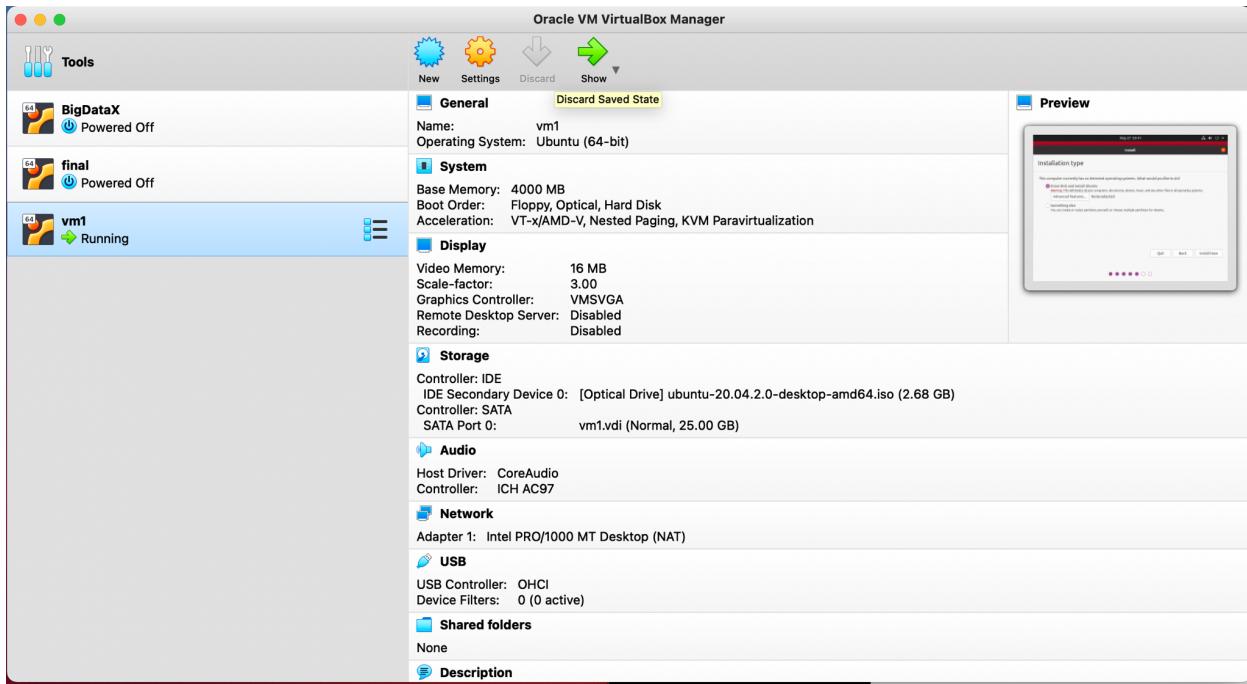
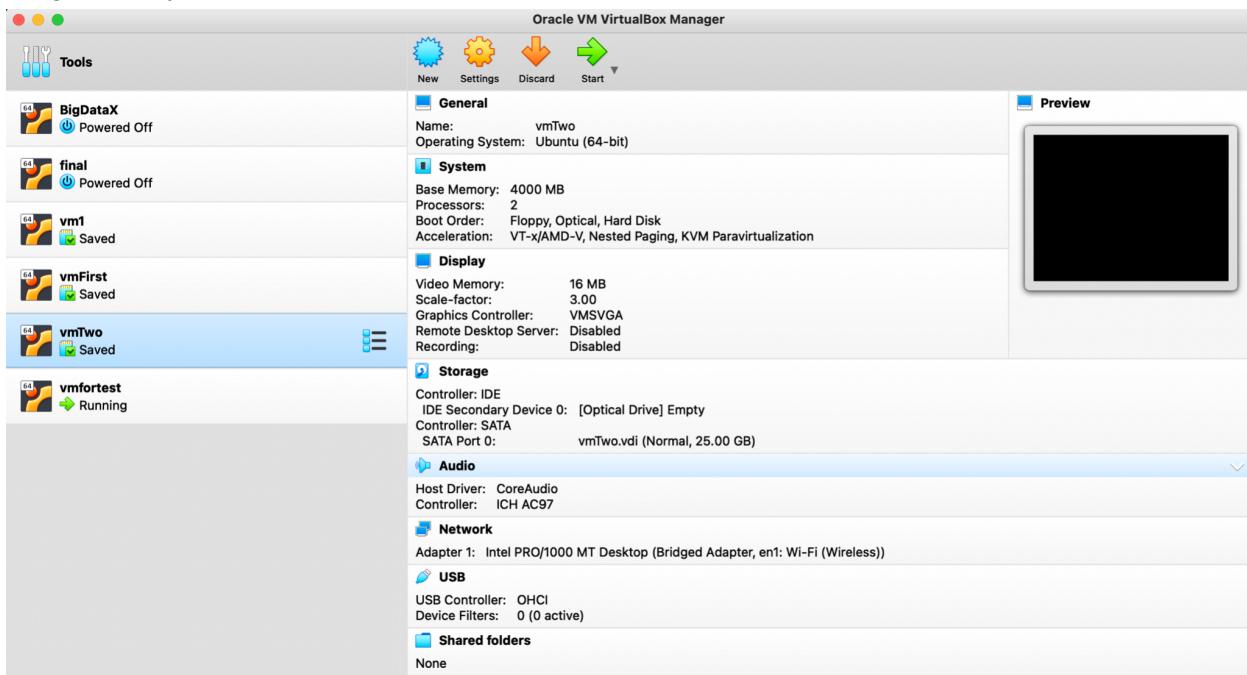


## Part 1:

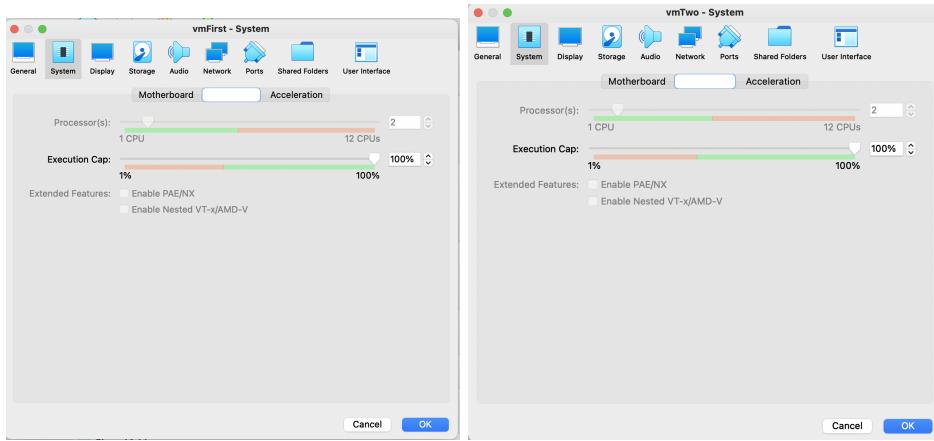
The image below displays the system information according the specifications on the PDF. The image displays information about vm1 which is the vm I chose to be the host



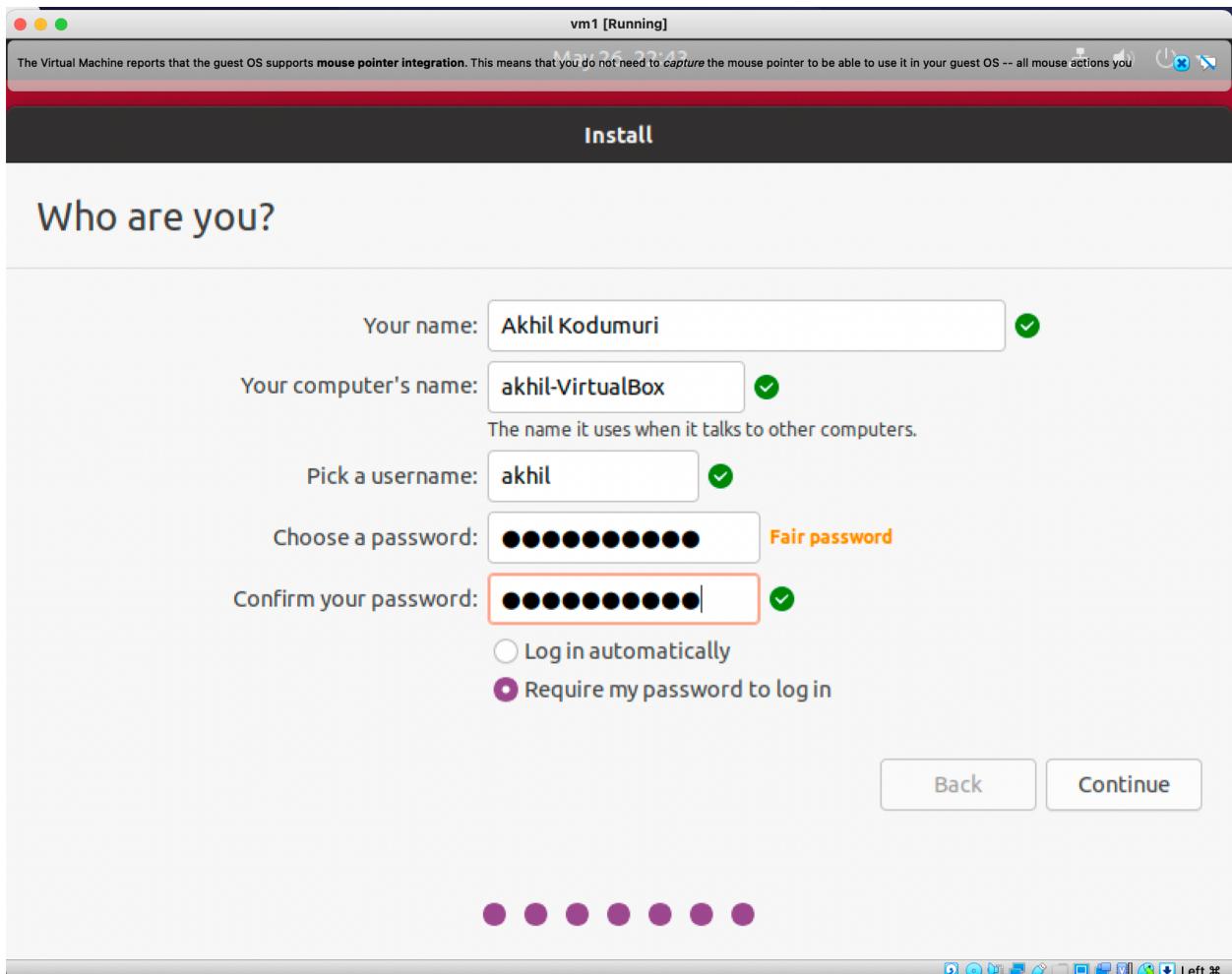
The image below displays the system information according the specifications on the PDF. The image displays information about vm2 which is the vm I chose to be the server/destination



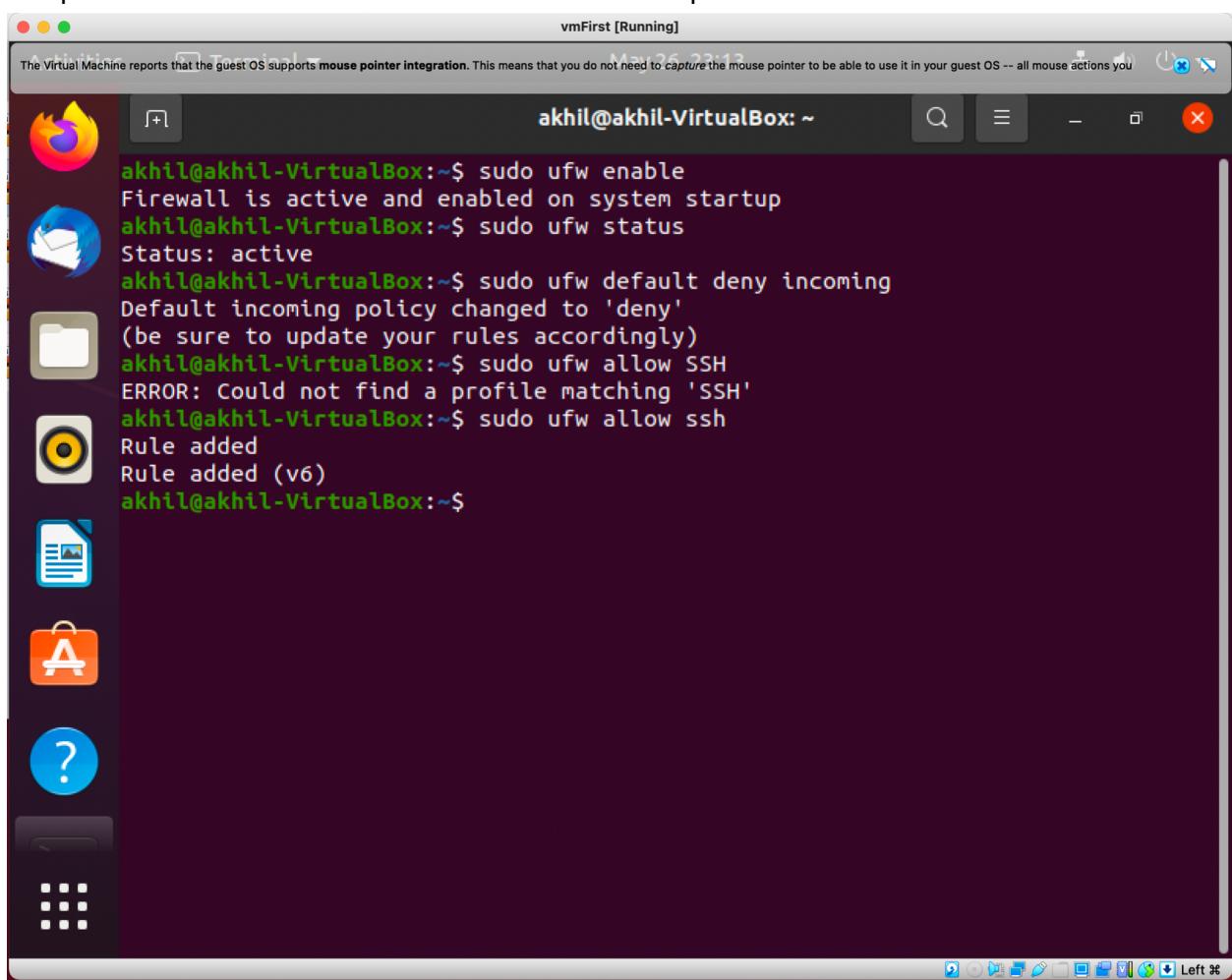
Images below shows processor information for vm1 and vm2



The image below displays the creation of a user id and password



The pictures below enables firewall and blocks all the ports for vm1

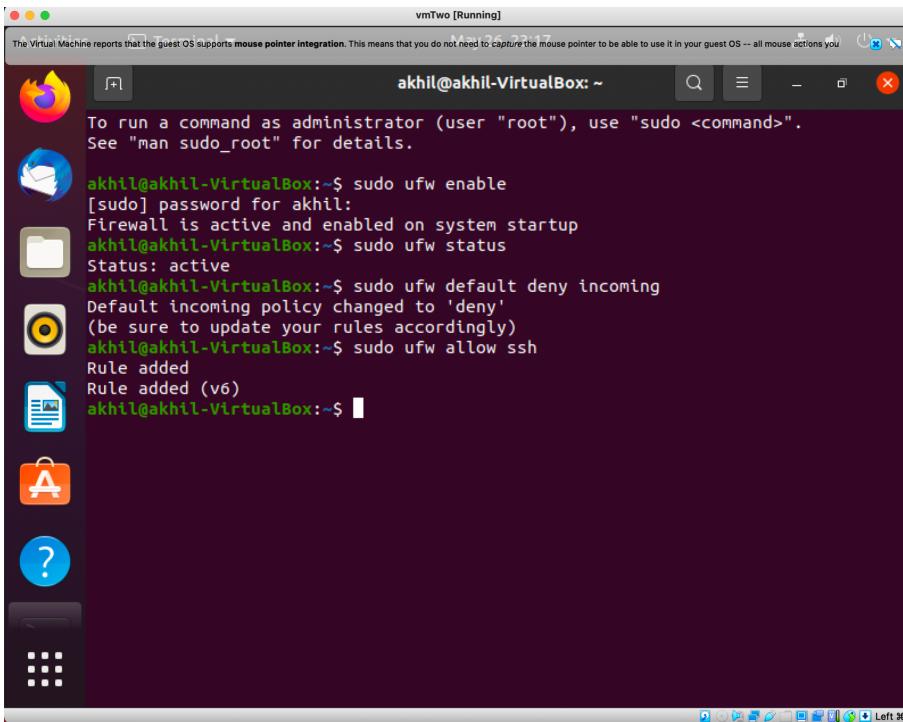


A screenshot of a Linux desktop environment showing a terminal window titled "vmFirst [Running]". The terminal window has a dark purple background and contains the following command-line session:

```
akhil@akhil-VirtualBox:~$ sudo ufw enable
Firewall is active and enabled on system startup
akhil@akhil-VirtualBox:~$ sudo ufw status
Status: active
akhil@akhil-VirtualBox:~$ sudo ufw default deny incoming
Default incoming policy changed to 'deny'
(be sure to update your rules accordingly)
akhil@akhil-VirtualBox:~$ sudo ufw allow SSH
ERROR: Could not find a profile matching 'SSH'
akhil@akhil-VirtualBox:~$ sudo ufw allow ssh
Rule added
Rule added (v6)
akhil@akhil-VirtualBox:~$
```

The terminal window includes standard Linux navigation icons (back, forward, search) and a scroll bar. The desktop interface features a dock with icons for various applications like a browser, file manager, and terminal.

The pictures below enables firewall and blocks all the ports for vm2



```
To run a command as administrator (user "root"), use "sudo <command>".  
See "man sudo_root" for details.  
[sudo] password for akhil:  
Firewall is active and enabled on system startup  
akhil@akhil-VirtualBox:~$ sudo ufw status  
Status: active  
akhil@akhil-VirtualBox:~$ sudo ufw default deny incoming  
Default incoming policy changed to 'deny'  
(be sure to update your rules accordingly)  
akhil@akhil-VirtualBox:~$ sudo ufw allow ssh  
Rule added  
Rule added (v6)  
akhil@akhil-VirtualBox:~$
```

Creating private and public keys

```

The Virtual Machine reports that the guest OS supports mouse pointer integration. This means that you do not need to capture the mouse pointer to be able to use it in your guest OS -- all mouse actions you
akhil@akhil-VirtualBox:~/.ssh$ ls
Desktop Documents Downloads Music Pictures Public Templates Videos
akhil@akhil-VirtualBox:~/.ssh$ cd .ssh/
akhil@akhil-VirtualBox:~/.ssh$ ls
akhil@akhil-VirtualBox:~/.ssh$ touch authorized_keys
akhil@akhil-VirtualBox:~/.ssh$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/akhil/.ssh/id_rsa): host
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in host
Your public key has been saved in host.pub
The key fingerprint is:
SHA256:cZ+eCJ+3YCP7JbrvrUqxgN/eI8pw0HrV6K+7xDn37DM akhil@akhil-VirtualBox
The key's randomart image is:
+---[RSA 3072]---+
          . .
         o o + . .
        o o = S o o
       + * X =
      o + @ +
     = + O BE.
    o .XOO+=o
+---[SHA256]---+
akhil@akhil-VirtualBox:~/.ssh$ ls
authorized_keys host host.pub
akhil@akhil-VirtualBox:~/.ssh$ 

```

## Adding public key to remote server

```

D25519)
Created symlink /etc/systemd/system/sshd.service → /lib/systemd/system/ssh.service
C Thunderbird Mail /etc/systemd/system/multi-user.target.wants/ssh.service → /lib/
systemd/system/ssh.service.
rescue-ssh.target is a disabled or a static unit, not starting it.
Processing triggers for systemd (245.4-4ubuntu3.4) ...
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for ufw (0.36-6) ...
akhil@akhil-VirtualBox:~/.ssh$ ssh-copy-id -i ~/.ssh/host.pub akhil@192.168.68.
134
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/akhil/.ssh/
/host.pub"
The authenticity of host '192.168.68.134 (192.168.68.134)' can't be established .
ECDSA key fingerprint is SHA256:qViKJyalpHS9oyZxiz/0hza8UT3WCLkKzyFEsqzPDlo.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter
out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are promp
ted now it is to install the new keys
akhil@192.168.68.134's password:
Number of key(s) added: 1

Now try logging into the machine, with: "ssh 'akhil@192.168.68.134'"
and check to make sure that only the key(s) you wanted were added.

```

## Sshing from host to server (vm1 to vm2)

```
The Virtual Machine reports that the guest OS supports mouse pointer integration. This means that you do not need to capture the mouse pointer to be able to use it in your guest OS - all mouse actions you perform will be sent to the guest OS.  
ECDSA key fingerprint is SHA256:qViKJyalpHS9oyZxiz/0h2aBuT3WCLKzyFesqzPDlo.  
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes  
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter  
out any that are already installed  
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are promp-  
ted now it is to install the new keys  
akhil@192.168.68.134's password:  
Number of key(s) added: 1  
Now try logging into the machine, with: "ssh 'akhil@192.168.68.134'"  
and check to make sure that only the key(s) you wanted were added.  
akhil@akhil-VirtualBox:~/.ssh$ ssh ^C  
akhil@akhil-VirtualBox:~/.ssh$ ^C  
akhil@akhil-VirtualBox:~/.ssh$ ssh akhil@192.168.68.134  
Welcome to Ubuntu 20.04.2 LTS (GNU/Linux 5.8.0-53-generic x86_64)  
* Documentation: https://help.ubuntu.com  
* Management: https://landscape.canonical.com  
* Support: https://ubuntu.com/advantage  
183 updates can be installed immediately.  
80 of these updates are security updates.  
To see these additional updates run: apt list --upgradable  
Your Hardware Enablement Stack (HWE) is supported until April 2025.  
akhil@akhil-VirtualBox:~$
```

## Part 2

- SSH (Secure Shell Protocol): SSH is used to establish a connection between two machines/computers host and destination, in which a user can login into a desired destination system from a host system.

```
akhilkodumuri — akhil@akhil-VirtualBox: ~ — ssh akhil@192.168.68.133 — 80x24  
akhilkodumuri@Akhils-MacBook-Pro ~ % ssh akhil@192.168.68.133  
akhil@192.168.68.133's password:  
Welcome to Ubuntu 20.04.2 LTS (GNU/Linux 5.8.0-53-generic x86_64)  
* Documentation: https://help.ubuntu.com  
* Management: https://landscape.canonical.com  
* Support: https://ubuntu.com/advantage  
  
172 updates can be installed immediately.  
71 of these updates are security updates.  
To see these additional updates run: apt list --upgradable  
  
Your Hardware Enablement Stack (HWE) is supported until April 2025.  
Last login: Tue May 25 14:51:07 2021 from 192.168.68.110  
akhil@akhil-VirtualBox:~$
```

- b. ssh-keygen: This command generates an authentication key that can be used to establish an SSH connection between two machines. This takes the form of a private (file\_name) and public key (file\_name.pub) which are generated from the command. The public key is stored on the destination machine (typically in an authorized\_key file) and the private key is used as the authentication when connecting from a host machine.

```

Generating public/private rsa key pair.
Enter file in which to save the key (/home/akhil/.ssh/id_rsa): hw
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in hw
Your public key has been saved in hw.pub
The key fingerprint is:
SHA256:i+FYZ88PTDjwVzEpBVRDbRw7PKDtRW9N7PfzW7p2kko akhil@akhil-VirtualBox
The key's randomart image is:
+---[RSA 3072]---+
|          .o=0oo.|
|          .o.B++oI|
|         . . o.*.+I|
|         o . o . +oI|
|        o S o . oI|
|       + = 0     ..I|
|       . o . = E .+I|
|           + .+.+I|
|           ooo=.I|
+---[SHA256]---+
akhil@akhil-VirtualBox:~$ ls
Desktop  Downloads  hw.pub  Pictures  Templates
Documents  hw      Music   Public    Videos
akhil@akhil-VirtualBox:~$
```

- c. scp (secure copy): This command copies a file from a host to a destination machine. The same credentials used for ssh can be used for scp.

```

akhil@akhil-VirtualBox:~$ ls
Desktop  Downloads  hw.pub  Pictures  Templates
Documents  hw      Music   Public    Videos
akhil@akhil-VirtualBox:~$
```

```

akhilkodumuri@Akhils-MacBook-Pro Desktop % touch hw.txt
akhilkodumuri@Akhils-MacBook-Pro Desktop % scp -i ~/.ssh/final
hw.txt akhil@192.168.68.133:/home/akhil
hw.txt
2021-05-04 04:48 AM             100%   0  0.0KB/s  00:00
akhilkodumuri@Akhils-MacBook-Pro Desktop %
```

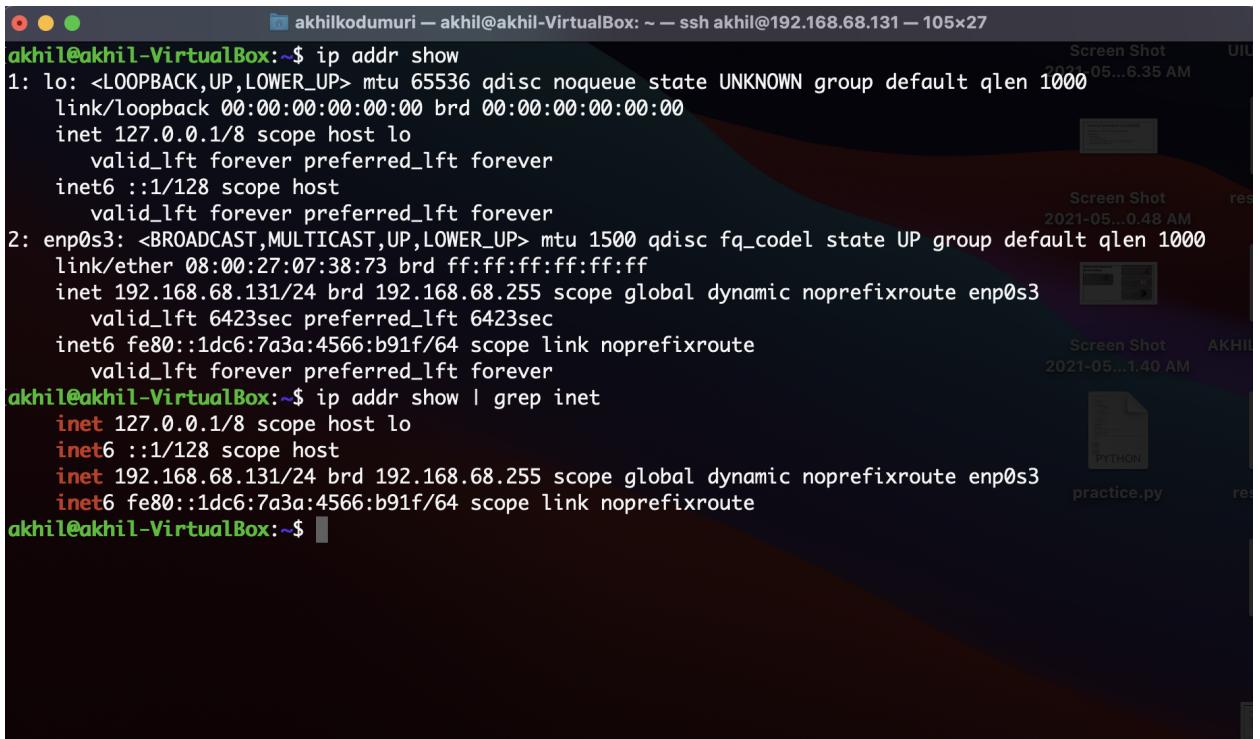
- d. history: this command displays all the past commands executed by the user since the beginning of the terminal session.

```
akhil@akhil-VirtualBox:~$ history
1 exit
2 ls
3 cd .ssh/
4 ls
5 nano authorized_keys
6 exit
7 ls
8 exit
9 clear
10 ssh-keygen
11 ls
12 man ssh-keygen
13 ls
14 ls -a
15 cd .ssh/
16 ls
17 man scp
18 clear
19 man scp
20 ls ~/
21 rm ~/hw.txt
22 clear
23 cd
```

- e. sudo: This command allows a user to execute a command with the assumed privileges of another user in the terminal. By default, the user is assumed to be root/super user. This command can be used to run commands that will change system level configurations. For example, running `sudo shutdown -r now` will shutdown your computer which can only be done by a root user because it acts on a system level change.

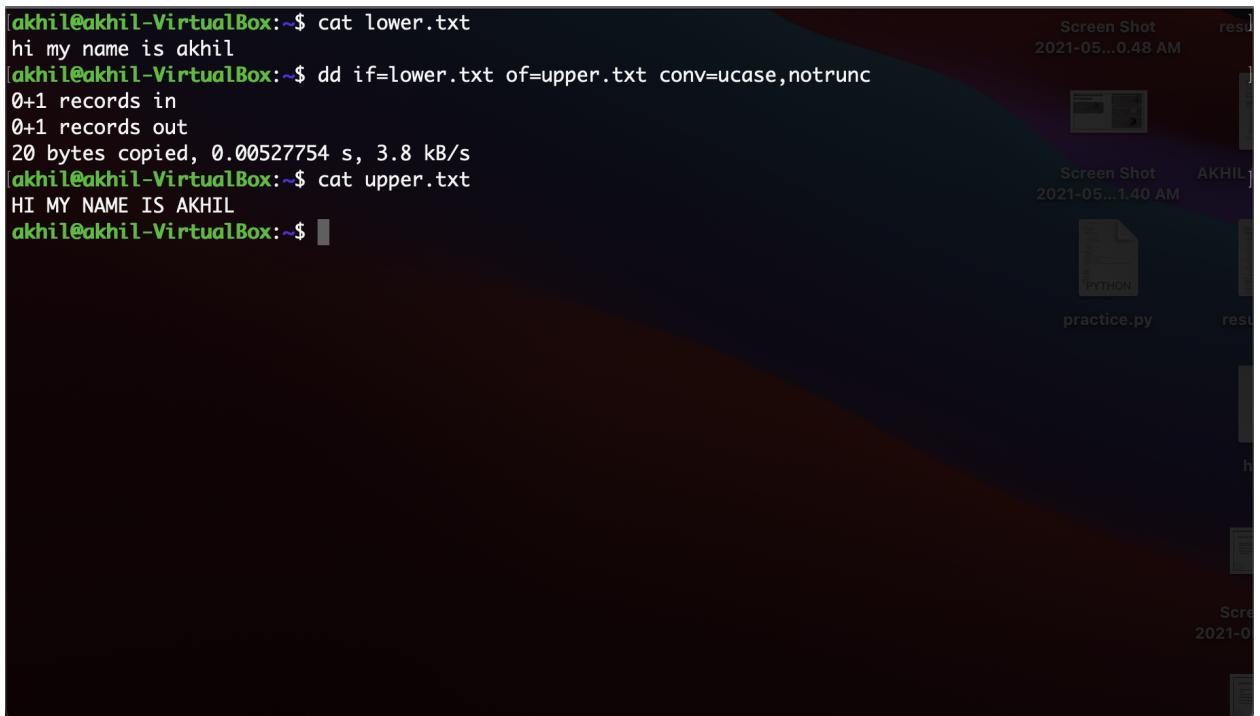
```
akhil@akhil-VirtualBox:~$ sudo shutdown -r now
akhil@akhil-VirtualBox:~$ Connection to 192.168.68.133 closed by remote host.
Connection to 192.168.68.133 closed.
akhilkodumuri@Akhils-MacBook-Pro ~ %
```

- f. ip (internet protocol): This command is used to accomplish tasks related to network administration. More specifically, this command can be used to get network interface information, and modify network interfaces or routing tables.



```
akhil@akhil-VirtualBox:~$ ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
        inet 127.0.0.1/8 scope host lo
            valid_lft forever preferred_lft forever
        inet6 ::1/128 scope host
            valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:07:38:73 brd ff:ff:ff:ff:ff:ff
        inet 192.168.68.131/24 brd 192.168.68.255 scope global dynamic noprefixroute enp0s3
            valid_lft 6423sec preferred_lft 6423sec
        inet6 fe80::1dc6:7a3a:4566:b91f/64 scope link noprefixroute
            valid_lft forever preferred_lft forever
akhil@akhil-VirtualBox:~$ ip addr show | grep inet
    inet 127.0.0.1/8 scope host lo
    inet6 ::1/128 scope host
    inet 192.168.68.131/24 brd 192.168.68.255 scope global dynamic noprefixroute enp0s3
        inet6 fe80::1dc6:7a3a:4566:b91f/64 scope link noprefixroute
akhil@akhil-VirtualBox:~$
```

- g. dd: This command is used to copy and convert files. This also includes reading and writing to said files. With these purposes combined, dd is known to be used to copy the contents of one hard disk to another.



```
akhil@akhil-VirtualBox:~$ cat lower.txt
hi my name is akhil
akhil@akhil-VirtualBox:~$ dd if=lower.txt of=upper.txt conv=ucase,notrunc
0+1 records in
0+1 records out
20 bytes copied, 0.00527754 s, 3.8 kB/s
akhil@akhil-VirtualBox:~$ cat upper.txt
HI MY NAME IS AKHIL
akhil@akhil-VirtualBox:~$
```

- h. fdisk: this command is used to interact with the disk partition table for a given block device where. A partition table contains information about all the partitions on a given

block. Information like the boot signature, number of tracks, and size of the partition. A track is divided into sectors which contain header and trailer information.

```

akhil@akhil-VirtualBox:~$ lsblk
Disk /dev/loop6: 55.43 MiB, 58114048 bytes, 113504 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/loop7: 65.1 MiB, 68259840 bytes, 133320 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/sda: 70 GiB, 75161927680 bytes, 146800640 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0xa17729b6

Device      Boot   Start     End   Sectors  Size Id Type
/dev/sda1    *      2048 1050623 1048576 512M  b W95 FAT32
/dev/sda2          1052670 146798591 145745922 69.5G  5 Extended
/dev/sda5          1052672 146798591 145745920 69.5G 83 Linux

akhil@akhil-VirtualBox:~$ 

```

- i. apt (advanced package tool): this command is used for managing, adding, updating, etc packages to linux operating systems. More specifically, apt provides a user with a way to interact with the linux package management system which is used for downloading, upgrading, and deleting software packages.

```

akhil@akhil-VirtualBox:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following NEW packages will be installed:
  distro-info
The following packages will be upgraded:
  alsamixer alsa-utils apport apport-gtk apt apt-utils bind9-dnsutils bind9-host bind9-libs bluez
  bluez-cups bluez-obexd dirmngr distro-info-data dnsmasq-base evince evince-common file-roller firefox
  fonts-noto-color-emoji fonts-opensymbol friendly-recovery gir1.2-gdkpixbuf-2.0
  gir1.2-gst-plugins-base-1.0 gir1.2-javascriptcoregtk-4.0 gir1.2-webkit2-4.0 gjs gnome-disk-utility
  gnome-shell gnome-shell-common gnome-shell-extension-appindicator gnupg gnupg-l10n gnupg-utils gpg
  gpg-agent gpg-wks-client gpg-wks-server gpgconf gpgsm gpgv gstreamer1.0-alsa gstreamer1.0-gl
  gstreamer1.0-gtk3 gstreamer1.0-plugins-base gstreamer1.0-plugins-base-apps gstreamer1.0-plugins-good
  gstreamer1.0-pulseaudio gstreamer1.0-x iio-sensor-proxy initramfs-tools initramfs-tools-bin
  initramfs-tools-core intel-microcode isc-dhcp-client isc-dhcp-common libapt-pkg6.0 libasound2
  libasound2-data libatopology2 libbluetooth3 libcaca0 libcurl3-gnutls libcurl4 libdjvuibre-text
  libdjvuibre21 libevdocument3-4 libevview3-3 libexiv2-27 libgdk-pixbuf2.0-0 libgdk-pixbuf2.0-bin
  libgdk-pixbuf2.0-common libgjs0g libglib2.0-0 libglib2.0-bin libglib2.0-data libgnome-autoar-0-0

```

- j. vi (visual): Provides is a built in text editor provided within unix based operating systems

```

Setting up libjcurl4 (1:0.11.1-0ubuntu0.20.04.1) ...
Setting up libjurt-java (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libreoffice-draw (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libjuh-java (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libreoffice-gnome (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libreoffice-impress (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libreoffice-base-core (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up python3-uno (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libreoffice-ogltrans (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libreoffice-calc (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libreoffice-writer (1:6.4.7-0ubuntu0.20.04.1) ...
Processing triggers for mime-support (3.64ubuntu1) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for gnome-menus (3.36.0-1ubuntu1) ...
Processing triggers for libc-bin (2.31-0ubuntu9.2) ...
Processing triggers for man-db (2.9.1-1) ...

Processing triggers for libreoffice-common (1:6.4.7-0ubuntu0.20.04.1) ...
Processing triggers for dbus (1.12.16-2ubuntu2.1) ...
Processing triggers for shared-mime-info (1.15-1) ...
Processing triggers for install-info (6.7.0.dfsg.2-5) ...
Processing triggers for fontconfig (2.13.1-2ubuntu3) ...
Processing triggers for desktop-file-utils (0.24-1ubuntu3) ...
Processing triggers for initramfs-tools (0.136ubuntu6.5) ...
update-initramfs: Generating /boot/initrd.img-5.8.0-53-generic

```

"hw.txt" [New File]

```

Last login: Tue May 25 15:03:57 on ttys001
akhilkodumuri@Akhils-MacBook-Pro ~ % vi hw.txt
akhilkodumuri@Akhils-MacBook-Pro ~ %
Setting up libjcurl4 (1:0.11.1-0ubuntu0.20.04.1) ...
Setting up libjurt-java (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libreoffice-draw (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libjuh-java (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libreoffice-gnome (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libreoffice-impress (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libreoffice-base-core (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up python3-uno (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libreoffice-ogltrans (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libreoffice-calc (1:6.4.7-0ubuntu0.20.04.1) ...
Setting up libreoffice-writer (1:6.4.7-0ubuntu0.20.04.1) ...
Processing triggers for mime-support (3.64ubuntu1) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...

```

- k. time: this command is used to find out information like time passed and even some information of the system usage to execute a command or file. This “time passed” can be defined by seconds, cpu time spent in user mode, and amount of cpu time spent in kernel mode.

```

akhil@akhil-VirtualBox:~$ time python3 hw.py
Hello world

real    0m0.010s
user    0m0.009s
sys     0m0.000s

```

- l. tar: this command is used to combine multiple files and even directories into a single archived, .tar, file. tar can also be used to extract these said archived files back to they're

individual components. tar is useful when combining data files together and is efficient for compression

```
akhil@akhil-VirtualBox:~$ tar cv homework.tar hw.txt hw1.txt hw2.txt
hw.txt
hw1.txt
hw2.txt
akhil@akhil-VirtualBox:~$ cat homework.tar
hw.txt000066400017500001750000000000161405304651011177 0ustar  akhilakhilhomework text
hw1.txt000066400017500001750000000000201405304501011245 0ustar  akhilakhilhomework 1 text
hw2.txt000066400017500001750000000000201405304514011252 0ustar  akhilakhilhomework 2 text
```

- m. cat: this command is used for printing the contents of a given file to screen and is used to append and redirect output (from files or terminal) to a file or screen.

```
akhil@akhil-VirtualBox:~$ cat hw1.txt
homework 1 text
akhil@akhil-VirtualBox:~$
```

- n. watch: this command will allow a user to “watch” the output of a given command periodically (default time is every 2 seconds) on screen. Essentially, watch is just running the command repeatedly and displaying its output.

```
Every 2.0s: python3 test.py
hello world
akhil-VirtualBox: Tue May 25 18:46:04 2021
```

```
Every 2.0s: python3 test.py
hello world
akhil-VirtualBox: Tue May 25 18:46:06 2021
```

In this pictures above, note the time difference on the top left corner.

- o. ps (process status): displays all the running processes currently running on a unix based system. In the example below, I ctrl-f mtga which is a game I am running on my mac (the mtga window can also be seen in the background of the picture).

The screenshot shows a Mac OS X desktop with a terminal window open. The title bar of the terminal window says "Q: mtg". The terminal output displays a list of processes from the "top" command. The processes listed include various system daemons and applications like Safari, Mail, and Finder. The output is as follows:

```

9137 ?? 0:26.15 /System/Library/Frameworks/WebKit.framework/Versions/A/XPCServices/com.apple.WebKit
9284 ?? 0:00.80 /System/Library/Frameworks/WebKit.framework/Versions/A/XPCServices/com.apple.WebKit
9352 ?? 0:00.88 /System/Library/Frameworks/WebKit.framework/Versions/A/XPCServices/com.apple.WebKit
9519 ?? 6:55.91 /System/Library/Frameworks/WebKit.framework/Versions/A/XPCServices/com.apple.WebKit
9662 ?? 0:12.45 /System/Library/Frameworks/WebKit.framework/Versions/A/XPCServices/com.apple.WebKit
9663 ?? 0:00.01 /System/Library/Frameworks/AudioToolbox.framework/XPCServices/com.apple.AudioToolbox
9664 ?? 0:11.16 /System/Library/Frameworks/WebKit.framework/Versions/A/XPCServices/com.apple.WebKit
9665 ?? 0:00.01 /System/Library/Frameworks/AudioToolbox.framework/XPCServices/com.apple.AudioToolbox
9973 ?? 0:25.60 /usr/libexec/PerfPowerServices
10070 ?? 0:31.45 /System/Library/Frameworks/WebKit.framework/Versions/A/XPCServices/com.apple.WebKit
10192 ?? 0:00.12 /System/Library/CoreServices/CoreServicesUIAgent.app/Contents/MacOS/CoreServicesUIAgent
10284 ?? 0:00.07 /System/Library/Frameworks/WebKit.framework/Versions/A/XPCServices/com.apple.WebKit
10306 ?? 37:35.42 /Users/Shared/Epic Games/MagicTheGathering/MTGA.app/Contents/MacOS/MTGA
10373 ?? 0:00.08 /System/Library/PrivateFrameworks/A0SKit.framework/Versions/A/XPCServices/com.apple.A0SKit
10397 ?? 0:00.06 /System/Library/PrivateFrameworks/CoreServices.framework/Metadata.framework
11740 ?? 0:04.22 /System/Library/PrivateFrameworks/MFAAuthentication.framework/Versions/A/XPCServices/com.apple.MFAAuthentication
12907 ?? 0:00.03 /System/Library/PrivateFrameworks/SystemAdministration.framework/XPCServices/com.apple.SystemAdministration
18348 ?? 0:00.46 /usr/libexec/xpcroleaccountd -launchd
19761 ?? 0:01.48 /System/Library/Frameworks/CryptoTokenKit.framework/PlugIns/setoken.appex
21754 ?? 0:00.10 /usr/libexec/colorsdisplayservices
21755 ?? 0:00.05 /usr/libexec/colorsdisplayservices
21758 ?? 0:00.78 /System/Library/CoreServices/iconservicesagent runAsRoot
21761 ?? 2:33.05 /System/Library/Frameworks/VideoToolbox.framework/Versions/A/XPCServices/com.apple.VideoToolbox
21891 ?? 211:41.17 /Applications/Safari.app/Contents/MacOS/Safari

```

- p. **top:** This command displays a summary of all the processes running on the users system and periodically updates the screen. Information memory and cpu usage are also given next to the process and about the overall system in general.

The screenshot shows a Linux terminal window running the "htop" command. The title bar of the terminal window says "Screen Shot 2021-05-06 6.35 AM". The terminal output displays a list of processes from the "htop" command. The processes listed include various system daemons and applications like Terminal, Podcasts, and Activity Monitor. The output is as follows:

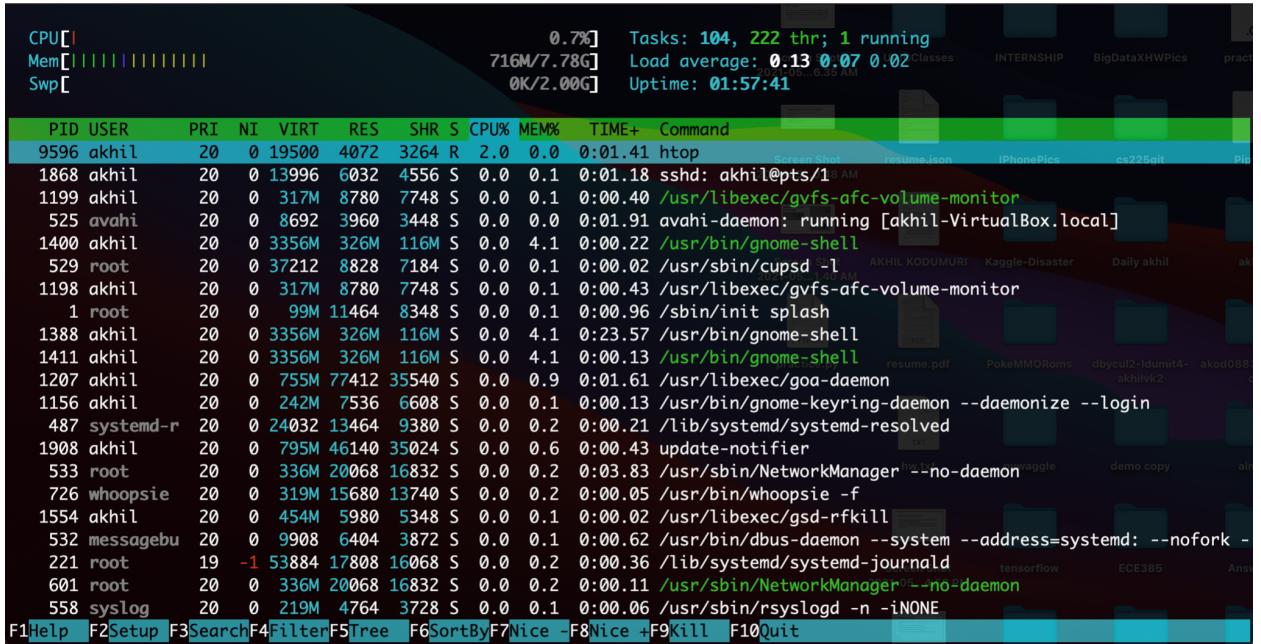
```

Processes: 495 total, 3 running, 492 sleeping, 2064 threads
Load Avg: 1.33, 1.59, 1.82 CPU usage: 1.73% user, 3.35% sys, 94.91% idle
SharedLibs: 455M resident, 131M data, 52M linkedit.
MemRegions: 180199 total, 5345M resident, 252M private, 2472M shared.
PhysMem: 13G used (1802M wired), 1940M unused.
VM: 184T vsize, 2949M framework vsize, 34816890(0) swapins, 50154506(0) swapouts.
Networks: packets: 262867632/252G in, 318225786/167G out.
Disks: 84847877/2489G read, 41836051/1386G written.

PID COMMAND %CPU TIME #TH #WQ #PORTS MEM PURG CMPRS PGRP PPID STATE
673* sysmond 9.9 10:56:42 3 2 26 2818K 0B 1104K 673 1 sleeping
0* kernel_task 8.7 52:43:20 492/8 0 0 33M 0B 0B 0 0 0 running
343* WindowServer 6.9 93:48:38 23/1 6 7698 1291M- 287M- 383M 343 1 running
10449* top 6.8 00:01.22 2/1 0 33 7309K 0B 0B 10449 10286 running
57597* Activity Mon 1.1 64:36.91 3 1 1540- 141M 32K- 89M 57597 1 sleeping
9097* Terminal 1.1 04:14.43 10 3 391- 237M 26M- 246M 9097 1 sleeping
28609* Podcasts 0.9 09:49:36 9 1 383 83M 0B 52M 28609 1 sleeping
89712* Notification 0.6 27:29.73 5 2 2886 43M 0B 17M 89712 1 sleeping
27457* gamecontroll 0.2 84:40.56 3 2 61 5793K 0B 2240K 27457 1 sleeping
45519* ReceiverHelp 0.2 23:55.83 18 4 322- 27M- 0B 69M 45519 1 sleeping
336* corebrightne 0.2 02:49:04 6 5 145 6610K 0B 3760K 336 1 sleeping
333* bluetoothd 0.1 01:46:02 6 4 1674 13M 0B 1312K 333 1 sleeping
432* coreaudiod 0.1 33:08:30 7 2 6211+ 71M 0B 48M 432 1 sleeping
288* logd 0.1 79:19.92 4 3 1550 22M 0B 8368K 288 1 sleeping

```

- q. **htop:** This command is similar to top however it provides a user with an interactive interface to kill, search, and sort by etc. In other words, htop provides the user with an interface to run the various uses of top.



- r. gcc: this command is used to compile C and C++ programs into an executable file written in machine code that the compiler understands.

```
akhil@akhil-VirtualBox:~$ gcc hw.c
akhil@akhil-VirtualBox:~$ ./a.out
Hello, World!
akhil@akhil-VirtualBox:~$
```

- s. tail: this command displays the final parts of a given file (default is last 10 lines). A user can specify the amount from the end to display but flags must be used.

```
akhil@akhil-VirtualBox:~$ tail lines.txt
11
12
13
14
15
16
17
18
19
20
akhil@akhil-VirtualBox:~$
```

- t. grep: this command is used to find patterns within a given file. Flags can be used to make more specific searches to restrict output.

```
akhil@akhil-VirtualBox:~$ cat lines.txt | grep 11
11
akhil@akhil-VirtualBox:~$
```

- u. kill: this command is used to send signals to a process currently running on your system. The most common use of kill to halt a process given its pid. In the pictures below, it should be noted that the game MTGA was running with pid 10734. In the second picture, the process is killed and then I grep to make sure it doesn't appear anymore

```
akhil@akhil-VirtualBox:~$ top | grep MTGA
10734* MTGA          0.0  01:41.89 56      5   436    1230M  0B    1146M 10734 1
      sleeping *0[15]  0.00000 0.00000   501 802680    908    219688
136874  2287118  6152090  1296235   5919   1552    0.0     0     0
      akhilkodumuri  N/A   N/A   N/A   N/A   N/A   N/A
10734* MTGA          45.5 01:42.48 56      5   436    1230M+ 0B    1146M 10734
      1    sleeping *0[15]  0.00827 0.00000   501 805215+    908    2205
20+    137544+  2290891+  6191013+  1304437+   5919   1552    45.5  1
236636075 925046921 akhilkodumuri  N/A   N/A   N/A   N/A   N/A   N/A
10734* MTGA          52.7 01:43.05 56      5   436    1230M- 0B    1146M 10734
      1    sleeping *0[15]  0.01122 0.00000   501 807711+    908    2213
39+    138207+  2294709+  6229619+  1312470+   5919   1554+   52.8  1
215423360 833855094 akhilkodumuri  N/A   N/A   N/A   N/A   N/A   N/A
10734* MTGA          52.7 01:43.63 56/2   5   436    1230M  0B    1146M 10734

akhil@akhil-VirtualBox:~$ kill -1 10734
akhil@akhil-VirtualBox:~$ top | grep MTGA
```

- v. killall: This command sends a signal to all the processes under a given name. In the pictures below, similar to kill, I kill the process MTGA. In the second picture, notice how the game in the background is gone.

```

akhilkodumuri@Akhils-MacBook-Pro ~ % top | grep MTGA
10827* MTGA          0.0  00:37.83 55      4   437    1227M 4816K 0B    10827 1
    sleeping *0[4]      0.00000 0.00000   501 512882   908 124689
    72330     1672861  2359176  439091    35   235      0.0   0   0
    akhilkodumuri      N/A   N/A   N/A   N/A   N/A   N/A
10827* MTGA          44.4  00:38.41 55      4   437    1227M+ 4816K 0B    10827
    1   sleeping *0[4]  0.00797 0.00000   501 515417+   908 traditional 12552 ft Strixhaven
    1+  72995+    1676740+  2398423+  447262+    35   238+    44.5   12
41773520 880824100 akhilkodumuri      N/A   N/A   N/A   N/A   N/A   N/A
10827* MTGA          53.7  00:38.99 54      4   436-   1227M- 4816K 0B    10827
    1   sleeping *0[4]  0.01109 0.00000   501 518353+   908 12650
    0+  73725+    1680436+  2437483+  455126+    35   239+    53.7   15

```

```

56958720 727181920 akhilkodumuri      N/A   N/A   N/A   N/A   N/A   N/A
10827* MTGA          53.7  00:39.57 56/1  4   438+   1227M+ 4816K 0B    10827
    1   running  *0[4]  0.01102 0.00057   501 520861+   908 12732
0+  74384+    1684083+  2476101+  462999+    35   246+    54.0   12
72288123 769876345 akhilkodumuri      N/A   N/A   N/A   N/A   N/A   N/A
10827* MTGA          54.1  00:40.15 56/1  4   438    1227M 4816K 0B    10827
    1   running  *0[4]  0.01097 0.00018   501 523358+   908 12813
9+  75037+    1687784+  2515413+  470796+    35   253+    54.4   12
35664469 735079476 akhilkodumuri      N/A   N/A   N/A   N/A   N/A   N/A
10827* MTGA          54.9  00:40.74 56      4   438    1227M 4816K 0B    10827
    1   sleeping *0[4]  0.01236 0.00000   501 525893+   908 12897
0+  75708+    1691409+  2554971+  478788+    35   253      54.9   12
38967313 782210469 akhilkodumuri      N/A   N/A   N/A   N/A   N/A   N/A
10827* MTGA          54.0  00:41.32 56/1  4   438    1227M 4816K 0B    10827
    1   running  *0[4]  0.00993 0.00000   501 528428+   908 12980
0+  76368+    1695107+  2594616+  486588+    35   254+    54.1   12
94817457 689403670 akhilkodumuri      N/A   N/A   N/A   N/A   N/A   N/A
10827* MTGA          53.6  00:41.90 56      4   438    1227M+ 4816K 0B    10827
    1   sleeping *0[4]  0.01251 0.00000   501 530926+   908 13062
4+  77023+    1698749+  2633917+  494451+    35   260+    53.9   12
30725260 765473286 akhilkodumuri      N/A   N/A   N/A   N/A   N/A   N/A
^C
akhilkodumuri@Akhils-MacBook-Pro ~ % killall -1 MTGA
akhilkodumuri@Akhils-MacBook-Pro ~ %

```

- w. du: This command estimates how much space a file and directory takes up on your disk. You can add flags to show the sizes in different units.

```

[akhil@akhil-VirtualBox:~$ du -h
4.0K ./Documents
4.0K ./Videos
4.0K ./Public
4.0K ./Music
4.0K ./Pictures
8.0K ./config/goa-1.0
8.0K ./config/ibus/bus
12K ./config/ibus
8.0K ./config/gtk-3.0
4.0K ./config/gnome-session/saved-session
8.0K ./config/gnome-session
4.0K ./config/update-notifier
32K ./config/evolution/sources
36K ./config/evolution
4.0K ./config/nautilus
4.0K ./config/procps
8.0K ./config/dconf
4.0K ./config/htop
84K ./config/pulse
196K ./config
4.0K ./gnupg/private-keys-v1.d

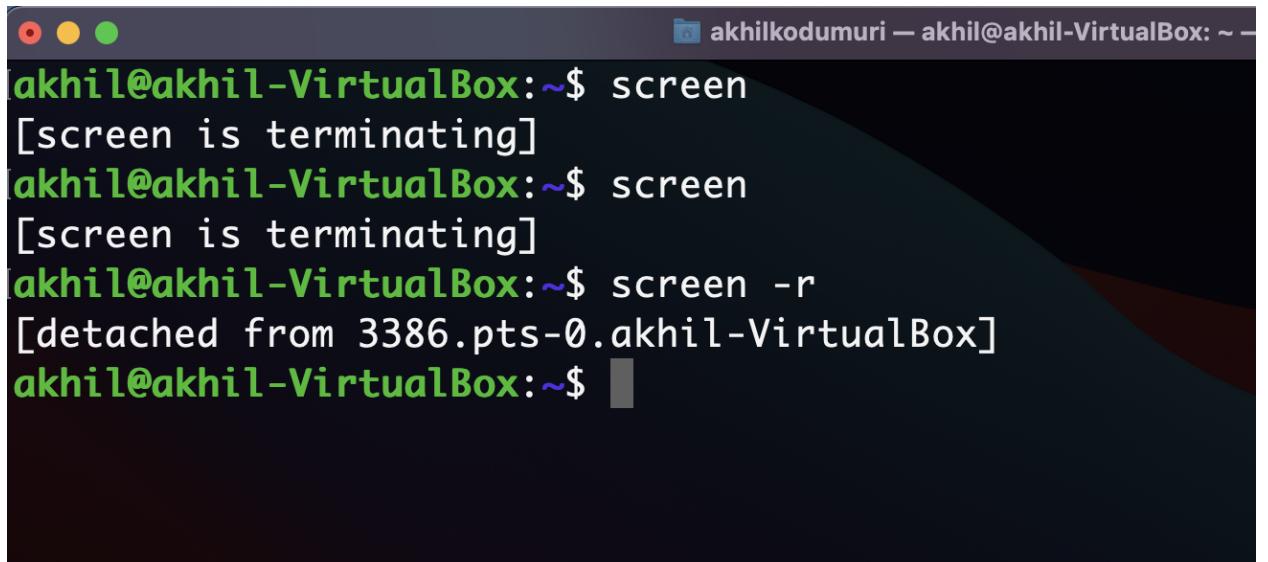
```

- x. df: This command displays how much disk space is left on the file systems on your computer. With no arguments, df displays how much disk space is used and available in blocks.

Filesystem	Size	Used	Avail	Use%	Mounted on
udev	3.9G	0	3.9G	0%	/dev
tmpfs	797M	1.3M	795M	1%	/run
/dev/sda5	68G	9.1G	56G	15%	/
tmpfs	3.9G	0	3.9G	0%	/dev/shm
tmpfs	5.0M	4.0K	5.0M	1%	/run/lock
tmpfs	3.9G	0	3.9G	0%	/sys/fs/cgroup
/dev/loop0	56M	56M	0	100%	/snap/core18/1988
/dev/loop1	56M	56M	0	100%	/snap/core18/2066
/dev/loop2	65M	65M	0	100%	/snap/gtk-common-themes/1514
/dev/loop3	219M	219M	0	100%	/snap/gnome-3-34-1804/66
/dev/loop4	66M	66M	0	100%	/snap/gtk-common-themes/1515
/dev/loop5	52M	52M	0	100%	/snap/snap-store/518
/dev/loop6	32M	32M	0	100%	/snap/snapd/11036
/dev/loop7	33M	33M	0	100%	/snap/snapd/11841
/dev/sda1	511M	4.0K	511M	1%	/boot/efi
tmpfs	797M	32K	797M	1%	/run/user/1000

- y. screen: This command creates a virtual shell of a given ssh session. This way, even if the ssh connection is lost or the session closes in any way, the process in the screen can continue. In my pictures, I established an ssh connection between my Macbook and

a ubuntu instance in VirtualBox. In the picture, a screen was created then I pressed ctrl-r to reattach the screen.



The screenshot shows a terminal window with a dark background and light-colored text. At the top, there are three colored circles (red, yellow, green) and the text "akhilkodumuri — akhil@akhil-VirtualBox: ~". Below this, the terminal prompt "akhil@akhil-VirtualBox:~\$" appears three times, followed by the command "screen". Each "screen" command is followed by the message "[screen is terminating]". After the third "screen" command, the user runs "screen -r", which is followed by the message "[detached from 3386.pts-0.akhil-VirtualBox]". Finally, the prompt "akhil@akhil-VirtualBox:~\$" appears again with a small gray square icon to its right.

```
akhil@akhil-VirtualBox:~$ screen
[screen is terminating]
akhil@akhil-VirtualBox:~$ screen
[screen is terminating]
akhil@akhil-VirtualBox:~$ screen -r
[detached from 3386.pts-0.akhil-VirtualBox]
akhil@akhil-VirtualBox:~$
```

z. vim: This command is the improved version of vi. For example, you can undo actions in vim and see an undo-tree. Pressing u, will accomplish this.

```
homework 1 text
~
~
```

```
Homework 1234
~
```

```
-- INSERT --
homework 1 text
~
```

1 change; before #2 21 seconds ago

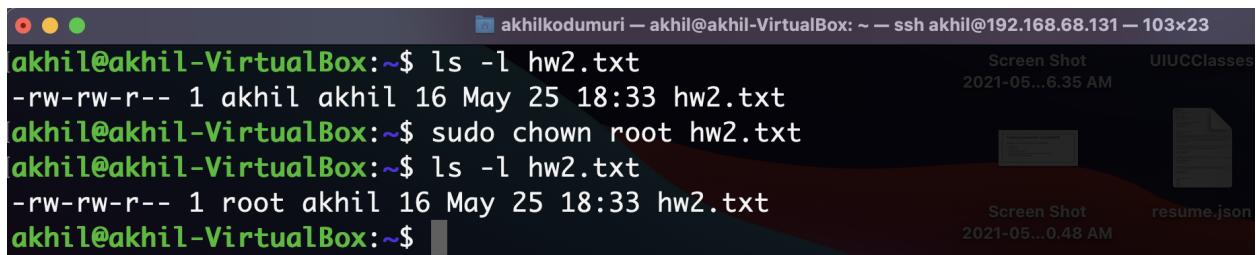
aa. chmod: This command is used to change the mode of a file. A user can make a file that was originally read only to read write. The permissions of who can read/write the file can also be changed with this command.



```
akhil@akhil-VirtualBox:~$ ls -l hw1.txt
-rw-rw-r-- 1 akhil akhil 16 May 25 18:33 hw1.txt
akhil@akhil-VirtualBox:~$ chmod g=r hw1.txt
akhil@akhil-VirtualBox:~$ ls -l hw1.txt
-rw-r--r-- 1 akhil akhil 16 May 25 18:33 hw1.txt
akhil@akhil-VirtualBox:~$
```

The screenshot shows a terminal window titled "akhilkodumuri" with the command "ssh akhil@192.168.68.131". It displays two "Screen Shot" icons at the top right, one from 2021-05...6.35 AM and another from 2021-05...0.48 AM. The terminal history shows the user running "ls -l hw1.txt" twice, once before and once after changing the group permission to "r" using the "chmod g=r" command. The file's mode changes from "rw-rw-r--" to "rw-r--r--".

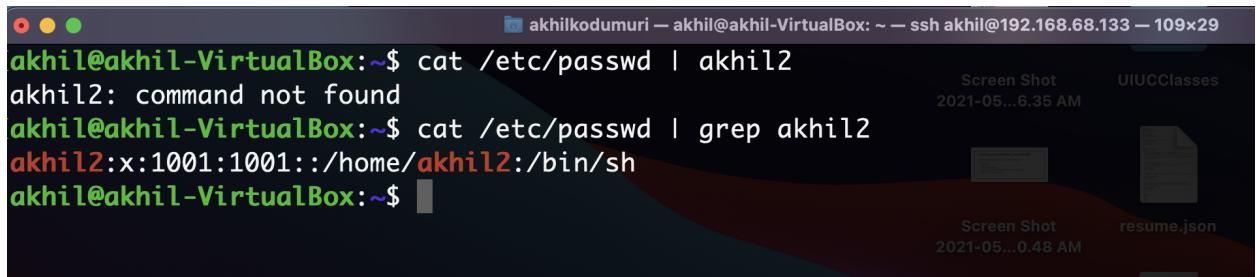
bb. chown: This command is used to change the ownership and group of a file.



```
akhil@akhil-VirtualBox:~$ ls -l hw2.txt
-rw-rw-r-- 1 akhil akhil 16 May 25 18:33 hw2.txt
akhil@akhil-VirtualBox:~$ sudo chown root hw2.txt
akhil@akhil-VirtualBox:~$ ls -l hw2.txt
-rw-rw-r-- 1 root akhil 16 May 25 18:33 hw2.txt
akhil@akhil-VirtualBox:~$
```

The screenshot shows a terminal window titled "akhilkodumuri" with the command "ssh akhil@192.168.68.131". It displays two "Screen Shot" icons at the top right, one from 2021-05...6.35 AM and another from 2021-05...0.48 AM. The terminal history shows the user running "ls -l hw2.txt", then using "sudo chown root hw2.txt" to change the owner to "root", and finally running "ls -l hw2.txt" again to verify the change.

cc. useradd: This command adds a new user that can login to your system. This command can also be used to add a password for the new user as well.



```
akhil@akhil-VirtualBox:~$ cat /etc/passwd | akhil2
akhil2: command not found
akhil@akhil-VirtualBox:~$ cat /etc/passwd | grep akhil2
akhil2:x:1001:1001::/home/akhil2:/bin/sh
akhil@akhil-VirtualBox:~$
```

The screenshot shows a terminal window titled "akhilkodumuri" with the command "ssh akhil@192.168.68.133". It displays two "Screen Shot" icons at the top right, one from 2021-05...6.35 AM and another from 2021-05...0.48 AM. The terminal history shows the user running "cat /etc/passwd" and then "grep akhil2" to search for the user "akhil2". The output shows the user entry "akhil2:x:1001:1001::/home/akhil2:/bin/sh".

dd. man: This command gives information about how to run certain linux commands, a description about their functions, and all the flags and uses for the program.

```
akhilkodumuri — akhil@akhil-VirtualBox: ~ — ssh akhil@192.168.68.133 — 109x29
MAN(1)                                Manual pager utils                                MAN(1)

NAME
man — an interface to the system reference manuals

SYNOPSIS
man [man options] [[section] page ...] ...
man -k [apropos options] regexp ...
man -K [man options] [section] term ...
man -f [whatis options] page ...
man -l [man options] file ...
man -wl-W [man options] page ...

DESCRIPTION
man is the system's manual pager. Each page argument given to man is normally the name of a program, utility or function. The manual page associated with each of these arguments is then found and displayed. A section, if provided, will direct man to look only in that section of the manual. The default action is to search in all of the available sections following a pre-defined order (see DEFAULTS), and to show only the first page found, even if page exists in several sections.

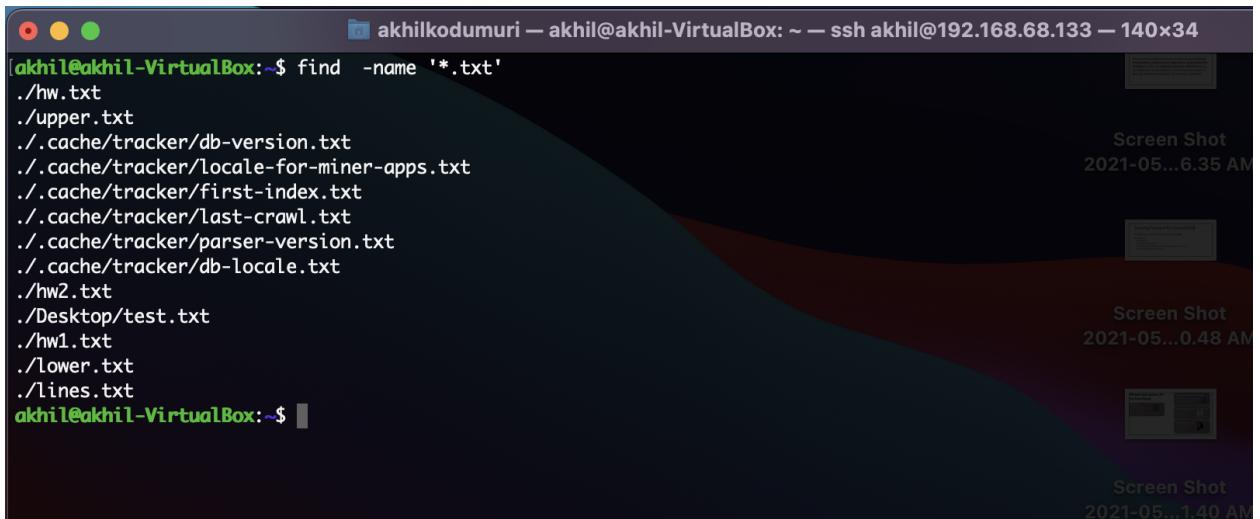
The table below shows the section numbers of the manual followed by the types of pages they contain.

1 Executable programs or shell commands
2 System calls (functions provided by the kernel)
3 Library calls (functions within program libraries)
4 Special files (usually found in /dev)
5 File formats and conventions, e.g. /etc/passwd
Manual page man(1) line 1 (press h for help or q to quit)
```

ee. locate: This command allows a user to find the location of a file by adding its name as an argument.

```
akhilkodumuri — akhil@akhil-VirtualBox: ~ — ssh akhil@192.168.68.133 — 140x34
[akhil@akhil-VirtualBox:~]$ locate -b '\hw1.txt'
/home/akhil/hw1.txt
akhil@akhil-VirtualBox:~$ 20
```

ff. find: This command can be used to search the file system for files that fit a certain pattern described by the user when executing the find command.

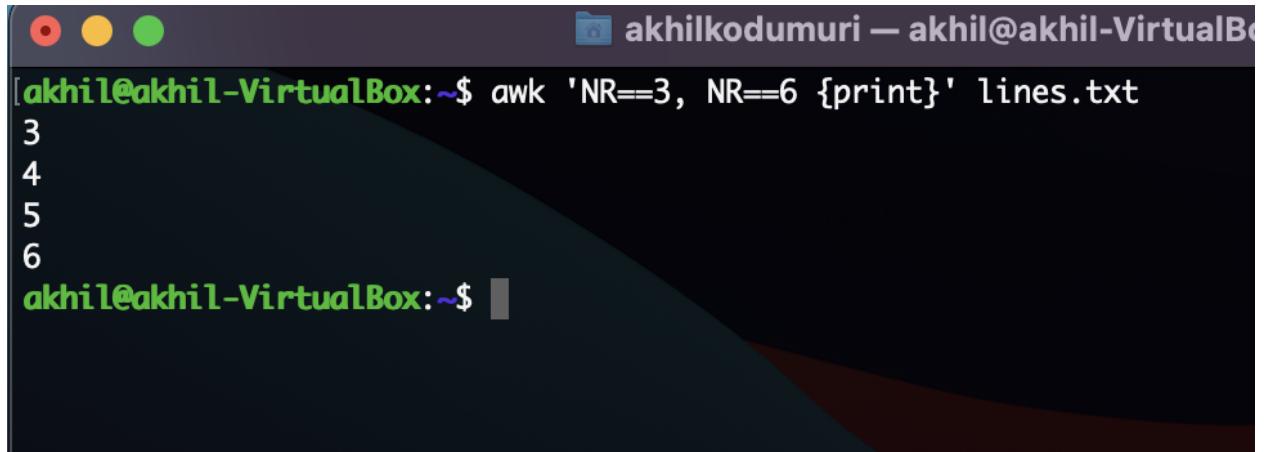


```
akhilkodumuri — akhil@akhil-VirtualBox: ~ — ssh akhil@192.168.68.133 — 140x34
[akhil@akhil-VirtualBox:~$ find -name '*.txt'
./hw.txt
./upper.txt
./cache/tracker/db-version.txt
./cache/tracker/locale-for-miner-apps.txt
./cache/tracker/first-index.txt
./cache/tracker/last-crawl.txt
./cache/tracker/parser-version.txt
./cache/tracker/db-locale.txt
./hw2.txt
./Desktop/test.txt
./hw1.txt
./lower.txt
./lines.txt
akhil@akhil-VirtualBox:~$ ]
```

gg. sed: This command is used to search, find, and replace data in a file. It's useful because these operations can be done without actually opening the file itself.

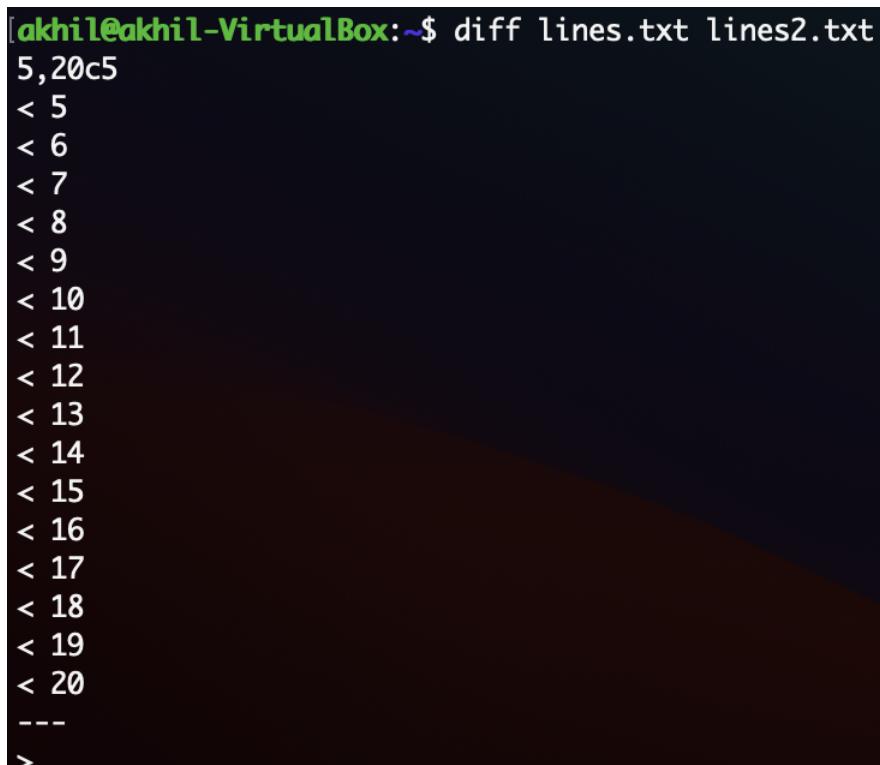
```
[akhil@akhil-VirtualBox:~$ tail lines.txt
11
12
13
14
15
16
17
18
19
20
[akhil@akhil-VirtualBox:~$ sed 's/15/100000/g' lines.txt
1
2
3
4
5
6
7
8
9
10
11
12
13
14
100000
16
17
18
19
20
akhil@akhil-VirtualBox:~$
```

ee. awk: This command is used to find patterns and act upon them when provided a file. This command is useful for manipulating data files.



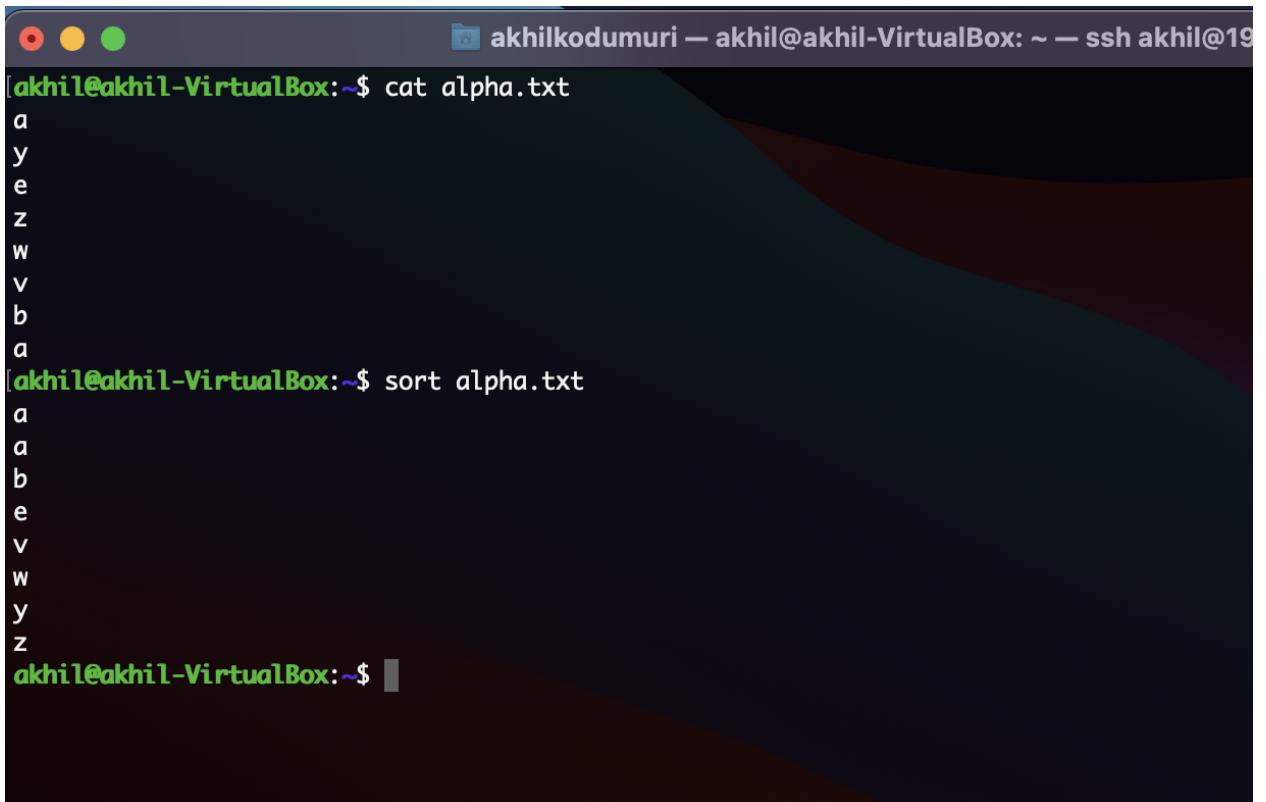
```
[akhil@akhil-VirtualBox:~$ awk 'NR==3, NR==6 {print}' lines.txt
3
4
5
6
akhil@akhil-VirtualBox:~$
```

ii. diff: This command compares two files and displays the differences if found.



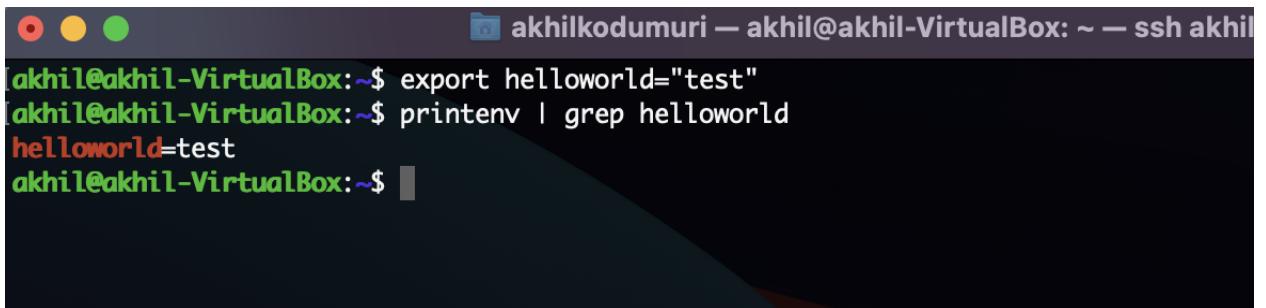
```
[akhil@akhil-VirtualBox:~$ diff lines.txt lines2.txt
5,20c5
< 5
< 6
< 7
< 8
< 9
< 10
< 11
< 12
< 13
< 14
< 15
< 16
< 17
< 18
< 19
< 20
---
```

jj. sort: This command can sort a file into an order defined by a user (alphabetically, numeric increasing, numeric decreasing, etc).



```
[akhil@akhil-VirtualBox:~$ cat alpha.txt
a
y
e
z
w
v
b
a
[akhil@akhil-VirtualBox:~$ sort alpha.txt
a
a
b
e
v
w
y
z
[akhil@akhil-VirtualBox:~$ ]
```

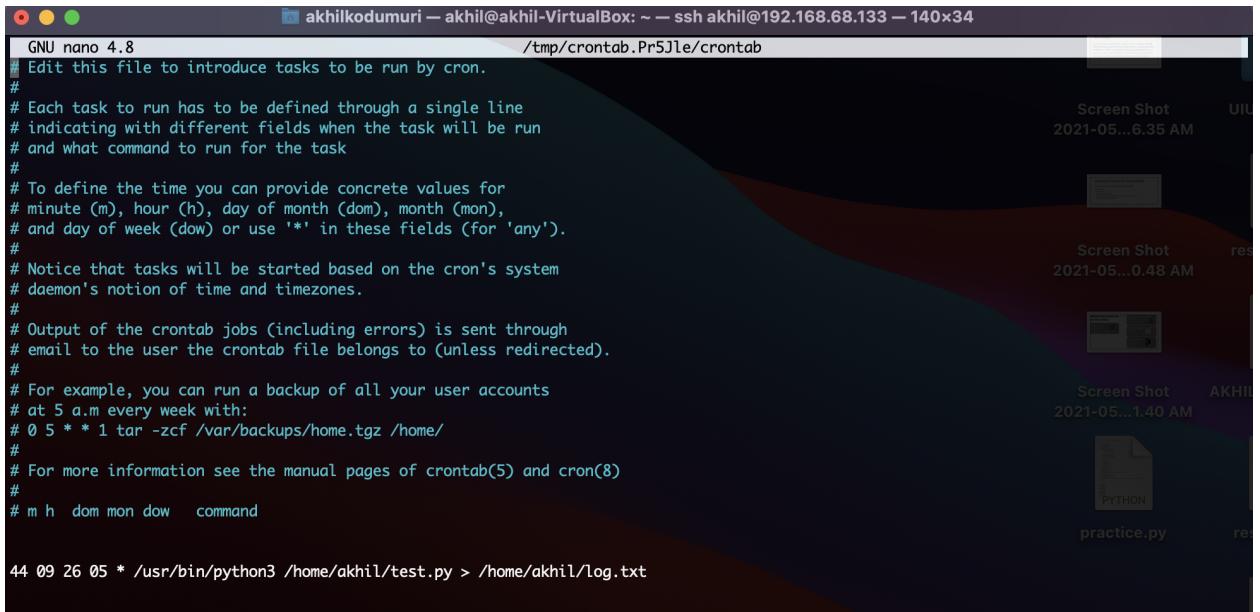
kk. export: This command is used to define new environment variables that can be used in future shell sessions and processes.



```
[akhil@akhil-VirtualBox:~$ export helloworld="test"
[akhil@akhil-VirtualBox:~$ printenv | grep helloworld
helloworld=test
[akhil@akhil-VirtualBox:~$ ]
```

ll. pwd: This command prints the path to working directory. In other, whatever directory the user is currently on, its path will be outputted.

mm. crontab: This command allows a user to schedule a time to run a specific file or operation.



The screenshot shows a Linux desktop environment with several windows open. In the foreground, a terminal window titled 'GNU nano 4.8' is active, displaying the contents of a crontab file. The file includes comments explaining cron syntax and a command to run a Python script at 5 AM every week. To the right of the terminal, there are three smaller windows labeled 'Screen Shot' with dates: '2021-05...6.35 AM', '2021-05...0.48 AM', and '2021-05...1.40 AM'. Below the terminal, another terminal window shows the output of 'crontab -e' and 'cat log.txt', which contains the text 'hello world'.

```
GNU nano 4.8
# Edit this file to introduce tasks to be run by cron.
#
# Each task to run has to be defined through a single line
# indicating with different fields when the task will be run
# and what command to run for the task
#
# To define the time you can provide concrete values for
# minute (m), hour (h), day of month (dom), month (mon),
# and day of week (dow) or use '*' in these fields (for 'any').
#
# Notice that tasks will be started based on the cron's system
# daemon's notion of time and timezones.
#
# Output of the crontab jobs (including errors) is sent through
# email to the user the crontab file belongs to (unless redirected).
#
# For example, you can run a backup of all your user accounts
# at 5 a.m every week with:
# 0 5 * * 1 tar -zcf /var/backups/home.tgz /home/
#
# For more information see the manual pages of crontab(5) and cron(8)
#
# m h dom mon dow   command
44 09 26 05 * /usr/bin/python3 /home/akhil/test.py > /home/akhil/log.txt
```

```
akhil@akhil-VirtualBox:~$ crontab -e
No modification made
akhil@akhil-VirtualBox:~$ cat log.txt
hello world
akhil@akhil-VirtualBox:~$
```

nn. mount: This command is used to add and remove files/devices to your current file system.

```
[akhil@akhil-VirtualBox:~]$ mount -l
sysfs on /sys type sysfs (rw,nosuid,nodev,noexec,relatime)
proc on /proc type proc (rw,nosuid,nodev,noexec,relatime)
udev on /dev type devtmpfs (rw,nosuid,noexec,relatime,size=4046936k,nr_inodes=1011734,mode=755)
devpts on /dev/pts type devpts (rw,nosuid,noexec,relatime,gid=5,mode=620,ptmxmode=000)
tmpfs on /run type tmpfs (rw,nosuid,nodev,noexec,relatime,size=815300k,mode=755)
/dev/sda5 on / type ext4 (rw,relatime,errors=remount-ro)
securityfs on /sys/kernel/security type securityfs (rw,nosuid,nodev,noexec,relatime)
tmpfs on /dev/shm type tmpfs (rw,nosuid,nodev)
tmpfs on /run/lock type tmpfs (rw,nosuid,nodev,noexec,relatime,size=5120k)
tmpfs on /sys/fs/cgroup type tmpfs (ro,nosuid,nodev,noexec,mode=755)
cgroup2 on /sys/fs/cgroup/unified type cgroup2 (rw,nosuid,nodev,noexec,relatime,nsdelegate)
cgroup on /sys/fs/cgroup/systemd type cgroup (rw,nosuid,nodev,noexec,relatime,xattr,name=systemd)
pstree on /sys/fs/pstree type pstree (rw,nosuid,nodev,noexec,relatime)
none on /sys/fs/bpf type bpf (rw,nosuid,nodev,noexec,relatime,mode=700)
cgroup on /sys/fs/cgroup/cpuset type cgroup (rw,nosuid,nodev,noexec,relatime,cpuset)
cgroup on /sys/fs/cgroup/freezer type cgroup (rw,nosuid,nodev,noexec,relatime,freezer)
cgroup on /sys/fs/cgroup/rdma type cgroup (rw,nosuid,nodev,noexec,relatime,rdma)
cgroup on /sys/fs/cgroup/net_cls,net_prio type cgroup (rw,nosuid,nodev,noexec,relatime,net_cls,net_prio)
cgroup on /sys/fs/cgroup/cpu,cpuacct type cgroup (rw,nosuid,nodev,noexec,relatime,cpu,cpuacct)
cgroup on /sys/fs/cgroup/memory type cgroup (rw,nosuid,nodev,noexec,relatime,memory)
cgroup on /sys/fs/cgroup/hugetlb type cgroup (rw,nosuid,nodev,noexec,relatime,hugetlb)
cgroup on /sys/fs/cgroup/blkio type cgroup (rw,nosuid,nodev,noexec,relatime,blkio)
cgroup on /sys/fs/cgroup/devices type cgroup (rw,nosuid,nodev,noexec,relatime,devices)
cgroup on /sys/fs/cgroup/perf_event type cgroup (rw,nosuid,nodev,noexec,relatime,perf_event)
cgroup on /sys/fs/cgroup/pids type cgroup (rw,nosuid,nodev,noexec,relatime,pids)
systemd-1 on /proc/sys/fs/binfmt_misc type autofs (rw,relatime,fd=28,pgrp=1,timeout=0,minproto=5,maxproto=5,direct,pipe_ino=15174)
debugfs on /sys/kernel/debug type debugfs (rw,nosuid,nodev,noexec,relatime)
mqueue on /dev/mqueue type mqueue (rw,nosuid,nodev,noexec,relatime)
tracefs on /sys/kernel/tracing type tracefs (rw,nosuid,nodev,noexec,relatime)
hugetlbfs on /dev/hugepages type hugetlbfs (rw,relatime,pagesize=2M)
fusectl on /sys/fs/fuse/connections type fusectl (rw,nosuid,nodev,noexec,relatime)
configfs on /sys/kernel/config type configfs (rw,nosuid,nodev,noexec,relatime)
/var/lib/snapd/snaps/gnome-3-34-1804_66.snap on /snap/gnome-3-34-1804/66 type squashfs (ro,nodev,relatime,x-gdu.hide)
```

oo. passwd: This command is used to change the password for the current user.

```
[akhil@akhil-VirtualBox:~]$ passwd
Changing password for akhil.
[Current password:
[New password:
[Retype new password:
passwd: password updated successfully
akhil@akhil-VirtualBox:~$ ]
```

pp. uname: This command displays system information: kernel name, user, operating system, hardware name, etc

```
[akhil@akhil-VirtualBox:~]$ uname -a
Linux akhil-VirtualBox 5.8.0-53-generic #60~20.04.1-Ubuntu SMP Thu May 6 09:52:46 UTC 2021 x86_64 x86_64 x86_64 GNU/Linux
akhil@akhil-VirtualBox:~$ ]
```

qq. whereis: This command outputs where to find the manual page for a given command along with where to find the commands source file/library

```
● ● ● akhil@akhil-VirtualBox: ~ — ssh akhil@192.168.68.133 — 140x34
[akhil@akhil-VirtualBox:~$ whereis pip3
pip3: /usr/bin/pip3 /usr/share/man/man1/pip3.1.gz
akhil@akhil-VirtualBox:~$ ] Screen Shot
2021-05...6.35 AM
```

rr. whatis: This command displays one line information about a given command.

```
akhil@akhil-VirtualBox:~$ whatis pip
pip (1) - A tool for installing and managing Python packages
akhil@akhil-VirtualBox:~$ whatis crontab
crontab (5) - tables for driving cron
crontab (1) - maintain crontab files for individual users (Vixie Cron)
akhil@akhil-VirtualBox:~$ whatis whatis
whatis (1) - display one-line manual page descriptions
akhil@akhil-VirtualBox:~$ ] S
2021
```

ss. su: This command is used to switch users on a system.

```
akhil@akhil-VirtualBox:~$ sudo su root
[sudo] password for akhil:
root@akhil-VirtualBox:/home/akhil# ]
```

tt. ping: This command is used to test the connectivity between a host and server/destination

```
● ● ● akhil@akhil-VirtualBox: ~ — ssh akhil@192.168.68.131 — 80x24
[akhil@akhil-VirtualBox:~$ ping google.com
PING google.com (142.250.191.110) 56(84) bytes of data. Screen Shot
2021-05...6.35 AM
64 bytes from ord38s28-in-f14.1e100.net (142.250.191.110): icmp_seq=1 ttl=53 tim
e=19.8 ms
64 bytes from ord38s28-in-f14.1e100.net (142.250.191.110): icmp_seq=2 ttl=53 tim
e=18.8 ms
64 bytes from ord38s28-in-f14.1e100.net (142.250.191.110): icmp_seq=3 ttl=53 tim
e=23.3 ms
64 bytes from ord38s28-in-f14.1e100.net (142.250.191.110): icmp_seq=4 ttl=53 tim
e=25.9 ms
Screen Shot resume.json IPhone
2021-05...0.48 AM AKHIL KODUMURI Kaggle-
```

uu.traceroute: This command tracks the path a packet takes to get to a specific destination. Each intermediate destination is then printed to the screen.

```
akhil@akhil-VirtualBox:~$ traceroute google.com
traceroute to google.com (172.217.1.46), 30 hops max, 60 byte packets
 1 _gateway (192.168.68.1)  6.373 ms  6.349 ms  6.334 ms
 2 96.120.28.21 (96.120.28.21)  14.066 ms  20.946 ms  20.934 ms
 3 68.87.209.169 (68.87.209.169)  20.927 ms  20.917 ms  20.910 ms
 4 162.151.37.113 (162.151.37.113)  20.903 ms  20.879 ms  20.812 ms
 5 162.151.47.221 (162.151.47.221)  19.123 ms  19.114 ms  19.105 ms
 6 be-124-ar01.elmhurst.il.chicago.comcast.net (69.139.235.53)  20.763 ms  15.4
26 ms  21.554 ms
 7 be-32241-cs04.chicago.il.ibone.comcast.net (96.110.40.45)  16.462 ms  20.496
ms be-32211-cs01.chicago.il.ibone.comcast.net (96.110.40.33)  20.473 ms
 8 be-1212-cr12.chicago.il.ibone.comcast.net (96.110.36.38)  20.459 ms be-1312-
cr12.chicago.il.ibone.comcast.net (96.110.36.42)  20.413 ms be-1112-cr12.chicago
.il.ibone.comcast.net (96.110.36.34)  25.143 ms
 9 be-304-cr13.350ecermak.il.ibone.comcast.net (96.110.38.221)  25.123 ms be-30
2-cr13.350ecermak.il.ibone.comcast.net (96.110.38.213)  25.109 ms be-301-cr13.35
```

vv. date: This command prints out the current date and time. date can also be used to set the date and time for a system.

```
akhil@akhil-VirtualBox:~$ date
Wed 26 May 2021 10:40:25 AM CDT
akhil@akhil-VirtualBox:~$
```

ww. time: this command is used to find out information like time passed and even some information of the system usage to execute a command or file. This “time passed” can be defined by seconds, cpu time spent in user mode, and amount of cpu time spent in kernel mode.

```
akhil@akhil-VirtualBox:~$ time python3 hw.py
Hello world

real    0m0.010s
user    0m0.009s
sys     0m0.000s
akhil@akhil-VirtualBox:~$
```

xx. wget: This command is used to download content from a server in which the server does not necessarily belong to the user and the user has not logged into said server.

```
 akhil@akhil-VirtualBox:~$ wget google.com
--2021-05-26 10:50:16-- http://google.com/
Resolving google.com (google.com)... 216.58.192.142, 2607:f8b0:4009:815::200e
Connecting to google.com (google.com)|216.58.192.142|:80... connected.
HTTP request sent, awaiting response... 301 Moved Permanently
Location: http://www.google.com/ [following]
--2021-05-26 10:50:16-- http://www.google.com/
Resolving www.google.com (www.google.com)... 142.250.191.132, 2607:f8b0:4009:819
::2004
Connecting to www.google.com (www.google.com)|142.250.191.132|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: unspecified [text/html]
Saving to: 'index.html.1'

index.html.1 [ <=> ] 14.60K --.-KB/s in 0.01s

2021-05-26 10:50:16 (1.04 MB/s) - 'index.html.1' saved [14949]

akhil@akhil-VirtualBox:~$
```

yy. wc: This command can count the amount of words, lines, and bytes in a given file.

```
 akhil@akhil-VirtualBox:~$ wc lines.txt
20 20 51 lines.txt
akhil@akhil-VirtualBox:~$ cat lines.txt
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

akhil@akhil-VirtualBox:~$
```

zz. pwgen: This command outputs passwords.

```
[akhil@akhil-VirtualBox:~$ pwgen
shieCo4g Iot1aipe aeg6Mong Maun4ooz ien9Ea8W Nai9hieR ohHaiS3n laiZoo8R
ohsh0Gid woh2Lait ur2Axu4o ahh1Diet Eimai8ma Bah4hah6 Lie3ieki Cufah6th
aed0eeYa zuc50ohe uH6xeWee Eegeic7e ahphuKa3 Cu5liuN1 qui7aeRi ohtil7aL
otuu6aiB Phu6Qued ta5Nauji Eethei1e ohphohP2 EmaiPh9k ahp0Mahv Ohth6quu
iep6Gah9 Meish1ah oof6Vei7 Uthai9th muuThie2 ietohTh6 Eeshu0oh Reng4aet
ieloh3Eb Kaidai4e ahd3zaiF 0y6apoov ieH3beev ahk4Ceto eihahp90 co6Ibohm
Siej7uy6 dai9Iet7 yohP4aan vai4Niep eiP3wo8o yak5Ahre Iequ1foh Eid7aeGo
eX1ve60o eiHo2iev Piece0ju oow50ich xaiG1lie ADoh7ien Phuvek6m ohwafe4H
voo0eChu api10hma cooBa5je Ewei9no4 zeje6Vee AiWie0ei bai8Biph Oomia9Ji
ZaeChai2 shooM1ae Ahz8moh1 Diog4ooH eGeb3me5 futeGai3 ie3aiY4p Cu9Tai1l
SheC0ahl mood0eeG ohPhae5d oa7eeCai Xahwei5u jiQuoc0o Id6eengo EeBei3iG
IeD2ufa9 yo2Suaj1 Hav8Meil uch5Ui5N seeM8aif gaeku4We nuo3Bae4 eise9ohT
Oole6oWu fu3cahQu Sae4iece caiduh1E gooHah0x tuca5ioC ieChood9 laeSoh2p
oaGh3voo neish8Ye Ue3joh6u quo04Eim Eevoh7mu sheCio1k boo8Ne0b Gieyai6r
yeiy5Soj ieTh8eeh eigm3Nu Rigae1Th iBie0eh2 iTi4Aich ookeiCh8 Phali4ak
big4Idie muis1Ieg oli7Ain8 Zaing3li aiMial7k Xif7Iqua liPheeC9 ceey80uP
Tho1iisi eeDiel4u Ai9le0fi ahCho2Ee Aey2Gubu eiB2waih phai1aaH Ho6Eeyae
ooiveis2e cex3aiRu lau7Aeng ief2EiVi Aequ3air Web5rool Chu3Aike dei7IePh
Goog1aeh iet8ENei Wo6lahv6 Ies4Shah muTae9ci oheTh5ow Dah0oFua Thoom4jo
Ahch9aup eS6roor2 Kae4Eobi Goo6jie4 vie0aiQu Iad7uuxo su7Waig7 mo3ToeBi
akhil@akhil-VirtualBox:~$
```

### Part 3:

In order to make sure generate-dataset.sh continued running even if the ssh connection broke, I ran the command in a screen shell. After 10 seconds of running, the output file contained 3849 different records.

Code and descriptions on GitHub Repo

### Part 4:

- Changing the number of processors in a VM will allow the VM to execute tasks faster and more efficiently. If your VM, will not be used to execute many tasks or any task that require many resources, minimum amount of processors is enough because delegation will spend no time scheduling which processor to use. As you increase the amount of processors, you may find that tasks will be executed faster, but eventually as you reach the maximum amount of processors performance will suffer because scheduling time will increase, the VM will start to under utilize other resources, and individual cpu performance will not be fully utilized.
- The none option turns off any virtualization interface thus no method will be used. The legacy option should be used when working with VM which were created with older versions of virtual box. Minimal is used when the guest OS is MAC. This is because

minimal provides information about CPU tick time that's important to the OS. Hyper-V is similar to Minimal but is used for Windows OS hosts. KVM is similar to the previous two but the paravirtualization software has a Linux KVM hypervisor and is thus used for Linux based systems.

- c. IDE storage devices use a parallel connection method to connect a storage device to the motherboard's data bus. IDE wires are known to be bulky thus carrying more data but being expensive. IDEs are obsolete since SATA can accomplish the same feats but faster. SATA uses a serial connection to accomplish the same thing but carries less data, has smaller wires, and thus is very efficient. An example use is when you need a lot of data for little cost. Typically, SATA is used for desktops and not laptops for this reason. NVMe are large and very fast compared to SATA and IDE and is a type of SSD that's attached to a PCI Express slot on a main board. NVMes are typically used for gaming because of this.
- d. Host only allows network interactions between host and other machines in the same network. NAT will assign your machine an IP and the machine can interact with other machines in the same network. But no other machine in or outside the network can access the NAT host. Bridged adapter will configure the VM to have the same network as the host. All machines connected to the same network as the host can access the bridged thus being less secure than the other two. Internal network allows connections over the local area network. Any machine connected to the same LAN can access the VM in this configuration.
- e. In regards to speed and bandwidth USB 1.1 is the slowest, then USB 2.0, then USB 3.0. The bandwidth are as follows: 12Mbps, 480Mbps, and 4.8Gbps respectively. USB 1.1 is compatible with all the VM options on virtual box. USB 2.0 is only compatible with workstation 6, and USB 3.0 is only compatible with Linux and Windows.