl0
ff01::%utun0     fe80::53d3:109:3a3 UmCI    utun0
ff02::%lo0      localhost        UmCI    lo0
ff02::%en0      link#6          UmCI    en0
ff02::%awdl0     link#8          UmCI    awdl0
ff02::%utun0     fe80::53d3:109:3a3 UmCI    utun0
```



e. *dig*

**Description:-** dig (domain information groper) is a flexible tool for interrogating DNS name servers. It performs DNS lookups and displays the answers that are returned from the name

server(s) that were queried. Most DNS administrators use dig to troubleshoot DNS problems because of its flexibility, ease of use and clarity of output. Other lookup tools tend to have less functionality than dig.

Although dig is normally used with command-line arguments, it also has a batch mode of operation for reading lookup requests from a file. A brief summary of its command-line arguments and options is printed when the -h option is given. Unlike earlier versions, the BIND 9 implementation of dig allows multiple lookups to be issued from the command line.

Unless it is told to query a specific name server, dig will try each of the servers listed in /etc/resolv.conf. If no usable server addresses are found, dig will send the query to the local host.

When no command line arguments or options are given, dig will perform an NS query for "." (the root).

It is possible to set per-user defaults for dig via \${HOME}/.digrc. This file is read and any options in it are applied before the command line arguments.

The IN and CH class names overlap with the IN and CH top level domain names. Either use the -t and -c options to specify the type and class, use the -q to specify the domain name, or use "IN." and "CH." when looking up these top level domains.

**Syntax:-** nslookup [-option] [name | -] [server]

**Options:-** -4

Use IPv4 only.

-6

Use IPv6 only.

-b address[#port]

Set the source IP address of the query. The address must be a valid address on one of the host's network interfaces, or "0.0.0.0" or "::". An optional port may be specified by appending "#<port>"

-c class



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Set the query class. The default class is IN; other classes are HS for Hesiod records or CH for Chaosnet records.

**-f file**

Batch mode: **dig** reads a list of lookup requests to process from the given file. Each line in the file should be organized in the same way they would be presented as queries to **dig** using the command-line interface.

**-i**

Do reverse IPv6 lookups using the obsolete RFC1886 IP6.INT domain, which is no longer in use. Obsolete bit string label queries (RFC2874) are not attempted.

**-k keyfile**

Sign queries using TSIG using a key read from the given file. Key files can be generated using **tsig-keygen(8)**. When using TSIG authentication with **dig**, the name server that is queried needs to know the key and algorithm that is being used. In BIND, this is done by providing appropriate **key** and **server** statements in named.conf.

**-m**

Enable memory usage debugging.

**-p port**

Send the query to a non-standard port on the server, instead of the default port 53. This option would be used to test a name server that has been configured to listen for queries on a non-standard port number.

**-q name**

The domain name to query. This is useful to distinguish the name from other arguments.

**-t type**

The resource record type to query. It can be any valid query type which is supported in BIND 9. The default query type is "A", unless the **-x** option is supplied to indicate a reverse lookup. A zone transfer can be requested by specifying a type of AXFR. When an incremental zone transfer (IXFR) is required, set the type to ixfr=N. The incremental zone transfer will contain the changes made to the zone since the serial number in the zone's SOA record was N.

**-v**

Print the version number and exit.

**-x addr**

Simplified reverse lookups, for mapping addresses to names. The addr is an IPv4 address in dotted-decimal notation, or a colon-delimited IPv6 address. When the **-x** is used, there is no need to provide the name, class and type arguments. **dig** automatically performs a lookup for a name like 94.2.0.192.in-addr.arpa and sets the query type and class to PTR and IN respectively. IPv6 addresses are looked up using nibble format under the IP6.ARPA domain (but see also the **-i** option).



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**-y [hmac:]keyname:secret**

Sign queries using TSIG with the given authentication key. keyname is the name of the key, and secret is the base64 encoded shared secret. hmac is the name of the key

algorithm; valid choices are hmac-md5, hmac-sha1, hmac-sha224, hmac-sha256, hmac-sha384, or hmac-sha512. If hmac is not specified, the default is hmac-md5 or if MD5 was disabled hmac-sha256.

### **Output:-**

```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ dig -x 216.58.220.110

; <>> DiG 9.10.6 <>> -x 216.58.220.110
;; global options: +cmd
;; Got answer:
;; -->HEADER<-- opcode: QUERY, status: NOERROR, id: 34097
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 4, ADDITIONAL: 9

;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags: udp: 4096
;; QUESTION SECTION:
;110.220.58.216.in-addr.arpa. IN PTR

;; ANSWER SECTION:
110.220.58.216.in-addr.arpa. 86400 IN PTR syd10s01-in-f110.1e100.net.

;; AUTHORITY SECTION:
220.58.216.in-addr.arpa. 75182 IN NS ns1.google.com.
220.58.216.in-addr.arpa. 75182 IN NS ns3.google.com.
220.58.216.in-addr.arpa. 75182 IN NS ns4.google.com.
220.58.216.in-addr.arpa. 75182 IN NS ns2.google.com.

;; ADDITIONAL SECTION:
ns3.google.com. 332377 IN A 216.239.36.10
ns3.google.com. 159537 IN AAAA 2001:4860:4802:36::a
ns1.google.com. 332377 IN A 216.239.32.10
ns1.google.com. 159537 IN AAAA 2001:4860:4802:32::a
ns4.google.com. 332377 IN A 216.239.38.10
ns4.google.com. 333692 IN AAAA 2001:4860:4802:38::a
ns2.google.com. 332377 IN A 216.239.34.10
ns2.google.com. 159537 IN AAAA 2001:4860:4802:34::a

;; Query time: 65 msec
;; SERVER: 192.168.0.1#53(192.168.0.1)
;; WHEN: Sat Aug 03 18:02:15 IST 2019
;; MSG SIZE rcvd: 354
```

```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ dig google.com +trace
; <>> DiG 9.10.6 <>> google.com +trace
;; global options: +cmd
;110.220.58.216.in-addr.arpa. IN PTR
;; Got answer:
;; -->HEADER<-- opcode: QUERY, status: NOERROR, id: 34097
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 4, ADDITIONAL: 9
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags: udp: 4096
;; QUESTION SECTION:
;google.com. IN A
;; ANSWER SECTION:
google.com. 86400 IN A 216.239.36.10
;; AUTHORITY SECTION:
ns1.google.com. 332377 IN A 216.239.36.10
ns1.google.com. 159537 IN AAAA 2001:4860:4802:36::a
ns3.google.com. 332377 IN A 216.239.34.10
ns3.google.com. 159537 IN AAAA 2001:4860:4802:34::a
ns4.google.com. 332377 IN A 216.239.38.10
ns4.google.com. 159537 IN AAAA 2001:4860:4802:38::a
ns2.google.com. 332377 IN A 216.239.32.10
ns2.google.com. 159537 IN AAAA 2001:4860:4802:32::a

;; ADDITIONAL SECTION:
ns1.google.com. 332377 IN A 216.239.36.10
ns1.google.com. 159537 IN AAAA 2001:4860:4802:36::a
ns3.google.com. 332377 IN A 216.239.34.10
ns3.google.com. 159537 IN AAAA 2001:4860:4802:34::a
ns4.google.com. 332377 IN A 216.239.38.10
ns4.google.com. 159537 IN AAAA 2001:4860:4802:38::a
ns2.google.com. 332377 IN A 216.239.32.10
ns2.google.com. 159537 IN AAAA 2001:4860:4802:32::a

;; Query time: 65 msec
;; SERVER: 192.168.0.1#53(192.168.0.1)
;; WHEN: Sat Aug 03 18:02:15 IST 2019
;; MSG SIZE rcvd: 354

;; Received 1897 bytes from 192.168.0.1 in 5 ms

;; Got answer:
;; -->HEADER<-- opcode: QUERY, status: NOERROR, id: 34097
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 4, ADDITIONAL: 9
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags: udp: 4096
;; QUESTION SECTION:
;google.com. IN A
;; ANSWER SECTION:
google.com. 86400 IN A 216.239.36.10
;; AUTHORITY SECTION:
ns1.google.com. 332377 IN A 216.239.36.10
ns1.google.com. 159537 IN AAAA 2001:4860:4802:36::a
ns3.google.com. 332377 IN A 216.239.34.10
ns3.google.com. 159537 IN AAAA 2001:4860:4802:34::a
ns4.google.com. 332377 IN A 216.239.38.10
ns4.google.com. 159537 IN AAAA 2001:4860:4802:38::a
ns2.google.com. 332377 IN A 216.239.32.10
ns2.google.com. 159537 IN AAAA 2001:4860:4802:32::a

;; ADDITIONAL SECTION:
ns1.google.com. 332377 IN A 216.239.36.10
ns1.google.com. 159537 IN AAAA 2001:4860:4802:36::a
ns3.google.com. 332377 IN A 216.239.34.10
ns3.google.com. 159537 IN AAAA 2001:4860:4802:34::a
ns4.google.com. 332377 IN A 216.239.38.10
ns4.google.com. 159537 IN AAAA 2001:4860:4802:38::a
ns2.google.com. 332377 IN A 216.239.32.10
ns2.google.com. 159537 IN AAAA 2001:4860:4802:32::a

;; Query time: 65 msec
;; SERVER: 192.168.0.1#53(192.168.0.1)
;; WHEN: Sat Aug 03 18:02:15 IST 2019
;; MSG SIZE rcvd: 354

;; Received 1178 bytes from 192.168.128.305(ns1.root-servers.net) in 234 ms

;; Got answer:
;; -->HEADER<-- opcode: QUERY, status: NOERROR, id: 34097
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 4, ADDITIONAL: 9
;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags: udp: 4096
;; QUESTION SECTION:
;ns1.root-servers.net. IN A
;; ANSWER SECTION:
ns1.root-servers.net. 332377 IN A 216.239.36.10
;; AUTHORITY SECTION:
ns3.root-servers.net. 332377 IN A 216.239.34.10
ns3.root-servers.net. 159537 IN AAAA 2001:4860:4802:34::a
ns5.root-servers.net. 332377 IN A 216.239.32.10
ns5.root-servers.net. 159537 IN AAAA 2001:4860:4802:32::a
ns7.root-servers.net. 332377 IN A 216.239.38.10
ns7.root-servers.net. 159537 IN AAAA 2001:4860:4802:38::a
ns9.root-servers.net. 332377 IN A 216.239.30.10
ns9.root-servers.net. 159537 IN AAAA 2001:4860:4802:30::a
ns1.root-servers.net. 332377 IN A 216.239.36.10
ns1.root-servers.net. 159537 IN AAAA 2001:4860:4802:36::a
ns3.root-servers.net. 332377 IN A 216.239.34.10
ns3.root-servers.net. 159537 IN AAAA 2001:4860:4802:34::a
ns5.root-servers.net. 332377 IN A 216.239.32.10
ns5.root-servers.net. 159537 IN AAAA 2001:4860:4802:32::a
ns7.root-servers.net. 332377 IN A 216.239.38.10
ns7.root-servers.net. 159537 IN AAAA 2001:4860:4802:38::a
ns9.root-servers.net. 332377 IN A 216.239.30.10
ns9.root-servers.net. 159537 IN AAAA 2001:4860:4802:30::a

;; ADDITIONAL SECTION:
ns1.root-servers.net. 332377 IN A 216.239.36.10
ns1.root-servers.net. 159537 IN AAAA 2001:4860:4802:36::a
ns3.root-servers.net. 332377 IN A 216.239.34.10
ns3.root-servers.net. 159537 IN AAAA 2001:4860:4802:34::a
ns5.root-servers.net. 332377 IN A 216.239.32.10
ns5.root-servers.net. 159537 IN AAAA 2001:4860:4802:32::a
ns7.root-servers.net. 332377 IN A 216.239.38.10
ns7.root-servers.net. 159537 IN AAAA 2001:4860:4802:38::a
ns9.root-servers.net. 332377 IN A 216.239.30.10
ns9.root-servers.net. 159537 IN AAAA 2001:4860:4802:30::a

;; Query time: 65 msec
;; SERVER: 192.168.128.305(ns1.root-servers.net)
;; WHEN: Sat Aug 03 18:02:15 IST 2019
;; MSG SIZE rcvd: 354

;; Received 55 bytes from 216.239.34.10(ns2.google.com) in 62 ms
```



```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ dig @8.8.8.8 -p 5300 google.com
; <>> DiG 9.10.6 <>> @8.8.8.8 -p 5300 google.com
; (1 server found)
;; global options: +cmd
;; connection timed out; no servers could be reached
```

### 3. Process Handling Commands:-

#### a. top

**Description:-** The **top** program periodically displays a sorted list of system processes. The default sorting key is pid, but other keys can be used instead. Various output options are available.

**Syntax:-** **top** [**-a** | **-d** | **-e** | **-c mode**]

- [-F | -f]**
- [-h]**
- [-i interval]**
- [-l samples]**
- [-ncols columns]**
- [-o key | -O skey]**
- [-R | -r]**
- [-S]**
- [-s delay-secs]**
- [-n nprocs]**
- [-stats keys]**
- [-pid processid]**
- [-user username]**
- [-U username]**
- [-u]**

**Options:-** **-a**    Equivalent to Fl c Ar a .

**-c mode**

Set event counting mode to mode. The supported modes are

a    Accumulative mode. Count events cumulatively, starting at the launch of **top**. Calculate CPU usage and CPU time since the launch of **top**.



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d Delta mode. Count events relative to the previous sample. Calculate CPU usage since the previous sample. This mode by default disables the memory object map

reporting. The memory object map reporting may be re-enabled with the **-r** option or the interactive **r** command.

e Absolute mode. Count events using absolute counters.

n Non-event mode (default). Calculate CPU usage since the previous sample.

**-d** Equivalent to **-c d**.

**-e** Equivalent to **-c e**.

**-F** Do not calculate statistics on shared libraries, also known as frameworks.

**-f** Calculate statistics on shared libraries, also known as frameworks (default).

**-h** Print command line usage information and exit.

**-i** interval

Update framework (**-f**) info every interval samples; see the PERFORMANCE/ACCURACY TRADEOFF section for more details.

**-l** samples

Use logging mode and display samples samples, even if standard output is a terminal. 0 is treated as infinity. Rather than redisplaying, output is periodically printed in raw form. Note that the first sample displayed will have an invalid %CPU displayed for each process, as it is calculated using the delta between samples.

**-n** nprocs

Display nprocs when using logging mode. The default is infinite. The number must be >0 or an error will occur.

**-n** nprocs

Only display up to nprocs processes.

**-O** skey

Use skey as a secondary key when ordering the process display. See **-o** for key names (pid is the default).

**-o** key Order the process display by sorting on key in descending order. A + or - can be prefixed to the key name to specify ascending or descending order, respectively. The supported keys are:

pid Process ID (default).

command

Command name.



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cpu CPU usage.

cpu\_me CPU time charged to me by other processes.

cpu\_others

CPU time charged to other processes by me.

csw The number of context switches.

time Execution time.

threads

alias: th

ports alias: prt

Number of Mach ports.

mregion

alias: mreg, reg

Number of memory regions.

mem Physical memory footprint of the process.

rprvt Resident private address space size.

purg Purgeable memory size.

vsize Total memory size.

vprvt Private address space size.

kprvt Private kernel memory size.

kshrd Shared kernel memory size.

pgrp Process group ID.

ppid Parent process ID.

state alias: pstate

Process state.

uid User ID.

wq alias: #wq, workqueue

The workqueue total/running.

faults alias: fault

The number of page faults.



**cow alias: cow\_faults**  
The copy-on-write faults.

**user alias: username**  
Username.

**msgsent**  
Total number of Mach messages sent.

**msgrecv**  
Total number of Mach messages received.

**sysbsd** Total BSD syscalls.

**sysmach**  
Total Mach syscalls.

**pageins**  
Total pageins.

**boosts** The number of boosts help by the process. This is followed by the number of times the process has transitioned from unboosted to boosted in brackets. An asterisk before the value indicates that the process was able to send boosts at some point since the previous update. For more information about boosts, see

**xpc\_transaction\_begin(3).**

**instrs** The number of instructions retired by the process in both user space and the kernel.

**cycles** The number of cycles spent executing instructions in the process in both user space and the kernel.

**-R** Do not traverse and report the memory object map for each process (default).

**-r** Traverse and report the memory object map for each process.

**-S** Display the global statistics for swap and purgeable memory.

**-s delay-secs**

Set the delay between updates to delay-secs seconds. The default delay between updates is 1 second.

**-stats keys**

Only display the comma separated statistics. See the **-o** flag for the valid keys.

**-pid processid**

Only display processid in **top**. This option may be specified multiple times.

**-user user**



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Only display processes owned by user

**-U user**

This is an alias for **-user**.

**-u** This is an alias equivalent to: **-o cpu -O time**

### Output:-

Ubuntu@ubuntu:~\$ top -u ubuntu													
top - 17:37:43 up 5:20, 1 user, load average: 0.11, 0.08, 0.02													
Tasks: 203 total, 2 running, 154 sleeping, 0 stopped, 1 zombie													
%Cpu(s): 1.3 us, 0.2 sy, 0.0 ni, 98.5 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st													
KiB Mem : 3774916 total, 145200 free, 1163884 used, 2465832 buff/cache													
KiB Swap: 0 total, 0 free, 0 used. 1614012 avail Mem													
PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND		
1526	ubuntu	20	0	759776	127368	93492	S	2.7	3.4	1:58.17	Xorg		
4445	ubuntu	20	0	727988	37880	28016	S	2.0	1.0	0:05.50	gnome-terminal		
1749	ubuntu	20	0	3926120	377612	73752	S	1.7	10.0	2:30.61	gnome-shell		
1687	ubuntu	20	0	220772	6984	6272	S	0.3	0.2	0:03.18	at-spi2-registr		
<b>5274</b>	<b>ubuntu</b>	<b>20</b>	<b>0</b>	<b>52960</b>	<b>4100</b>	<b>3416</b>	R	<b>0.3</b>	<b>0.1</b>	<b>0:00.05</b>	<b>top</b>		
1506	ubuntu	20	0	77044	8352	6776	S	0.0	0.2	0:00.39	systemd		
1507	ubuntu	20	0	114000	2528	8	S	0.0	0.1	0:00.00	(sd-pam)		
1520	ubuntu	20	0	290128	7356	6424	S	0.0	0.2	0:00.16	gnome-keyring-d		
1524	ubuntu	20	0	213876	6104	5496	S	0.0	0.2	0:00.00	gdm-x-session		
1578	ubuntu	20	0	51080	5632	3908	S	0.0	0.1	0:01.21	dbus-daemon		
1581	ubuntu	20	0	569392	14592	11932	S	0.0	0.4	0:00.43	gnome-session-b		
1657	ubuntu	20	0	0	0	0	Z	0.0	0.0	0:00.01	xbrlapi		
1676	ubuntu	20	0	11304	312	0	S	0.0	0.0	0:00.07	ssh-agent		
1679	ubuntu	20	0	349284	6388	5824	S	0.0	0.2	0:00.01	at-spi-bus-laun		
1684	ubuntu	20	0	50056	4576	3972	S	0.0	0.1	0:00.40	dbus-daemon		
1728	ubuntu	20	0	289836	7476	6784	S	0.0	0.2	0:00.00	gnome-keyring-d		
1782	ubuntu	20	0	367448	7248	6236	S	0.0	0.2	0:00.12	gvfsd		
1787	ubuntu	20	0	416112	5464	4932	S	0.0	0.1	0:00.01	gvfsd-fuse		
1798	ubuntu	9	-11	1174568	13040	9244	S	0.0	0.3	0:00.33	pulseaudio		
1843	ubuntu	20	0	364584	9176	6496	S	0.0	0.2	0:03.89	ibus-daemon		
1847	ubuntu	20	0	689580	18948	16084	S	0.0	0.5	0:00.15	gnome-shell-cal		
1853	ubuntu	20	0	1373976	26596	22232	S	0.0	0.7	0:00.21	evolution-sourc		
1864	ubuntu	20	0	188024	5384	4720	S	0.0	0.1	0:00.07	dconf-service		
1867	ubuntu	20	0	308188	7804	6568	S	0.0	0.2	0:00.39	gvfs-udisks2-vo		
1872	ubuntu	20	0	282276	6028	5480	S	0.0	0.2	0:00.04	gvfs-mtp-volume		
1874	ubuntu	20	0	776044	31032	25684	S	0.0	0.8	0:00.22	goa-daemon		
1878	ubuntu	20	0	290516	6588	5836	S	0.0	0.2	0:00.05	gvfs-gphoto2-vo		



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```
ubuntu@ubuntu:~$ top -n 10
```

```
top - 17:38:14 up 5:20, 1 user, load average: 0.19, 0.10, 0.02
Tasks: 208 total, 1 running, 159 sleeping, 0 stopped, 1 zombie
%Cpu(s): 7.8 us, 1.3 sy, 0.0 ni, 90.6 id, 0.0 wa, 0.0 hi, 0.3 si, 0.0 st
KiB Mem : 3774916 total, 120652 free, 1209588 used, 2444676 buff/cache
KiB Swap: 0 total, 0 free, 0 used. 1566124 avail Mem
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
1749	ubuntu	20	0	3928128	379572	73636	S	18.3	10.1	2:35.81	gnome-shell
1526	ubuntu	20	0	762276	127992	93808	S	6.6	3.4	1:59.62	Xorg
5333	ubuntu	20	0	1211004	38040	27628	S	6.6	1.0	0:00.45	gnome-screensho
4445	ubuntu	20	0	727988	37880	28016	S	2.7	1.0	0:05.87	gnome-terminal-
5347	root	20	0	61816	3036	2556	S	0.7	0.1	0:00.02	systemd-hostnam
1	root	20	0	225632	9896	7164	S	0.3	0.3	0:16.57	systemd
10	root	20	0	0	0	0	I	0.3	0.0	0:01.94	rcu_sched
1578	ubuntu	20	0	51080	5640	3908	S	0.3	0.1	0:01.25	dbus-daemon
1798	ubuntu	9	-11	1436784	13164	9368	S	0.3	0.3	0:00.34	pulseaudio
1843	ubuntu	20	0	364584	9176	6496	S	0.3	0.2	0:03.96	ibus-daemon
2056	ubuntu	20	0	369972	7768	6432	S	0.3	0.2	0:00.09	gvfsd-trash
4248	ubuntu	20	0	858320	53676	36880	S	0.3	1.4	0:08.70	nautilus
4845	root	20	0	0	0	0	I	0.3	0.0	0:00.34	kworker/2:2-eve
5275	ubuntu	20	0	52960	4124	3444	R	0.3	0.1	0:00.12	top
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00	kthreadd
3	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	rcu_gp
4	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	rcu_par_gp
6	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/0:0H-kb
8	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	mm_percpu_wq
9	root	20	0	0	0	0	S	0.0	0.0	0:00.19	ksoftirqd/0
11	root	20	0	0	0	0	I	0.0	0.0	0:00.00	rcu_bh
12	root	rt	0	0	0	0	S	0.0	0.0	0:00.02	migration/0
13	root	rt	0	0	0	0	S	0.0	0.0	0:00.07	watchdog/0
14	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cpuhp/0
15	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cpuhp/1

```
ubuntu@ubuntu:~$ top -b
```

```
top - 17:40:40 up 5:23, 1 user, load average: 0.37, 0.20, 0.07
Tasks: 209 total, 1 running, 157 sleeping, 0 stopped, 1 zombie
%Cpu(s): 0.6 us, 0.2 sy, 0.0 ni, 99.1 id, 0.1 wa, 0.0 hi, 0.0 si, 0.0 st
KiB Mem : 3774916 total, 147896 free, 1197560 used, 2429460 buff/cache
KiB Swap: 0 total, 0 free, 0 used. 1576124 avail Mem
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
1749	ubuntu	20	0	3929188	382576	74840	S	12.5	10.1	2:55.02	gnome-shell
1526	ubuntu	20	0	760900	129284	94480	S	6.2	3.4	2:05.44	Xorg
4445	ubuntu	20	0	727988	37920	28004	S	6.2	1.0	0:06.76	gnome-terminal-
5347	ubuntu	20	0	52932	4072	3472	R	6.2	0.1	0:00.02	top
1	root	20	0	225632	9896	7164	S	0.0	0.3	0:16.75	systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00	kthreadd
3	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	rcu_gp
4	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	rcu_par_gp
6	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/0:0H-kb
8	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	mm_percpu_wq
9	root	20	0	0	0	0	S	0.0	0.0	0:00.19	ksoftirqd/0
10	root	20	0	0	0	0	I	0.0	0.0	0:02.02	rcu_sched
11	root	20	0	0	0	0	I	0.0	0.0	0:00.00	rcu_bh
12	root	rt	0	0	0	0	S	0.0	0.0	0:00.02	migration/0
13	root	rt	0	0	0	0	S	0.0	0.0	0:00.07	watchdog/0
14	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cpuhp/0



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```
ubuntu@ubuntu:~$ top -c
top - 17:42:14 up 5:24, 1 user, load average: 0.28, 0.22, 0.09
Tasks: 216 total, 1 running, 160 sleeping, 0 stopped, 1 zombie
%Cpu(s): 9.1 us, 1.3 sy, 0.0 ni, 89.1 id, 0.0 wa, 0.0 hi, 0.5 si, 0.0 st
KTB Mem : 3774916 total, 179160 free, 1210092 used, 2385664 buff/cache
KiB Swap: 0 total, 0 free, 0 used. 1551536 avail Mem

 PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND
 1749 ubuntu 20 0 3930376 382264 74888 S 29.1 10.1 3:04.81 /usr/bin/gnome-shell
 1526 ubuntu 20 0 756644 125048 90244 S 7.6 3.3 2:09.08 /usr/lib/xorg/Xorg vt1 -displayfd 3 -auth /run/user/999/gdm/Xauthority ++
5227 root 20 0 0 0 0 I 0.7 0.0 0:00.44 [kworker/u16:0-i]
 10 root 20 0 0 0 0 I 0.3 0.0 0:02.09 [rcu_sched]
5437 ubuntu 20 0 52932 4072 3472 S 0.3 0.1 0:00.48 top -b
5573 ubuntu 20 0 53080 4148 3376 R 0.3 0.1 0:00.11 top -c
 1 root 20 0 225632 9896 7164 S 0.0 0.3 0:16.86 /sbin/init noprompt ignore_uuid splash ---
 2 root 20 0 0 0 0 S 0.0 0.0 0:00.00 [kthreadd]
 3 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 [rcu_gp]
 4 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 [rcu_par_gp]
 6 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 [kworker/0:0H-kb]
```

b. ps

**Description:-** The **ps** utility displays a header line, followed by lines containing information about all of your processes that have controlling terminals.

A different set of processes can be selected for display by using any combination of the **-a**, **-G**, **-g**, **-p**, **-T**, **-t**, **-U**, and **-u** options. If more than one of these options are given, then **ps** will select all processes which are matched by at least one of the given options.

For the processes which have been selected for display, **ps** will usually display one line per process. The **-M** option may result in multiple output lines (one line per thread) for some processes. By default all of these output lines are sorted first by controlling terminal, then by process ID. The **-m**, **-r**, and **-v** options will change the sort order. If more than one sorting option was given, then the selected processes will be sorted by the last sorting option which was specified.

For the processes which have been selected for display, the information to display is selected based on a set of keywords (see the **-L**, **-O**, and **-o** options). The default output format includes, for each process, the process' ID, controlling terminal, CPU time (including both user and system time), state, and associated command.

**Syntax:-** **top [-a | -d | -e | -c mode]**

- [-F | -f]**
- [-h]**
- [-i interval]**
- [-l samples]**
- [-ncols columns]**
- [-o key | -O skey]**
- [-R | -r]**
- [-S]**
- [-s delay-secs]**
- [-n nprocs]**



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**[-stats keys]  
[-pid processid]  
[-user username]  
[-U username]  
[-u]**

**Options:-** **-A** Display information about other users' processes, including those without controlling terminals.

**-a** Display information about other users' processes as well as your own. This will skip any processes which do not have a controlling terminal, unless the **-x** option is also specified.

**-C** Change the way the CPU percentage is calculated by using a ``raw'' CPU calculation that ignores ``resident'' time (this normally has no effect).

**-c** Change the ``command'' column output to just contain the executable name, rather than the full command line.

**-d** Like **-A**, but excludes session leaders.

**-E** Display the environment as well. This does not reflect changes in the environment after process launch.

**-e** Identical to **-A**.

**-f** Display the uid, pid, parent pid, recent CPU usage, process start time, controlling tty, elapsed CPU usage, and the associated command. If the **-u** option is also used, display the user name rather than the numeric uid. When **-o** or **-O** is used to add to the display following **-f**, the command field is not truncated as severely as it is in other formats.

**-G** Display information about processes which are running with the specified real group IDs.

**-g** Display information about processes with the specified process group leaders.

**-h** Repeat the information header as often as necessary to guarantee one header per page of information.

**-j** Print information associated with the following keywords: **user**, **pid**, **ppid**, **pgid**, **sess**, **jobj**, **state**, **tt**, **time**, and **command**.

**-L** List the set of keywords available for the **-O** and **-o** options.

**-I** Display information associated with the following keywords: **uid**, **pid**, **ppid**, **flags**, **cpu**, **pri**, **nice**, **vsz=SZ**, **rss**, **wchan**, **state=S**, **paddr=ADDR**, **tty**, **time**, and **command=CMD**.

**-M** Print the threads corresponding to each task.



**-m** Sort by memory usage, instead of the combination of controlling terminal and process ID.

**-O** Add the information associated with the space or comma separated list of keywords specified, after the process ID, in the default information display. Keywords may be appended with an equals (=) sign and a string. This causes the printed header to use the specified string instead of the standard header.

**-o** Display information associated with the space or comma separated list of keywords specified. Multiple keywords may also be given in the form of more than one **-o** option.

Keywords may be appended with an equals (=) sign and a string. This causes the printed header to use the specified string instead of the standard header. If all keywords have empty header texts, no header line is written.

**-p** Display information about processes which match the specified process IDs.

**-r** Sort by current CPU usage, instead of the combination of controlling terminal and process ID.

**-S** Change the way the process time is calculated by summing all exited children to their parent process.

**-T** Display information about processes attached to the device associated with the standard input.

**-t** Display information about processes attached to the specified terminal devices.

**-U** Display the processes belonging to the specified real user IDs.

**-u** Display the processes belonging to the specified usernames.

**-v** Display information associated with the following keywords: **pid**, **state**, **time**, **sl**, **re**, **pagein**, **vsz**, **rss**, **lim**, **tsiz**, **%cpu**, **%mem**, and **command**. The **-v** option implies the **-m** option.

**-w** Use 132 columns to display information, instead of the default which is your window size. If the **-w** option is specified more than once, **ps** will use as many columns as necessary without regard for your window size. When output is not to a terminal, an unlimited number of columns are always used.

**-X** When displaying processes matched by other options, skip any processes which do not have a controlling terminal.

**-x** When displaying processes matched by other options, include processes which do not have a controlling terminal. This is the opposite of the **-X** option. If both **-X** and **-x** are specified in the same command, then **ps** will use the one which was specified last.



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**%cpu** The CPU utilization of the process; this is a decaying average over up to a minute of previous (real) time. Because the time base over which this is computed varies

(some processes may be very young), it is possible for the sum of all **%cpu** fields to exceed 100%.

**%mem** The percentage of real memory used by this process.

**flags** The flags associated with the process as in the include file `<sys/proc.h>`:

P_ADVLOCK	0x00001	Process may hold a POSIX advisory lock
P_CONTROLT	0x00002	Has a controlling terminal
P_LP64	0x00004	Process is LP64
P_NOCLDSTOP	0x00008	No SIGCHLD when children stop
P_PPWAIT	0x00010	Parent is waiting for child to exec/exit
P_PROFIL	0x00020	Has started profiling
P_SELECT	0x00040	Selecting; wakeup/waiting danger
P_CONTINUED	0x00080	Process was stopped and continued
P_SUGID	0x00100	Had set id privileges since last exec
P_SYSTEM	0x00200	System proc: no sigs, stats or swapping
P_TIMEOUT	0x00400	Timing out during sleep
P_TRACED	0x00800	Debugged process being traced
P_WAITED	0x01000	Debugging process has waited for child
P_WEXIT	0x02000	Working on exiting
P_EXEC	0x04000	Process called exec
P_OWEUPC	0x08000	Owe process an addupc() call at next ast
P_WAITING	0x40000	Process has a wait() in progress
P_KDEBUG	0x80000	Kdebug tracing on for this process

**lim** The soft limit on memory used, specified via a call to `setrlimit(2)`.

**lstart** The exact time the command started, using the `'%c' format described in `strftime(3)`.

**nice** The process scheduling increment (see `setpriority(2)`).

**rss** the real memory (resident set) size of the process (in 1024 byte units).

**start** The time the command started. If the command started less than 24 hours ago, the start time is displayed using the ``%l:ps.1p" format described in `strftime(3)`. If

the command started less than 7 days ago, the start time is displayed using the ``%a6.15p" format. Otherwise, the start time is displayed using the ``%e%b%y" format.

**state** The state is given by a sequence of characters, for example, ``RWNA". The first character indicates the run state of the process:

- I Marks a process that is idle (sleeping for longer than about 20 seconds).
- R Marks a runnable process.
- S Marks a process that is sleeping for less than about 20 seconds.
- T Marks a stopped process.



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- U Marks a process in uninterruptible wait.
- Z Marks a dead process (a ``zombie").

Additional characters after these, if any, indicate additional state information:

- + The process is in the foreground process group of its control terminal.
- < The process has raised CPU scheduling priority.
- > The process has specified a soft limit on memory requirements and is currently exceeding that limit; such a process is (necessarily) not swapped.

A the process has asked for random page replacement (VA\_ANOM, from vadvise(2), for example, lisp(1) in a garbage collect).

- E The process is trying to exit.
- L The process has pages locked in core (for example, for raw I/O).
- N The process has reduced CPU scheduling priority (see setpriority(2)).
- S The process has asked for FIFO page replacement (VA\_SEQL, from vadvise(2), for example, a large image processing program using virtual memory to sequentially address voluminous data).
- s The process is a session leader.
- V The process is suspended during a vfork(2).
- W The process is swapped out.
- X The process is being traced or debugged.

**tt** An abbreviation for the pathname of the controlling terminal, if any. The abbreviation consists of the three letters following `/dev/tty`, or, for the console, ``con".

This is followed by a '-' if the process can no longer reach that controlling terminal (i.e., it has been revoked).

**wchan** The event (an address in the system) on which a process waits. When printed numerically, the initial part of the address is trimmed off and the result is printed in hex, for example, 0x80324000 prints as 324000.

### Output:-

```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ ps -a
 PID TTY          TIME CMD
 841 ttys000      0:00.02 login -pf hrutvikdesai
 842 ttys000      0:00.02 -bash
 851 ttys000      0:00.00 ps -a
```

```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ ps -f -p 107,108
 UID  PID  PPID  C STIME   TIME CMD
 241  107     1   0 1:50PM ??        0:00.36 /usr/sbin/distnoted daemon
    0   108     1   0 1:50PM ??        0:01.92 /usr/libexec/amfid
```



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```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ ps -f -u hrutvikdesai
UID  PID  PPID  C STIME   TTY      TIME CMD
501  268    1  0  1:50PM ??        0:05.19 /usr/sbin/cfprefsd agent
501  269    1  0  1:50PM ??        0:01.12 /usr/libexec/UserEventAgent (Aqua)
501  271    1  0  1:50PM ??        0:01.13 /usr/sbin/distnoted agent
501  272    1  0  1:50PM ??        0:01.08 /usr/sbin/universalaccessd launchd -
501  273    1  0  1:50PM ??        0:01.11 /System/Library/Frameworks/CoreTelephony.framework/Support/CommCenter -L
```

```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ ps -ef
UID  PID  PPID  C STIME   TTY      TIME CMD
0    1    0    0  1:50PM ??        0:14.76 /sbin/launchd
0    43   1    0  1:50PM ??        0:00.73 /usr/sbin/syslogd
0    44   1    0  1:50PM ??        0:00.55 /usr/libexec/UserEventAgent (System)
0    47   1    0  1:50PM ??        0:00.29 /System/Library/PrivateFrameworks/Uninstall.framework/Resources/uninstalld
0    48   1    0  1:50PM ??        0:02.73 /usr/libexec/kextd
0    49   1    0  1:50PM ??        0:03.25 /System/Library/Frameworks/CoreServices.framework/Versions/A/Frameworks/FSEvents.framework/Versions/A/Support/fsevents
```

```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ ps -d
PID TTY      TIME CMD
234 ??      0:00.09 /usr/sbin/systemstats --logger-helper /private/var/db/systemstat
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ ps -T
PID TTY      TIME CMD
841 ttys000  0:00.02 login -pf hrutvikdesai
842 ttys000  0:00.07 -bash
976 ttys000  0:00.00 ps -T
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ ps -r
PID TTY      TIME CMD
842 ttys000  0:00.07 -bash
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ ps -x
PID TTY      TIME CMD
268 ??      0:05.21 /usr/sbin/cfprefsd agent
269 ??      0:01.13 /usr/libexec/UserEventAgent (Aqua)
```

### c. kill

**Description:-** The **kill** utility sends a signal to the processes specified by the pid operands.

Only the super-user may send signals to other users' processes.

**Syntax:-** **kill** [-s signal\_name] pid ...

**kill** -l [exit\_status]

**kill** -signal\_name pid ...

**kill** -signal\_number pid ...

**Options:-** -s signal\_name

A symbolic signal name specifying the signal to be sent instead of the default TERM.

**-l** [exit\_status]



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If no operand is given, list the signal names; otherwise, write the signal name corresponding to exit\_status.

### -signal\_name

A symbolic signal name specifying the signal to be sent instead of the default TERM.

### -signal\_number

A non-negative decimal integer, specifying the signal to be sent instead of the default TERM.

The following PIDs have special meanings:

-1 If superuser, broadcast the signal to all processes; otherwise broadcast to all processes belonging to the user.

Some of the more commonly used signals:

- |    |  |
|----|--|
| 1  | HUP (hang up)                            |
| 2  | INT (interrupt)                          |
| 3  | QUIT (quit)                              |
| 6  | ABRT (abort)                             |
| 9  | KILL (non-catchable, non-ignorable kill) |
| 14 | ALRM (alarm clock)                       |
| 15 | TERM (software termination signal)       |

Some shells may provide a builtin **kill** command which is similar or identical to this utility. Consult the builtin(1) manual page.

### Output:-

```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ kill -l
 1) SIGHUP      2) SIGINT      3) SIGQUIT      4) SIGILL
 5) SIGTRAP     6) SIGABRT     7) SIGEMT      8) SIGFPE
 9) SIGKILL     10) SIGBUS     11) SIGSEGV     12) SIGSYS
13) SIGPIPE     14) SIGALRM     15) SIGTERM     16) SIGURG
17) SIGSTOP     18) SIGTSTP     19) SIGCONT     20) SIGCHLD
21) SIGTTIN     22) SIGTTOU     23) SIGIO       24) SIGXCPU
25) SIGXFSZ     26) SIGVTALRM   27) SIGPROF     28) SIGWINCH
29) SIGINFO     30) SIGUSR1     31) SIGUSR2
```



```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ sudo kill 81  
[Password:  
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ sudo kill 101
```

d. pgrep

**Description:-** The **pgrep** command searches the process table on the running system and prints the process IDs of all processes that match the criteria given on the command line.

The **pkill** command searches the process table on the running system and signals all processes that match the criteria given on the command line.

**Syntax:-** **pgrep** [-Lafilnoqvx] [-F pidfile] [-G gid] [-P ppid] [-U uid] [-d delim] [-g pggrp] [-t tty] [-u euid] pattern ...  
**pkill** [-signal] [-ILafilnovx] [-F pidfile] [-G gid] [-P ppid] [-U uid] [-g pggrp] [-t tty] [-u euid] pattern ...

**Options:-** **-F pidfile** Restrict matches to a process whose PID is stored in the pidfile file.

**-G gid** Restrict matches to processes with a real group ID in the comma-separated list gid.

**-I** Request confirmation before attempting to signal each process.

**-L** The pidfile file given for the **-F** option must be locked with the flock(2) syscall or created with pidfile(3).

**-P ppid** Restrict matches to processes with a parent process ID in the comma-separated list ppid.

**-U uid** Restrict matches to processes with a real user ID in the comma-separated list uid.

**-d delim** Specify a delimiter to be printed between each process ID. The default is a newline. This option can only be used with the **pgrep** command.

**-a** Include process ancestors in the match list. By default, the current **pgrep** or **pkill** process and all of its ancestors are excluded (unless **-v** is used).

**-f** Match against full argument lists. The default is to match against process names.

**-g pggrp** Restrict matches to processes with a process group ID in the comma-separated list pggrp. The value zero is taken to mean the process group ID of the running **pgrep** or **pkill** command.

**-i** Ignore case distinctions in both the process table and the supplied pattern.



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**-l** Long output. For **pgrep**, print the process name in addition to the process ID for each matching process. If used in conjunction with **-f**, print the process ID and the full argument list for each matching process. For **pkill**, display the kill command used for each process killed.

**-n** Select only the newest (most recently started) of the matching processes.

**-o** Select only the oldest (least recently started) of the matching processes.

**-q** Do not write anything to standard output.

**-t tty** Restrict matches to processes associated with a terminal in the comma-separated list **tty**. Terminal names may be of the form **ttyxx** or the shortened form **xx**. A single dash ('-') matches processes not associated with a terminal.

**-u euid** Restrict matches to processes with an effective user ID in the comma-separated list **euid**.

**-v** Reverse the sense of the matching; display processes that do not match the given criteria.

**-x** Require an exact match of the process name, or argument list if **-f** is given. The default is to match any substring.

**-signal** A non-negative decimal number or symbolic signal name specifying the signal to be sent instead of the default TERM. This option is valid only when given as the first argument to **pkill**.

### Output:-

```
ubuntu@ubuntu:~$ pgrep -c -u ubuntu
71
```

```
ubuntu@ubuntu:~$ pgrep -u ubuntu -d:
1506:1507:1520:1524:1526:1578:1581:1657:1676:1679:1684:1687:172R:1749:1782:1787:1798:1843:1847:1853:1864:1867:1872:1874:1878:1882:1892:1894:19
ubuntu@ubuntu:~$ pgrep -u ubuntu -l
1506 systemd
1507 (sd-pam)
1520 gnome-keyring-d
1524 gdm-x-session
1526 Xorg
1578 dbus-daemon
1581 gnome-session-b
1657 xbrlapi
1676 ssh-agent
1679 at-spi-bus-laun
1684 dbus-daemon
1687 at-spi2-registr
1728 gnome-keyring-d
1749 gnome-shell
1782 gvfsd
1787 gvfsd-fuse
1798 pulseaudio
1843 ibus-daemon
1847 gnome-shell-cal
1853 evolution-sourc
1864 dconf-service
1867 gvfs-udisks2-vo
1872 gvfs-mtp-volume
1874 goa-daemon
1878 gvfs-gphoto2-vo
1882 gvfs-goa-volume
1892 ibus-dconf
1894 ibus-x11
1900 ibus-portal
1914 goa-identity-se
```



```
ubuntu@ubuntu:~$ pgrep -u ubuntu -a
1506 /lib/systemd/systemd --user
1507 (sd-pam)
1520 /usr/bin/gnome-keyring-daemon --daemonize --login
1524 /usr/lib/gdm3/gdm-x-session --run-script env GNOME_SESSION_MODE=ubuntu gnome-session --session=ubuntu
1526 /usr/lib/xorg/Xorg vt1 -displayfd 3 -auth /run/user/999/gdm/Xauthority -background none -noreset -keeptty -verbose 3
1578 /usr/bin/dbus-daemon --session --address=systemd: --nofork --nopidfile --systemd-activation --syslog-only
1581 /usr/lib/gnome-session/gnome-session-binary --session=ubuntu
1657 xbrlapi
1676 /usr/bin/ssh-agent /usr/bin/im-launch env GNOME_SESSION_MODE=ubuntu gnome-session --session=ubuntu
1679 /usr/lib/at-spi2-core/at-spi-bus-launcher
1684 /usr/bin/dbus-daemon --config-file=/usr/share/defaults/at-spi2/accessibility.conf --nofork --print-address 3
1687 /usr/lib/at-spi2-core/at-spi2-registryd --use-gnome-session
1728 /usr/bin/gnome-keyring-daemon --start --foreground --components=secrets
1749 /usr/bin/gnome-shell
1782 /usr/lib/gvfs/gvfsd
1787 /usr/lib/gvfs/gvfsd-fuse /run/user/999/gvfs -f -o big_writes
1798 /usr/bin/pulseaudio --start --log-target=syslog
1843 ibus-daemon --xim --panel disable
1847 /usr/lib/gnome-shell/gnome-shell-calendar-server
```

```
ubuntu@ubuntu:~$ pgrep -u ubuntu -n -l
5548 bash
```

#### e. renice

**Description:-** The **renice** utility alters the scheduling priority of one or more running processes. The following who parameters are interpreted as process ID's, process group ID's, user ID's

or user names. The **renice**'ing of a process group causes all processes in the process group to have their scheduling priority altered. The **renice**'ing of a user causes all processes owned by the user to have their scheduling priority altered. By default, the processes to be affected are specified by their process ID's.

**Syntax:-** **renice priority** [[-p] pid ...] [[-g] pgrp ...] [[-u] user ...]  
**renice -n increment** [[-p] pid ...] [[-g] pgrp ...] [[-u] user ...]

#### Options:-

**-g** Force who parameters to be interpreted as process group ID's.

**-n** Instead of changing the specified processes to the given priority, interpret the following argument as an increment to be applied to the current priority of each process.

**-u** Force the who parameters to be interpreted as user names or user ID's.

**-p** Reset the who interpretation to be (the default) process ID's.



**Output:-**

```
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ sudo renice 19 841
[Hrutviks-MacBook-Pro:~ hrutvikdesai$ ps -a
 PID TTY          TIME CMD
 841 ttys000    0:00.02 login -pf hrutvikdesai
 842 ttys000    0:00.14 -bash
1168 ttys000    0:00.00 ps -a
```

```
ubuntu@ubuntu:~$ renice -n 15 -p 1900
1900 (process ID) old priority 0, new priority 15
```

```
ubuntu@ubuntu:~$ sudo renice -n 5 -u ubuntu
999 (user ID) old priority 0, new priority 5
```

**4. Disk Handling Commands:-**

a. *fdisk*

**Description:-** In order for the BIOS to boot the kernel, certain conventions must be adhered to. Sector 0 of a bootable hard disk must contain boot code, an MBR partition table, and a magic number (0xAA55). These MBR partitions (also known as BIOS partitions) can be used to break the disk up into several pieces.

The BIOS loads sector 0 of the boot disk into memory, verifies the magic number, and begins executing the code at the first byte. The normal DOS MBR boot code searches the MBR

partition table for an ``active'' partition (indicated by a '\*' in the first column), and if one is found, the boot block from that partition is loaded and executed in place of the original (MBR) boot block.

**Syntax:-** **fdisk [-ieu] [-f mbrname] [-c cylinders] [-h heads] [-s sectors] [-S size] [-b size] device**

**Options:-** -i Initialize the MBR sector.

-a style  
Specify an automatic partitioning style.

-e Edit existing MBR sectors.



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**-f mbrname**

Specifies an alternate MBR template file.

**-u** Update MBR code, preserving existing partition table.

**-y** Do not ask for confirmation before writing.

**-d** Dump partition table in a format readable by the -r option.

**-r** Read a partition table from the standard input.

**-t** Test if the disk is partitioned.

**-c cylinders, -h heads, -s sectors**

Specifies an alternate BIOS geometry for fdisk to use.

**-S size**

Specify the disk size in blocks.

**-b size**

Specify the number of bytes per disk block.

### Output:-

```
ubuntu@ubuntu:~$ sudo fdisk -l
Disk /dev/loop0: 1.8 GiB, 1905045504 bytes, 3720792 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/loop1: 91 MiB, 95408128 bytes, 186344 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/loop2: 34.6 MiB, 36216832 bytes, 70736 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```



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```
ubuntu@ubuntu:~$ sudo fdisk /dev/sda1
Welcome to fdisk (util-linux 2.31.1).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Command (m for help): p
Disk /dev/sda1: 350 MiB, 367001600 bytes, 716800 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 4096 bytes
I/O size (minimum/optimal): 4096 bytes / 4096 bytes
Disklabel type: dos
Disk identifier: 0x73736572

Device      Boot   Start     End   Sectors   Size Id Type
/dev/sda1p1        1920221984 3736432267 1816210284   866G 72 unknown
/dev/sda1p2        1936028192 3889681299 1953653108 931.6G 6c unknown
/dev/sda1p3            0          0          0       0B  0 Empty
/dev/sda1p4        27722122  27722568         447 223.5K  0 Empty

Partition 4 does not start on physical sector boundary.

Partition table entries are not in disk order.
```

```
Command (m for help): n
Partition type
  p  primary (3 primary, 0 extended, 1 free)
  e  extended (container for logical partitions)
Select (default e): e
No free partition available!

All primary partitions have been defined already.
```

```
ubuntu@ubuntu:~$ sudo fdisk -s /dev/sda1
358400
```

b. df



**Description:-** The **df** utility displays statistics about the amount of free disk space on the specified filesystem or on the filesystem of which file is a part. Values are displayed in 512-byte per block counts. If neither a file or a filesystem operand is specified, statistics for all mounted filesystems are displayed (subject to the **-t** option below).

**Syntax:-** **fdisk** [**-ieu**] [**-f mbrname**] [**-c cylinders**] [**-h heads**] [**-s sectors**] [**-S size**] [**-b size**] device

Options:- **-a** Show all mount points, including those that were mounted with the MNT\_IGNORE flag.

**-b** Use (the default) 512-byte blocks. This is only useful as a way to override an BLOCKSIZE specification from the environment.

**-g** Use 1073741824-byte (1-Gbyte) blocks rather than the default. Note that this overrides the BLOCKSIZE specification from the environment.

**-H** "Human-readable" output. Use unit suffixes: Byte, Kilobyte, Megabyte, Gigabyte, Terabyte and Petabyte in order to reduce the number of digits to three or less using base 10 for sizes.

**-h** "Human-readable" output. Use unit suffixes: Byte, Kilobyte, Megabyte, Gigabyte, Terabyte and Petabyte in order to reduce the number of digits to three or less using base 2 for sizes.

**-i** Include statistics on the number of free inodes. This option is now the default to conform to Version 3 of the Single UNIX Specification ("SUSv3") Use -P to suppress this output.

**-k** Use 1024-byte (1-Kbyte) blocks, rather than the default. Note that this overrides the BLOCKSIZE specification from the environment.

**-l** Only display information about locally-mounted filesystems.

**-m** Use 1048576-byte (1-Mbyte) blocks rather than the default. Note that this overrides the BLOCKSIZE specification from the environment.

**-n** Print out the previously obtained statistics from the filesystems. This option should be used if it is possible that one or more filesystems are in a state such that they will not be able to provide statistics without a long delay. When this option is specified, df will not request new statistics from the filesystems, but will respond with the possibly stale statistics that were previously obtained.

**-P** Use (the default) 512-byte blocks. This is only useful as a way to override an BLOCKSIZE specification from the environment.



**-T** Only print out statistics for filesystems of the specified types. More than one type may be specified in a comma separated list. The list of filesystem types can be prefixed with ``no'' to specify the filesystem types for which action should not be taken. For example, the df command:

```
df -T nonfs,mfs
```

lists all filesystems except those of type NFS and MFS. The lsvfs(1) command can be used to find out the types of filesystems that are available on the system.

**-t** If used with no arguments, this option is a no-op (Mac OS X already prints the total allocated-space figures). If used with an argument, it acts like -T, but this usage is deprecated and should not be relied upon.

**Output:-**

```
ubuntu@ubuntu:~$ df -a
Filesystem      1K-blocks    Used Available Use% Mounted on
sysfs            0        0        0    - /sys
proc              0        0        0    - /proc
udev             1865008     0    1865008   0% /dev
devpts            0        0        0    - /dev/pts
tmpfs            377496    1668    375828   1% /run
/dev/sdb1       30265360  1956192  28309168   7% /cdrom
/dev/loop0       1860480  1860480        0 100% /rofs
/cow             1887460  355832  1531628  19% /
securityfs       0        0        0    - /sys/kernel/security
```

```
ubuntu@ubuntu:~$ df -h /home/ubuntu/
Filesystem      Size  Used Avail Use% Mounted on
/cow           1.9G  348M  1.5G  19% /
```



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```
ubuntu@ubuntu:~$ df --total
Filesystem      1K-blocks    Used Available Use% Mounted on
udev            1865008      0   1865008   0% /dev
tmpfs           377496     1672   375824   1% /run
/dev/sdb1       30265360  1956192  28309168   7% /cdrom
/dev/loop0      1860480  1860480      0 100% /rofs
/cow            1887460  355908  1531552  19% /
tmpfs           1887460      0  1887460   0% /dev/shm
tmpfs            5120        4   5116   1% /run/lock
tmpfs           1887460      0  1887460   0% /sys/fs/cgroup
tmpfs           1887460  14412  1873048   1% /tmp
tmpfs           377492       64  377428   1% /run/user/999
/dev/loop1      93184    93184      0 100% /snap/core/6350
/dev/loop2      35456    35456      0 100% /snap/gtk-common-themes/818
/dev/sda3      307199996 84198216 223001780  28% /media/ubuntu/0AE4AF54E4AF40B5
/dev/loop3      144128   144128      0 100% /snap/gnome-3-26-1604/74
/dev/loop4      2304     2304      0 100% /snap/gnome-calculator/260
/dev/loop5      13312    13312      0 100% /snap/gnome-characters/139
/dev/loop6      14976    14976      0 100% /snap/gnome-logs/45
/dev/loop7      3840     3840      0 100% /snap/gnome-system-monitor/57
total          349807992 88694148 261113844  26% -
```

```
ubuntu@ubuntu:~$ df -T /home/ubuntu/
Filesystem      Type  1K-blocks    Used Available Use% Mounted on
/cow           overlay  1887460  356040  1531420  19% /
```

### c. cfdisk

**Description:-** cfdisk is a curses-based program for partitioning any block device. The default device is /dev/sda.

Note that cfdisk provides basic partitioning functionality with a user-friendly interface. If you need advanced features, use fdisk(8) instead.

Since version 2.25 cfdisk supports MBR (DOS), GPT, SUN and SGI disk labels, but no longer provides any functionality for CHS

(Cylinder-Head-Sector) addressing. CHS has never been important for Linux, and this addressing concept does not make any sense for new devices.

Since version 2.25 cfdisk also does not provide a 'print' command any more. This functionality is provided by the utilities



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partx(8) and lsblk(8) in a very comfortable and rich way.

### Syntax:- cfdisk [options] [device]

#### Options:- -h, --help

Display help text and exit.

#### -L, --color[=when]

Colorize the output. The optional argument when can be auto, never or always. If the when argument is omitted, it defaults

to auto. The colors can be disabled, for the current built-in default see --help output. See also the COLORS section.

#### -V, --version

Display version information and exit.

#### -z, --zero

Start with an in-memory zeroed partition table. This option does not zero the partition table on the disk; rather, it sim-

ply starts the program without reading the existing partition table. This option allows you to create a new partition table from scratch or from an sfdisk-compatible script.

## COMMANDS

The commands for cfdisk can be entered by pressing the corresponding key (pressing Enter after the command is not necessary). Here is a list of the available commands:

b Toggle the bootable flag of the current partition. This allows you to select which primary partition is bootable on the drive. This command may not be available for all partition label types.

d Delete the current partition. This will convert the current partition into free space and merge it with any free space immediately surrounding the current partition. A partition already marked as free space or marked as unusable cannot be deleted.

h Show the help screen.

n Create a new partition from free space. cfdisk then prompts you for the size of the partition you want to create. The default size is equal to the entire available free space at the current position.

The size may be followed by a multiplicative suffix: KiB (=1024), MiB (=1024\*1024), and so on for GiB, TiB, PiB, EiB, ZiB and YiB (the "iB" is optional, e.g. "K" has the same meaning as "KiB").



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q Quit the program. This will exit the program without writing any data to the disk.

s Sort the partitions in ascending start-sector order. When deleting and adding partitions, it is likely that the numbering

of the partitions will no longer match their order on the disk. This command restores that match.

t Change the partition type. By default, new partitions are created as Linux partitions.

u Dump the current in-memory partition table to an sfdisk-compatible script file.

The script files are compatible between cfdisk, fdisk, sfdisk and other libfdisk applications. For more details see

sfdisk(8).

It is also possible to load an sfdisk-script into cfdisk if there is no partition table on the device or when you start

cfdisk with the --zero command-line option.

W Write the partition table to disk (you must enter an uppercase W). Since this might destroy data on the disk, you must

either confirm or deny the write by entering `yes' or `no'. If you enter `yes', cfdisk will write the partition table to

disk and then tell the kernel to re-read the partition table from the disk.

The re-reading of the partition table does not always work. In such a case you need to inform the kernel about any new partitions by using partprobe(8) or partx(8), or by rebooting the system.

x Toggle extra information about a partition.

### Output:-

Device	Boot	Start	End	Sectors	Size	Id	Type
/dev/sda1	*	2048	710847	7106400	250M	7	HPFS/NTFS/exFAT
/dev/sda2		710848	362371071	361652224	172.5G	7	HPFS/NTFS/exFAT
/dev/sda3		362371072	970773107	614400000	293G	7	HPFS/NTFS/exFAT
Free space		970773108		2090	1M		

Partition type: HPFS/NTFS/exFAT (7)  
Attributes: 80  
Filesystem UUID: 1A4879AF487989F1  
Filesystem LABEL: System Reserved  
Filesystem: ntfs

[Bootable] [Delete] [Resize] [Quit] [Type] [Help] [Write] [Dump]  
Quit program without writing changes



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```
ubuntu@ubuntu:~  
File Edit View Search Terminal Help  
Select partition type  
0 Empty  
1 FAT12  
2 XENIX root  
3 XENIX usr  
4 FAT16 <32M  
5 Extended  
6 FAT16  
7 HPFS/NTFS/exFAT  
8 AIX  
9 AIX bootable  
a OS/2 Boot Manager  
b W95 FAT32  
c W95 FAT32 (LBA)  
e W95 FAT16 (LBA)  
f W95 Ext'd (LBA)  
10 OPUS  
11 Hidden FAT12  
12 Compaq diagnostics  
14 Hidden FAT16 <32M  
16 Hidden FAT16  
17 Hidden HPFS/NTFS  
18 AST SmartSleep  
1b Hidden W95 FAT32  
1c Hidden W95 FAT32 (LBA)  
1e Hidden W95 FAT16 (LBA)  
24 NEC DOS  
27 Hidden NTFS WinRE  
39 Plan 9  
3c PartitionMagic recovery  
40 Ventx 80286  
41 PPC PReP Boot  
42 SFS  
4d QNX4.x  
4e QNX4.x 2nd part
```



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```
ubuntu@ubuntu: ~
File Edit View Search Terminal Help
Disk: /dev/sda
Size: 465.8 GiB, 500107862016 bytes, 976773168 sectors
Label: dos, identifier: 0x3a7144e1

Device Boot Start End Sectors Size Id Type
>> /dev/sda1 * 2048 718847 716800 350M 7 HPFS/NTFS/exFAT
/dev/sda2 718848 362371071 361652224 172.5G 7 HPFS/NTFS/exFAT
/dev/sda3 362371072 976771071 614400000 293G 7 HPFS/NTFS/exFAT
Free space 976771072 976773167 2096 1M

Partition type: HPFS/NTFS/exFAT (7)
Attributes: 80
Filesystem UUID: 1A4879AF487989F1
Filesystem LABEL: System Reserved
Filesystem: ntfs

[Bootable] [ Delete ] [ Resize ] [ Quit ] [ Type ] [ Help ] [ Write ] [ Dump ]
Quit program without writing changes
```

```
ubuntu@ubuntu: ~
File Edit View Search Terminal Help
Disk: /dev/sda
Size: 465.8 GiB, 500107862016 bytes, 976773168 sectors
Label: dos, identifier: 0x3a7144e1

Device Boot Start End Sectors Size Id Type
>> /dev/sda1 * 2048 718847 716800 350M 7 HPFS/NTFS/exFAT
/dev/sda2 718848 362371071 361652224 172.5G 7 HPFS/NTFS/exFAT
/dev/sda3 362371072 976771071 614400000 293G 7 HPFS/NTFS/exFAT
Free space 976771072 976773167 2096 1M

Partition type: HPFS/NTFS/exFAT (7)
Attributes: 80
Filesystem UUID: 1A4879AF487989F1
Filesystem LABEL: System Reserved
Filesystem: ntfs

[Bootable] [ Delete ] [ Resize ] [ Quit ] [ Type ] [ Help ] [ Write ] [ Dump ]
Quit program without writing changes
```

d.

parted

Descrip  
tion  
:-

parted is a program to manipulate disk partitions. It supports multiple partition table formats, including MS-DOS and GPT. It is

useful for creating space for new operating systems, reorganising disk usage, and copying data to new hard disks.

Syntax:- `fdisk [options] [device]`



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### **Options:**--h, --help

displays a help message

### -l, --list

lists partition layout on all block devices

### -m, --machine

displays machine parseable output

### -s, --script

never prompts for user intervention

### -v, --version

displays the version

### -a alignment-type, --align alignment-type

Set alignment for newly created partitions, valid alignment types are:

none Use the minimum alignment allowed by the disk type.

cylinder

Align partitions to cylinders.

minimal

Use minimum alignment as given by the disk topology information. This and the opt value will use layout information

provided by the disk to align the logical partition table addresses to actual physical blocks on the disks. The min

value is the minimum alignment needed to align the partition properly to physical blocks, which avoids performance degradation.

optimal

Use optimum alignment as given by the disk topology information. This aligns to a multiple of the physical block size in a way that guarantees optimal performance.

## COMMANDS

[device]

The block device to be used. When none is given, parted will use the first block device it finds.

[command [options]]

Specifies the command to be executed. If no command is given, parted will present a command prompt. Possible commands are:



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**help [command]**

Print general help, or help on command if specified.

**align-check type partition**

Check if partition satisfies the alignment constraint of type. type must be "minimal" or "optimal".

**mklabel label-type**

Create a new disklabel (partition table) of label-type. label-type should be one of "aix", "amiga", "bsd", "dvh", "gpt", "loop", "mac", "msdos", "pc98", or "sun".

**mkpart part-type [fs-type] start end**

Make a part-type partition for filesystem fs-type (if specified), beginning at start and ending at end (by default in

megabytes). part-type should be one of "primary", "logical", or "extended".

**name partition name**

Set the name of partition to name. This option works only on Mac, PC98, and GPT disklabels. The name can be placed in quotes, if necessary.

**print** Display the partition table.

**quit** Exit from parted.

**rescue start end**

Rescue a lost partition that was located somewhere between start and end. If a partition is found, parted will ask if you want to create an entry for it in the partition table.

**resizepart partition end**

Change the end position of partition. Note that this does not modify any filesystem present in the partition.

**rm partition**

Delete partition.

**select device**

Choose device as the current device to edit. device should usually be a Linux hard disk device, but it can be a partition, software raid device, or an LVM logical volume if necessary.

**set partition flag state**

Change the state of the flag on partition to state. Supported flags are: "boot", "root", "swap", "hidden", "raid", "lvm", "lba", "legacy\_boot", "irst", "esp" and "palo". state should be either "on" or "off".



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unit unit

Set unit as the unit to use when displaying locations and sizes, and for interpreting those given by the user when

not suffixed with an explicit unit. unit can be one of "s" (sectors), "B" (bytes), "kB", "MB", "MiB", "GB", "GiB",

"TB", "TiB", "%" (percentage of device size), "cyl" (cylinders), "chs" (cylinders, heads, sectors), or "compact"

(megabytes for input, and a human-friendly form for output).

toggle partition flag

Toggle the state of flag on partition.

version

Display version information and a copyright message.

### Output:-

```
ubuntu@ubuntu:~$ sudo parted
GNU Parted 3.2
Using /dev/sda
Welcome to GNU Parted! Type 'help' to view a list of commands.
(parted) print
Model: ATA HGST HTS545050A (parted) resizepart
Disk /dev/sda: 500GB      Partition number? 1
Sector size (logical/physi End? [368MB]?
Partition Table: msdos
Disk Flags:

Number  Start   End     Size    Type      File system  Flags
 1       1049kB  368MB  367MB  primary   ntfs          boot
 2       368MB   186GB  185GB  primary   ntfs
 3       186GB   500GB  315GB  primary   ntfs
```

```
(parted) rm 1
Partition type? primary/extended? p
File system type? [ext2]?
Start?
Start? 1
End? 11
Warning: You requested a partition from 1000kB to 11.0MB (sectors 1953..21484).
The closest location we can manage is 1048kB to 1048kB (sectors 2047..2047).
Is this still acceptable to you?
Yes/No? y
Warning: The resulting partition is not properly aligned for best performance.
Ignore/Cancel? c
```



e. lsblk

**Description:-** lsblk lists information about all available or the specified block devices. The lsblk command reads the sysfs filesystem and udev

db to gather information. If the udev db is not available or lsblk is compiled without udev support than it tries to read LABELs,

UUIDs and filesystem types from the block device. In this case root permissions are necessary.

The command prints all block devices (except RAM disks) in a tree-like format by default. Use lsblk --help to get a list of all available columns.

The default output, as well as the default output from options like --fs and --topology, is subject to change. So whenever possi-

ble, you should avoid using default outputs in your scripts. Always explicitly define expected columns by using --output columns-list in environments where a stable output is required.

**Syntax:-** lsblk [options] [device...]

**Options:-** -a, --all

Also list empty devices. (By default they are skipped.)

-b, --bytes

Print the SIZE column in bytes rather than in a human-readable format.

-D, --discard

Print information about the discarding capabilities (TRIM, UNMAP) for each device.

-z, --zoned

Print the zone model for each device.

-d, --nodeps



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Do not print holder devices or slaves. For example, `lsblk --nodeps /dev/sda` prints information about the sda device only.

**-e, --exclude** list

Exclude the devices specified by the comma-separated list of major device numbers. Note that RAM disks (major=1) are excluded by default. The filter is applied to the top-level devices only.

**-f, --fs**

Output info about filesystems. This option is equivalent to `-o NAME,FSTYPE,LABEL,UUID,MOUNTPOINT`. The authoritative information about filesystems and raids is provided by the `blkid(8)` command.

**-h, --help**

Display help text and exit.

**-I, --include** list

Include devices specified by the comma-separated list of major device numbers. The filter is applied to the top-level devices only.

**-i, --ascii**

Use ASCII characters for tree formatting.

**-J, --json**

Use JSON output format.

**-l, --list**

Produce output in the form of a list.

**-m, --perms**

Output info about device owner, group and mode. This option is equivalent to `-o NAME,SIZE,OWNER,GROUP,MODE`.

**-n, --noheadings**

Do not print a header line.

**-o, --output** list

Specify which output columns to print. Use `--help` to get a list of all supported columns.

The default list of columns may be extended if list is specified in the format `+list` (e.g. `lsblk -o +UUID`).

**-O, --output-all**

Output all available columns.

**-P, --pairs**



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Produce output in the form of key="value" pairs. All potentially unsafe characters are hex-escaped (|x<code>).

**-p, --paths**

Print full device paths.

**-r, --raw**

Produce output in raw format. All potentially unsafe characters are hex-escaped (|x<code>) in the NAME, KNAME, LABEL, PART-LABEL and MOUNTPOINT columns.

**-S, --scsi**

Output info about SCSI devices only. All partitions, slaves and holder devices are ignored.

**-s, --inverse**

Print dependencies in inverse order. If the --list output is requested then the lines are still ordered by dependencies.

**-t, --topology**

Output info about block-device topology. This option is equivalent to -o NAME,ALIGNMENT,MIN-IO,OPT-IO,PHY-SEC,LOG-SEC,ROTA,SCHED,RQ-SIZE,RA,WSAME.

**-V, --version**

Display version information and exit.

**-x, --sort column**

Sort output lines by column. This option enables --list output format by default. It is possible to use the option --tree to force tree-like output and then the tree branches are sorted by the column.

### **Output:-**



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```
ubuntu@ubuntu:~$ lsblk -a
NAME   MAJ:MIN RM    SIZE RO TYPE MOUNTPOINT
loop0    7:0    0  1.8G  1 loop /rofs
loop1    7:1    0   91M  1 loop /snap/core/6350
loop2    7:2    0  34.6M  1 loop /snap/gtk-common-themes/818
loop3    7:3    0 140.7M  1 loop /snap/gnome-3-26-1604/74
loop4    7:4    0   2.3M  1 loop /snap/gnome-calculator/260
loop5    7:5    0   13M  1 loop /snap/gnome-characters/139
loop6    7:6    0  14.5M  1 loop /snap/gnome-logs/45
loop7    7:7    0   3.7M  1 loop /snap/gnome-system-monitor/57
sda      8:0    0 465.8G  0 disk 
└─sda2   8:2    0 172.5G  0 part 
└─sda3   8:3    0 293G   0 part /media/ubuntu/0AE4AF54E4AF40B5
sdb      8:16   1  28.9G  0 disk 
└─sdb1   8:17   1  28.9G  0 part /cdrom
sr0     11:0   1 1024M  0 rom
```

```
ubuntu@ubuntu:~$ lsblk -b
NAME   MAJ:MIN RM    SIZE RO TYPE MOUNTPOINT
loop0    7:0    0 1905045504  1 loop /rofs
loop1    7:1    0  95408128  1 loop /snap/core/6350
loop2    7:2    0  36216832  1 loop /snap/gtk-common-themes/818
loop3    7:3    0 147496960  1 loop /snap/gnome-3-26-1604/74
loop4    7:4    0  2355200  1 loop /snap/gnome-calculator/260
loop5    7:5    0 13619200  1 loop /snap/gnome-characters/139
loop6    7:6    0 15208448  1 loop /snap/gnome-logs/45
loop7    7:7    0  3878912  1 loop /snap/gnome-system-monitor/57
sda      8:0    0 500107862016  0 disk 
└─sda2   8:2    0 185165938688  0 part 
└─sda3   8:3    0 314572800000  0 part /media/ubuntu/0AE4AF54E4AF40B5
sdb      8:16   1  31016878080  0 disk 
└─sdb1   8:17   1  31012749312  0 part /cdrom
sr0     11:0   1 1073741312  0 rom
```

```
ubuntu@ubuntu:~$ lsblk -z
NAME   ZONED
loop0  none
loop1  none
loop2  none
loop3  none
loop4  none
loop5  none
loop6  none
loop7  none
sda    none
└─sda2 none
└─sda3 none
sdb    none
└─sdb1 none
sr0    none
```



```
ubuntu@ubuntu:~$ lsblk -i
NAME   MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
loop0    7:0     0  1.8G  1 loop /rofs
loop1    7:1     0   91M  1 loop /snap/core/6350
loop2    7:2     0 34.6M  1 loop /snap/gtk-common-themes/818
loop3    7:3     0 140.7M  1 loop /snap/gnome-3-26-1604/74
loop4    7:4     0   2.3M  1 loop /snap/gnome-calculator/260
loop5    7:5     0   13M  1 loop /snap/gnome-characters/139
loop6    7:6     0 14.5M  1 loop /snap/gnome-logs/45
loop7    7:7     0   3.7M  1 loop /snap/gnome-system-monitor/57
sda      8:0     0 465.8G  0 disk
└─sda2   8:2     0 172.5G  0 part
`─sda3   8:3     0  293G  0 part /media/ubuntu/0AE4AF54E4AF40B5
sdb      8:16    1  28.9G  0 disk
`─sdb1   8:17    1  28.9G  0 part /cdrom
sr0     11:0    1 1024M  0 rom
```

5.  
System  
m  
Com  
man  
ds:-  
a  
.uptim  
e

**Description:-** uptime gives a one line display of the following information. The current time, how long the system has been running, how many

users are currently logged on, and the system load averages for the past 1, 5, and 15 minutes.

This is the same information contained in the header line displayed by w(1).

System load averages is the average number of processes that are either in a runnable or uninterruptable state. A process in a

runnable state is either using the CPU or waiting to use the CPU. A process in uninterruptable state is waiting for some I/O

access, eg waiting for disk. The averages are taken over the three time intervals. Load averages are not normalized for the num-

ber of CPUs in a system, so a load average of 1 means a single CPU system is loaded all the time while on a 4 CPU system it means

it was idle 75% of the time.

**Syntax:-** uptime [options]

**Options:-** -p, --pretty

show uptime in pretty format



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-h, --help  
display this help text

-s, --since  
system up since, in yyyy-mm-dd HH:MM:SS format

-V, --version  
display version information and exit

### Output:-

```
ubuntu@ubuntu:~$ man uptime
ubuntu@ubuntu:~$ uptime h
23:06:25 up 1:06, 1 user, load average: 0.41, 0.25, 0.20
```

```
ubuntu@ubuntu:~$ uptime -p
up 1 hour, 6 minutes
```

```
ubuntu@ubuntu:~$ uptime -s
2019-08-11 21:59:36
```

```
ubuntu@ubuntu:~$ uptime -V
uptime from procps-ng 3.3.12
```

### b. users

**Description:-** Output who is currently logged in according to FILE. If FILE is not specified, use /var/run/utmp. /var/log/wtmp as FILE is common.

**Syntax:-** uptime [options]

**Options:-** --help display this help and exit

--version  
output version information and exit

### Output:-

```
ubuntu@ubuntu:~$ users
ubuntu
```



```
ubuntu@ubuntu:~$ users --help
Usage: users [OPTION]... [FILE]
Output who is currently logged in according to FILE.
If FILE is not specified, use /var/run/utmp. /var/log/wtmp as FILE is common.

--help      display this help and exit
--version   output version information and exit

GNU coreutils online help: <http://www.gnu.org/software/coreutils/>
Report users translation bugs to <http://translationproject.org/team/>
Full documentation at: <http://www.gnu.org/software/coreutils/users>
or available locally via: info '(coreutils) users invocation'
```

```
ubuntu@ubuntu:~$ users --version
users (GNU coreutils) 8.28
Copyright (C) 2017 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.
```

c. who

**Description:-** Print information about users who are currently logged in.

**Syntax:-** uptime [options]

**Options:-** -a, --all

same as -b -d --login -p -r -t -T -u

-b, --boot

time of last system boot

-d, --dead

print dead processes

-H, --heading

print line of column headings



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--ips print ips instead of hostnames. with --lookup, canonicalizes based on stored IP, if available, rather than stored hostname

- l, --login  
print system login processes
- lookup  
attempt to canonicalize hostnames via DNS
- m  
only hostname and user associated with stdin
- p, --process  
print active processes spawned by init
- q, --count  
all login names and number of users logged on
- r, --runlevel  
print current runlevel
- s, --short  
print only name, line, and time (default)
- t, --time  
print last system clock change
- T, -w, --mesg  
add user's message status as +, - or ?
- u, --users  
list users logged in
- message  
same as -T
- writable  
same as -T
- help display this help and exit
- version  
output version information and exit

### Output:-

```
ubuntu@ubuntu:~$ who -a
          system boot  2019-08-11 22:00
ubuntu    ? :0          2019-08-11 22:00    ?
                                         1556 (:0)
          run-level 5  2019-08-11 22:01
```



```
ubuntu@ubuntu:~$ who -u
ubuntu      :0          2019-08-11 22:00    ?
                                         1556 (:0)
```

```
ubuntu@ubuntu:~$ who -b -H
NAME      LINE      TIME                  PID COMMENT
system   boot   2019-08-11 22:00
```

```
ubuntu@ubuntu:~$ who -q -H
ubuntu
# users=1
```

d. cat

**Description:-** Concatenate FILE(s) to standard output.

With no FILE, or when FILE is -, read standard input.

**Syntax:-** cat [OPTION]... [FILE]...

**Options:-** -A, --show-all  
equivalent to -vET

-b, --number-nonblank  
number nonempty output lines, overrides -n

-e equivalent to -vE

-E, --show-ends  
display \$ at end of each line

-n, --number  
number all output lines

-s, --squeeze-blank  
suppress repeated empty output lines

-t equivalent to -vT

-T, --show-tabs  
display TAB characters as ^I



-u (ignored)  
-v, --show-nonprinting  
use ^ and M- notation, except for LFD and TAB  
--help display this help and exit  
--version  
output version information and exit

**Output:-**

```
ubuntu@ubuntu:~$ cat aaa  
errrgeerggf
```

```
ubuntu@ubuntu:~$ cat -n aaa  
1 errrgeerggf
```

```
ubuntu@ubuntu:~$ cat >bbb  
whveuhwee
```

```
ubuntu@ubuntu:~$ cat aaa >> bbb  
ubuntu@ubuntu:~$ cat aaa  
errrgeerggf  
ubuntu@ubuntu:~$ cat bbb  
whveuhwee  
errrgeerggf
```

e. *free*

**Description:-** free displays the total amount of free and used physical and swap memory in the system, as well as the buffers and caches used by the kernel. The information is gathered by parsing /proc/meminfo. The displayed columns are:

total Total installed memory (MemTotal and SwapTotal in /proc/meminfo)

used Used memory (calculated as total - free - buffers - cache)



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free Unused memory (MemFree and SwapFree in /proc/meminfo)

shared Memory used (mostly) by tmpfs (Shmem in /proc/meminfo)

buffers

Memory used by kernel buffers (Buffers in /proc/meminfo)

cache Memory used by the page cache and slabs (Cached and SReclaimable in /proc/meminfo)

buff/cache

Sum of buffers and cache

available

Estimation of how much memory is available for starting new applications, without swapping. Unlike the data provided by the cache or free fields, this field takes into account page cache and also that not all reclaimable memory slabs will be reclaimed due to items being in use (MemAvailable in /proc/meminfo, available on kernels 3.14, emulated on kernels 2.6.27+, otherwise the same as free)

### Syntax:- `free [options]`

#### Options:- `-b, --bytes`

Display the amount of memory in bytes.

`-k, --kibi`

Display the amount of memory in kibibytes. This is the default.

`-m, --mebi`

Display the amount of memory in mebibytes.

`-g, --gibi`

Display the amount of memory in gibibytes.

`--tebi` Display the amount of memory in tebibytes.

`--pebi` Display the amount of memory in pebibytes.

`--kilo` Display the amount of memory in kilobytes. Implies `--si`.

`--mega` Display the amount of memory in megabytes. Implies `--si`.

`--giga` Display the amount of memory in gigabytes. Implies `--si`.

`--tera` Display the amount of memory in terabytes. Implies `--si`.



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--peta Display the amount of memory in petabytes. Implies --si.

-h, --human

Show all output fields automatically scaled to shortest three digit unit and display the units of print out. Following units are used.

B = bytes

K = kibibyte

M = mebibyte

G = gibibyte

T = tebibyte

P = pebibyte

If unit is missing, and you have exbibyte of RAM or swap, the number is in tebibytes and columns might not be aligned with header.

-w, --wide

Switch to the wide mode. The wide mode produces lines longer than 80 characters. In this mode buffers and cache are reported in two separate columns.

-c, --count count

Display the result count times. Requires the -s option.

-l, --lohi

Show detailed low and high memory statistics.

-s, --seconds delay

Continuously display the result delay seconds apart. You may actually specify any floating point number for delay using either . or , for decimal point. usleep(3) is used for microsecond resolution delay times.

--si Use kilo, mega, giga etc (power of 1000) instead of kibi, mebi, gibi (power of 1024).

-t, --total

Display a line showing the column totals.

--help Print help.

-V, --version

Display version information.



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### Output:-

```
ubuntu@ubuntu:~$ free -b
total        used         free        shared   buff/cache   available
Mem:    3865522176  1085652992  207577088  643686400  2572292096  1861107712
Swap:          0           0           0
```

```
ubuntu@ubuntu:~$ free -k
total        used         free        shared   buff/cache   available
Mem:    3774924     1060468     202184     628668     2512272     1817084
Swap:          0           0           0
```

```
ubuntu@ubuntu:~$ free -m
total        used         free        shared   buff/cache   available
Mem:      3686       1034       197       615       2454       1774
Swap:          0           0           0
```

```
ubuntu@ubuntu:~$ free -g
total        used         free        shared   buff/cache   available
Mem:        3          1          0          0          2          1
Swap:        0          0          0
```

### 6. Miscellaneous Commands:-

#### a. date

**Description:-** Display the current time in the given FORMAT, or set the system date.

**Syntax:-** `date [OPTION]... [+FORMAT]`  
`date [-u|--utc|--universal] [MMDDhhmm[[CC]YY][.ss]]`

**Options:-** `-d, --date=STRING`  
display time described by STRING, not 'now'

`--debug`  
annotate the parsed date, and warn about questionable usage to stderr

`-f, --file=DATEFILE`  
like `--date`; once for each line of DATEFILE

`-I[FMT], --iso-8601[=FMT]`  
output date/time in ISO 8601 format. FMT='date' for date only (the default),  
'hours', 'minutes', 'seconds', or 'ns' for  
date and time to the indicated precision. Example: 2006-08-14T02:34:56-06:00



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-R, --rfc-email

output date and time in RFC 5322 format. Example: Mon, 14 Aug 2006 02:34:56 -0600

--rfc-3339=FMT

output date/time in RFC 3339 format. FMT='date', 'seconds', or 'ns' for date and time to the indicated precision. Example:

2006-08-14 02:34:56-06:00

-r, --reference=FILE

display the last modification time of FILE

-s, --set=STRING

set time described by STRING

-u, --utc, --universal

print or set Coordinated Universal Time (UTC)

--help display this help and exit

--version

output version information and exit

### Output:-

```
ubuntu@ubuntu:~$ date -u
Sun Aug 11 23:56:10 UTC 2019
```

```
ubuntu@ubuntu:~$ date --date="2/02/2010"
Tue Feb  2 00:00:00 UTC 2010
```

```
ubuntu@ubuntu:~$ date -r aaa
Sun Aug 11 23:40:30 UTC 2019
```

```
ubuntu@ubuntu:~$ date "+%D"
08/11/19
```



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b. time

**Description:-** time run the program COMMAND with any given arguments ARG.... When COMMAND finishes, time displays information about resources used by COMMAND (on the standard error output, by default). If COMMAND exits with non-zero status, time displays a warning message and the exit status.

time determines which information to display about the resources used by the COMMAND from the string FORMAT. If no format is specified on the command line, but the TIME environment variable is set, its value is used as the format. Otherwise, a default format built into time is used.

**Syntax:-** \_time [ -apqvV ] [ -f FORMAT ] [ -o FILE ]  
[ --append ] [ --verbose ] [ --quiet ] [ --portability ]  
[ --format=FORMAT ] [ --output=FILE ] [ --version ]  
[ --help ] COMMAND [ ARGS ]

**Options:-** -o FILE, --output=FILE

Write the resource use statistics to FILE instead of to the standard error stream. By default, this overwrites the file,

destroying the file's previous contents. This option is useful for collecting information on interactive programs and programs that produce output on the standard error stream.

-a, --append

Append the resource use information to the output file instead of overwriting it.

This option is only useful with the ` -o '  
or ` --output ' option.

-f FORMAT, --format FORMAT

Use FORMAT as the format string that controls the output of time. See the below more information.

--help Print a summary of the command line options and exit.

-p, --portability

Use the following format string, for conformance with POSIX standard 1003.2:

real %e  
user %U  
sys %S

-v, --verbose

Use the built-in verbose format, which displays each available piece of information on the program's resource use on its own



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line, with an English description of its meaning.

--quiet

Do not report the status of the program even if it is different from zero.

-V, --version

Print the version number of time and exit.

### Output:-

```
ubuntu@ubuntu:~$ time -p sleep 3
real 3.01
user 0.00
sys 0.00
```

```
ubuntu@ubuntu:~$ help time
time: time [-p] pipeline
      Report time consumed by pipeline's execution.
```

Execute PIPELINE and print a summary of the real time, user CPU time, and system CPU time spent executing PIPELINE when it terminates.

Options:

-p print the timing summary in the portable Posix format

The value of the TIMEFORMAT variable is used as the output format.

Exit Status:

The return status is the return status of PIPELINE.

### Conclusion:



**Post Lab Descriptive Questions (Add questions from examination point view)**

1. Explain different functions of operating system.

**Functions of Operating System**

Operating system performs the following functions:-

**1. Booting**

Booting is a process of starting the computer operating system starts the computer to work. It checks the computer and makes it ready to work.

**2. Memory Management**

It is also an important function of operating system. The memory cannot be managed without operating system. Different programs and data execute in memory at one time. if there is no operating system, the programs may mix with each other. The system will not work properly.

**3. Loading and Execution**

A program is loaded in the memory before it can be executed. Operating system provides the facility to load programs in memory easily and then execute it.

**4. Data Security**

Data is an important part of computer system. The operating system protects the data stored on the computer from illegal use, modification or deletion.

**5. Disk Management**

Operating system manages the disk space. It manages the stored files and folders in a proper way.

**6. Process Management**

CPU can perform one task at one time. if there are many tasks, operating system decides which task should get the CPU.

**7. Device Controlling**

operating system also controls all devices attached to computer. The hardware devices are controlled with the help of small software called device drivers.

**8. Printing Controlling**

Operating system also controls printing function. If a user issues two print commands at a time, it does not mix data of these files and prints them separately.

**9. Providing Interface**

It is used in order that user interface acts with a computer mutually. User interface controls how you input data and instruction and how information is displayed on screen. The operating system offers two types of the interface to the user;



**Graphical-line interface:** It interacts with of visual environment to communicate with the computer. It uses windows, icons, menus and other graphical objects to issues commands.  
**Command-line interface:** it provides an interface to communicate with the computer by typing commands.

## 2. What are the default permission assigned by Unix for Directory.

When you create a file or directory, the default file permissions assigned to the file or directory are controlled by the **user mask**. The user mask is set by the `umask` command in a user initialization file. You can display the current value of the user mask by typing `umask` and pressing Return.

The user mask contains the following octal values:

- The first digit sets permissions for the user
- The second sets permissions for group
- The third sets permissions for other, also referred to as “world”

Note that if the first digit is zero, it is not displayed. For example, if `umask` is set to 022, 22 is displayed.

To determine the `umask` value you want to set, subtract the value of the permissions you want from 666 (for a file) or 777 (for a directory). The remainder is the value to use with the `umask` command. For example, suppose you want to change the default mode for files to 644 (`rwx-r--r--`). The difference between 666 and 644 is 022, which is the value you would use as an argument to the `umask` command.

You can also determine the `umask` value you want to set by using the following table, which shows the file and directory permissions that are created for each of the octal values of `umask`.

Table 4–22 Permissions for `umask` Values

umask Octal Value	File Permissions	Directory Permissions
0	<code>rwx</code>	<code>rwx</code>
1	<code>rwx</code>	<code>rwx</code>
2	<code>r--</code>	<code>r-x</code>
3	<code>r--</code>	<code>r--</code>
4	<code>-w-</code>	<code>-wx</code>
5	<code>-w-</code>	<code>-w-</code>
6	<code>--x</code>	<code>--x</code>
7	<code>--- (none)</code>	<code>--- (none)</code>

The following line in a user initialization file sets the default file permissions to `rwx-rw-rw-`.



```
umask 000
```

3. Give difference between DOS and WINDOWS.

<b>BASIS FOR COMPARISON</b>		<b>DOS</b>	<b>WINDOWS</b>
Basic		Command line OS	Graphical OS
Ease of use		Complex	Simple
Features		Single processing or tasking and single user.	Multitasking or multiprocessing and multi-user.
Power consumption		Low	High
Use of peripherals		Allow the use of keyboard	Use of mouse and keyboard both is permitted.



<b>BASIS FOR COMPARISON</b>	<b>DOS</b>	<b>WINDOWS</b>
Memory consumption	Less	More
Multimedia application	No support is provided	Supported
Size of the OS	Small	Large
Versions	DOS/360, IBM system/360, DOS 11, TRS DOS, MS-DOS, 86 DOS.	Windows 1.0, 2x, 3x, 9x(95 and 98), NT, 2000, XP, Vista, 7, 8 and 8.1, 10.

**4. Explain Booting Process.**

**Power Up**

The first step of any boot process is applying power to the machine. When the user turns a computer on, a series of events begins that ends when the operating system gets control from



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the boot process and the user is free to work. When the computer is turned on, the central processor executes some startup code in ROM that is located on the motherboard.

### Power-On Self Test

The next step in the boot process is called the POST, or power on self test. This test checks all connected hardware, including RAM and secondary storage devices to be sure it is all functioning properly. After POST has completed its job, the boot process searches the boot device list for a device with a BIOS on it.

### Find a Boot Device

The I/O system is essential to the operation of the computer because it defines the rules for communications between the CPU and the other devices attached to the computer via the motherboard. The I/O system, sometimes found in the "io.sys" file on the boot device, provides extensions to the BIOS located in ROM on the motherboard.

### Load the Operating System

Once the hardware functionality is confirmed and the input/output system is loaded, the boot process begins loading the operating system from the boot device. The OS is loaded into RAM, and any instructions specific to the particular operating system are executed. The actual operating system is somewhat irrelevant, as the computer will follow the same boot pattern in any case.

### Transfer Control

Once the previous steps are complete and the operating system is safely loaded into RAM, the boot process relinquishes control to the OS. The OS then proceeds to execute any pre-configured startup routines to define user configuration or application execution. At the end of the handoff, the computer is ready for use.

Date: 25/09/2019

Signature of faculty in-charge