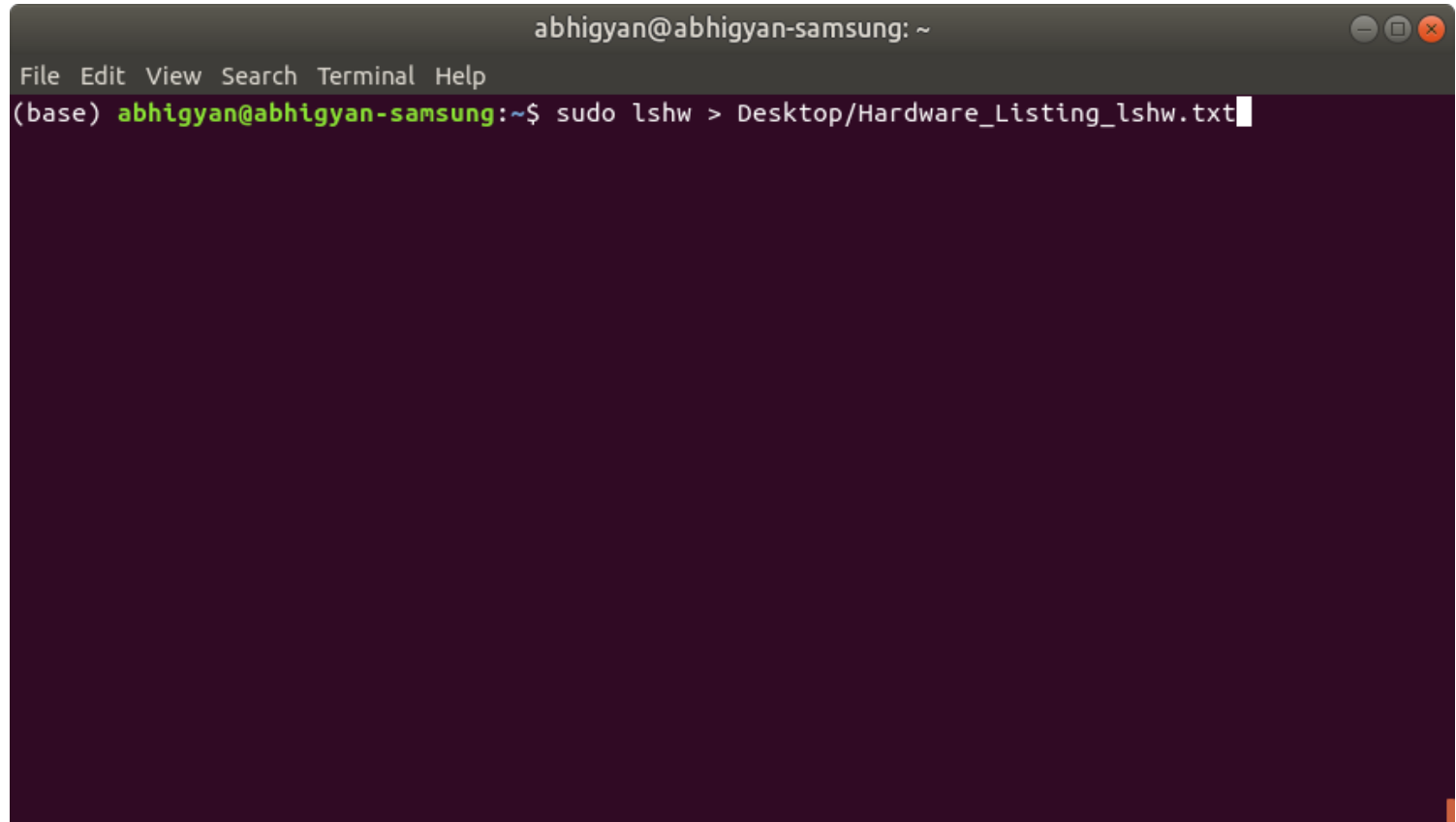


# Homework 1

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ME19B001

# Homework from Session 1

## 1.1. Make a listing of the hard ware components you have in your laptop.

A terminal window with a dark purple background. The title bar at the top reads 'abhigyan@abhigyan-samsung: ~' and has standard window control buttons on the right. Below the title bar is a menu bar with 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. The main area of the terminal shows a prompt '(base) abhigyan@abhigyan-samsung:~\$' followed by the command 'sudo lshw > Desktop/Hardware\_Listing\_lshw.txt'. The cursor is at the end of the command line.

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
(base) abhigyan@abhigyan-samsung:~$ sudo lshw > Desktop/Hardware_Listing_lshw.txt
```

Command used:

## 1.1. Make a listing of the hard ware components you have in your laptop.

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
abhigyan@abhigyan-samsung:~$ cat Desktop/Hardware_Listing_lshw.txt  
abhigyan-samsung  
  description: Laptop  
    product: 530U3C/530U4C (System SKUNumber)  
    vendor: SAMSUNG ELECTRONICS CO., LTD.  
    version: 0.1  
    serial:  
    width: 64 bits  
    capabilities: smbios-2.7 dmi-2.7 smp vsyscall32  
    configuration: administrator_password=unknown boot=normal chassis=laptop family=ChiefRiver System frontpanel_password=unknown keyboard_password=unknown power-on_password=unknown sku=System SKUNumber uuid=  
*-core  
  description: Motherboard  
    product: SAMSUNG_NP1234567890  
    vendor: SAMSUNG ELECTRONICS CO., LTD.  
    physical id: 0  
    version: FAB1  
    serial:  
    slot: Part Comp  
*-firmware  
  description: BIOS  
    vendor: Phoenix Technologies Ltd.  
    physical id: 0  
    version: P15AAJ  
    date: 07/23/2015  
    size: 128KiB  
    capacity: 3008KiB  
    capabilities: pci upgrade shadowing cdboot bootselect edd int5pinctscreen int9keyboard int14serial int17printer int10video pc98 acpi usb biosboot specification netboot uefi  
*-cpu  
  description: CPU  
    product: Intel(R) Core(TM) i5-3317U CPU @ 1.70GHz  
    vendor: Intel Corp.  
    physical id: 4  
    bus info: cpu@0
```

Contents of file Hardware\_Listing\_lshw.txt

## 1.2. Look up internet and identify other variants or models of each of the hardware components. Critically compare the specs with the ones you have in your machine in a tabular fashion.

Component Name	Installed version of Hardware	Other versions of Hardware	Comparison
CPU	i5-3317U	Xeon W-3175X	The Xeon W-3175X has 28 cores, compared to the meagre 2 cores present in the i5-3317U. It also has a boosted frequency of 4.3 GHz compared to the 2.6 GHz offered by the i5. It outperforms the i5 in every single aspect, except in terms of cost.
GPU	nVidia GeForce GT 820M	nVidia Titan XP	The GT 820M I have has a computing power of 240 GFLOPS, while the Titan XP has 12TFLOPS. To put that into perspective, the Titan has 50 times the graphics processing power of the GT 820M
Firmware	BIOS	UEFI	UEFI is an improvement over the older BIOS. UEFI uses the GUID Partition Table (GPT) while BIOS uses the Master Boot Record (MBR). This itself brings a lot of extra functionality to UEFI, as it uses 64-bit entries in its table, while BIOS uses 32-bit entries. This leads to much more theoretical capacity of the hard drive. Also, UEFI is platform independent, while BIOS is embedded into the ROM of a computer's motherboard. This is a great boon for computer manufacturers, as they have much less difficulty in scaling their firmware to new hardware, which is considerably more difficult for BIOS. UEFI also provides secure boot options which are not available in BIOS.
Memory	8GB SODIMM-DDR3 RAM	DDR4 RAM	DDR4 is the latest version of RAM available in the market, though DDR5 is currently under development. The SODIMM RAM is the form factor that is used in laptops, while other form factors are used in desktop computers. As we go from DDR3 to DDR5, the speed of data transfer and efficiency increases, but each motherboard can only use one type of RAM. Also, DDR4 runs at a lower voltage.
Storage	1TB HDD + 24 GB SSD	1024 GB SSD	An SSD is a solid state drive, which has no moving parts whatsoever. It has much lower error rates and much higher data transfer rates, but costs a lot more. An HDD is a hard disk drive, which uses a mechanical rotating disk and a pin to read it. This is the most prevalent due to its low cost, but is highly prone to errors.
USB Ports	USB 3.0	USB Type-C	USB 3.0 is a universal serial bus port which is shaped similar to the previous USB ports, and can transfer data and power. It is backwards compatible with all the previous types of USB, such as USB 1.0, 1.1, 2.0, etc. USB Type-C is an emerging port which has a new shape and is much faster in terms of both speed and power transfer. It is, however, not backwards compatible, but it is soon emerging as the primary USB port in various machines.

**1.3. List the CPU and GPU capabilities of your machine in GigaFlops as per theoretical or vendor provided specs. You don't have to do any benchmarking yourself for this information.**

CPU Information from lshw:

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
een int9keyboard int14serial int17printer int10video pc98 acpi usb biosbootspeci  
fication netboot uefi  
*-cpu  
  description: CPU  
  product: Intel(R) Core(TM) i5-3317U CPU @ 1.70GHz  
  vendor: Intel Corp.  
  physical id: 4  
  bus info: cpu@0  
  version: Intel(R) Core(TM) i5-3317U CPU @ 1.70GHz  
  serial: To Be Filled By O.E.M.  
  slot: CPU Socket - U3E1  
  size: 1064MHz  
  capacity: 1700MHz  
  width: 64 bits  
  clock: 100MHz  
  capabilities: x86-64 fpu fpu_exception wp vme de pse tsc msr pae mce c  
x8 apic sep mtrr pge mca cmov pat pse36 clflush dts acpi mmx fxsr sse2 ss ht  
tm pbe syscall nx rdtscp constant_tsc arch_perfmon pebs bts rep_good nopl xtopo  
logy nonstop_tsc cpuid aperfmperf pni pclmulqdq dtes64 monitor ds_cpl vmx est tm  
2 ssse3 cx16 xtpr pdcm pcid sse4_1 sse4_2 x2apic popcnt tsc_deadline_timer aes x  
save avx f16c rdrand lahf_lm cpuid_fault epb pti ssbd ibrs ibpb stibp tpr_shadow  
vnmi flexpriority ept vpid fsgsbase smep erms xsaveopt dtherm ida arat pln pts  
md_clear flush_l1d cpufreq  
  configuration: cores=2 enabledcores=2 threads=4
```

### 1.3. List the CPU and GPU capabilities of your machine in GigaFlops as per theoretical or vendor provided specs. You don't have to do any benchmarking yourself for this information.

Thus, as per the output of `sudo lshw`, the number of cores is 2, the frequency is 1.70 GHz, but according to the [Intel Webpage on Intel i5-3317U](#), the frequency can be increased to 2.60 GHz using Intel TurboBoost Technology and that it is an Ivy Bridge Processor. On digging around on the internet, one can find that any such Ivy Bridge Processor can perform 4 double-precision floating-point operations per cycle and 8 single-precision floating-point operations per cycle (source: <https://stackoverflow.com/a/15657772>). Thus, my CPUs theoretical capability is:

$$(2 \text{ cores}) * (2.60 \text{ GHz}) * (8 \text{ FLOPC}) = 41.2 \text{ GFLOPS}$$

(FLOPC = Floating-point operations per cycle, FLOPS = Floating-point operations per second, prefix G means Giga)

Note: The theoretical FLOPs is given by the formula:

$$(\text{Number of Cores}) * (\text{Average Frequency}) * (\text{Operations per cycle}) \quad (\text{source})$$

### 1.3. List the CPU and GPU capabilities of your machine in GigaFlops as per theoretical or vendor provided specs. You don't have to do any benchmarking yourself for this information.

As per the output of `hwinfo`, the graphics card in my computer is Samsung Electronics GeForce GT 620M, from nVidia Corporation:

#### GPU Information from `hwinfo`:

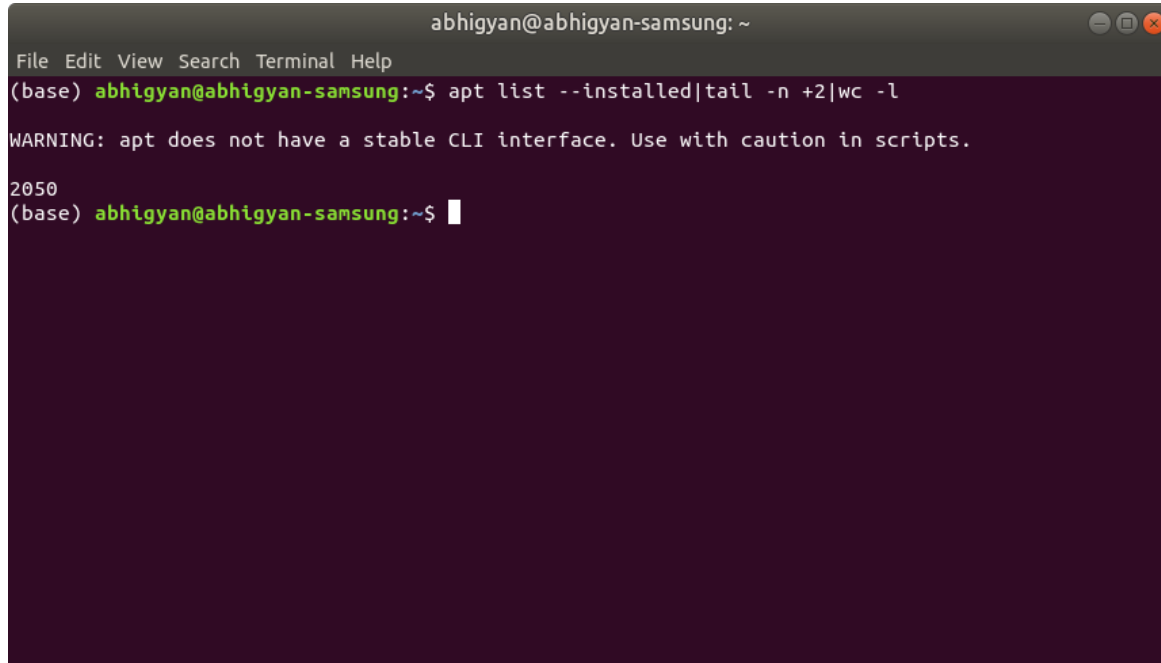
According to [this website](#), the theoretical performance of this GPU is 240.0 GFLOPS.

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
Driver Info #0:  
  Driver Status: mei_me is active  
  Driver Activation Cmd: "modprobe mei_me"  
  Config Status: cfg=new, avail=yes, need=no, active=unknown  
  
20: PCI 100.0: 0302 3D controller  
  [Created at pci.378]  
  Unique ID: VCu0.f9JwTwtRLB6  
  Parent ID: vSkL.FI3pkwniqb0  
  SysFS ID: /devices/pci0000:00/0000:00:01.0/0000:01:00.0  
  SysFS BusID: 0000:01:00.0  
  Hardware Class: graphics card  
  Model: "Samsung Electronics GeForce GT 620M"  
  Vendor: pci 0x10de "nVidia Corporation"  
  Device: pci 0x1140 "GF117M [GeForce 610M/710M/810M/820M / GT 620M/625M/630M/720M]"  
  SubVendor: pci 0x144d "Samsung Electronics Co Ltd"  
  SubDevice: pci 0xc0d7 "GeForce GT 620M"  
  Revision: 0xa1  
  Driver: "nouveau"  
  Driver Modules: "nouveau"  
  Memory Range: 0xf0000000-0xf0ffffff (rw,non-prefetchable)  
  Memory Range: 0xc0000000-0xcffffff (ro,non-prefetchable)  
  Memory Range: 0xd0000000-0xd1ffffff (ro,non-prefetchable)  
  I/O Ports: 0x3000-0x3fff (rw)  
  IRQ: 29 (98 events)  
  Module Alias: "pci:v000010DEd00001140sv0000144Dsd0000C0D7bc03sc02i00"  
  Driver Info #0:  
    Driver Status: nvidiafb is not active  
    Driver Activation Cmd: "modprobe nvidiafb"  
  Driver Info #1:  
    Driver Status: nouveau is active  
    Driver Activation Cmd: "modprobe nouveau"  
  Config Status: cfg=new, avail=yes, need=no, active=unknown  
  Attached to: #18 (PCI bridge)  
  
21: PCI 1b.0: 0403 Audio device  
  [Created at pci.378]
```



## 1.4. Count the number of packages installed on your OS.

Command used:

A terminal window titled 'abhigyan@abhigyan-samsung: ~' with a menu bar (File, Edit, View, Search, Terminal, Help). The prompt is '(base) abhigyan@abhigyan-samsung:~\$'. The command 'apt list --installed|tail -n +2|wc -l' is entered. The output is '2050'. A warning message 'WARNING: apt does not have a stable CLI interface. Use with caution in scripts.' is displayed above the output. The prompt is now '(base) abhigyan@abhigyan-samsung:~\$' with a cursor.

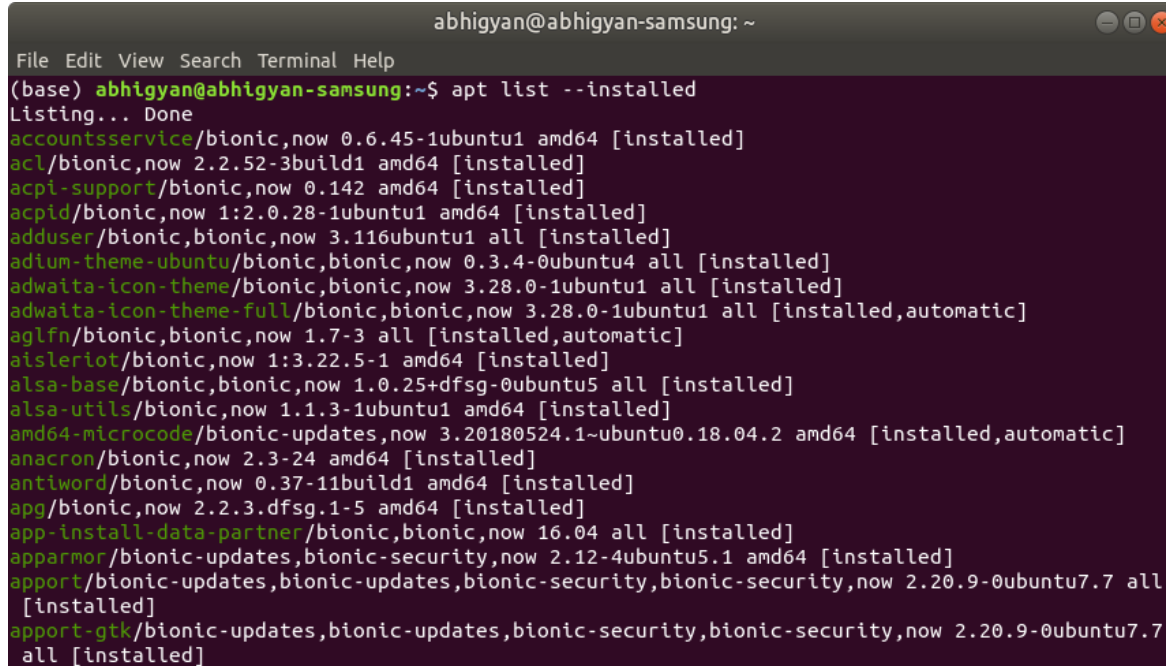
```
abhigyan@abhigyan-samsung: ~
File Edit View Search Terminal Help
(base) abhigyan@abhigyan-samsung:~$ apt list --installed|tail -n +2|wc -l
WARNING: apt does not have a stable CLI interface. Use with caution in scripts.
2050
(base) abhigyan@abhigyan-samsung:~$
```

Thus, number of packages installed is **2050**, as the command `wc -l` counts the number of lines in the output of

```
apt list --installed|tail -n +2
```

## 1.4. Count the number of packages installed on your OS.

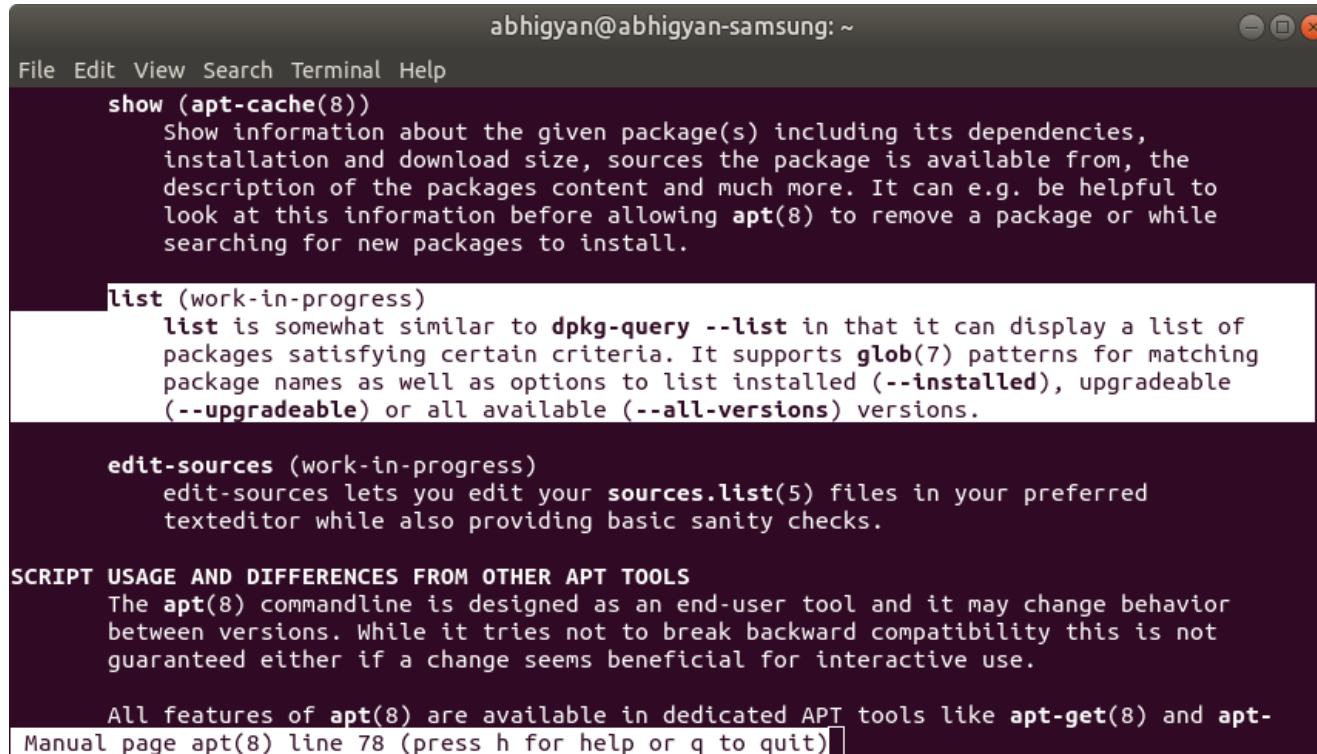
Note 1: The 1<sup>st</sup> line of the output of `apt list --installed` was omitted through `tail -n +2` as the first line's content is just "Listing... Done", as shown below:

A terminal window titled 'abhigyan@abhigyan-samsung: ~' showing the command 'apt list --installed' and its output. The output lists various installed packages with their versions and architectures. The first line of the output is 'Listing... Done', which is omitted in the screenshot. The packages listed include accountsservice, acl, acpi-support, acpid, adduser, adium-theme-ubuntu, adwaita-icon-theme, adwaita-icon-theme-full, aglfn, alsaserializer, alsa-base, alsa-utils, amd64-microcode, anacron, antiword, apg, app-install-data-partner, apparmor, apport, and apport-gtk.

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
(base) abhigyan@abhigyan-samsung:~$ apt list --installed  
Listing... Done  
accountsservice/bionic,now 0.6.45-1ubuntu1 amd64 [installed]  
acl/bionic,now 2.2.52-3build1 amd64 [installed]  
acpi-support/bionic,now 0.142 amd64 [installed]  
acpid/bionic,now 1:2.0.28-1ubuntu1 amd64 [installed]  
adduser/bionic,bionic,now 3.116ubuntu1 all [installed]  
adium-theme-ubuntu/bionic,bionic,now 0.3.4-0ubuntu4 all [installed]  
adwaita-icon-theme/bionic,bionic,now 3.28.0-1ubuntu1 all [installed]  
adwaita-icon-theme-full/bionic,bionic,now 3.28.0-1ubuntu1 all [installed,automatic]  
aglfn/bionic,bionic,now 1.7-3 all [installed,automatic]  
alsaserializer/bionic,now 1:3.22.5-1 amd64 [installed]  
alsa-base/bionic,bionic,now 1.0.25+dfsg-0ubuntu5 all [installed]  
alsa-utils/bionic,now 1.1.3-1ubuntu1 amd64 [installed]  
amd64-microcode/bionic-updates,now 3.20180524.1-ubuntu0.18.04.2 amd64 [installed,automatic]  
anacron/bionic,now 2.3-24 amd64 [installed]  
antiword/bionic,now 0.37-11build1 amd64 [installed]  
apg/bionic,now 2.2.3.dfsg.1-5 amd64 [installed]  
app-install-data-partner/bionic,bionic,now 16.04 all [installed]  
apparmor/bionic-updates,bionic-security,now 2.12-4ubuntu5.1 amd64 [installed]  
apport/bionic-updates,bionic-updates,bionic-security,bionic-security,now 2.20.9-0ubuntu7.7 all  
[installed]  
apport-gtk/bionic-updates,bionic-updates,bionic-security,bionic-security,now 2.20.9-0ubuntu7.7  
all [installed]
```

## 1.4. Count the number of packages installed on your OS.

Note 2: This can also be achieved using the `dpkg-query --list` command (as shown in the manpage of the `apt` command):



```
abhigyan@abhigyan-samsung: ~
File Edit View Search Terminal Help

show (apt-cache(8))
  Show information about the given package(s) including its dependencies,
  installation and download size, sources the package is available from, the
  description of the packages content and much more. It can e.g. be helpful to
  look at this information before allowing apt(8) to remove a package or while
  searching for new packages to install.

list (work-in-progress)
  list is somewhat similar to dpkg-query --list in that it can display a list of
  packages satisfying certain criteria. It supports glob(7) patterns for matching
  package names as well as options to list installed (--installed), upgradeable
  (--upgradeable) or all available (--all-versions) versions.

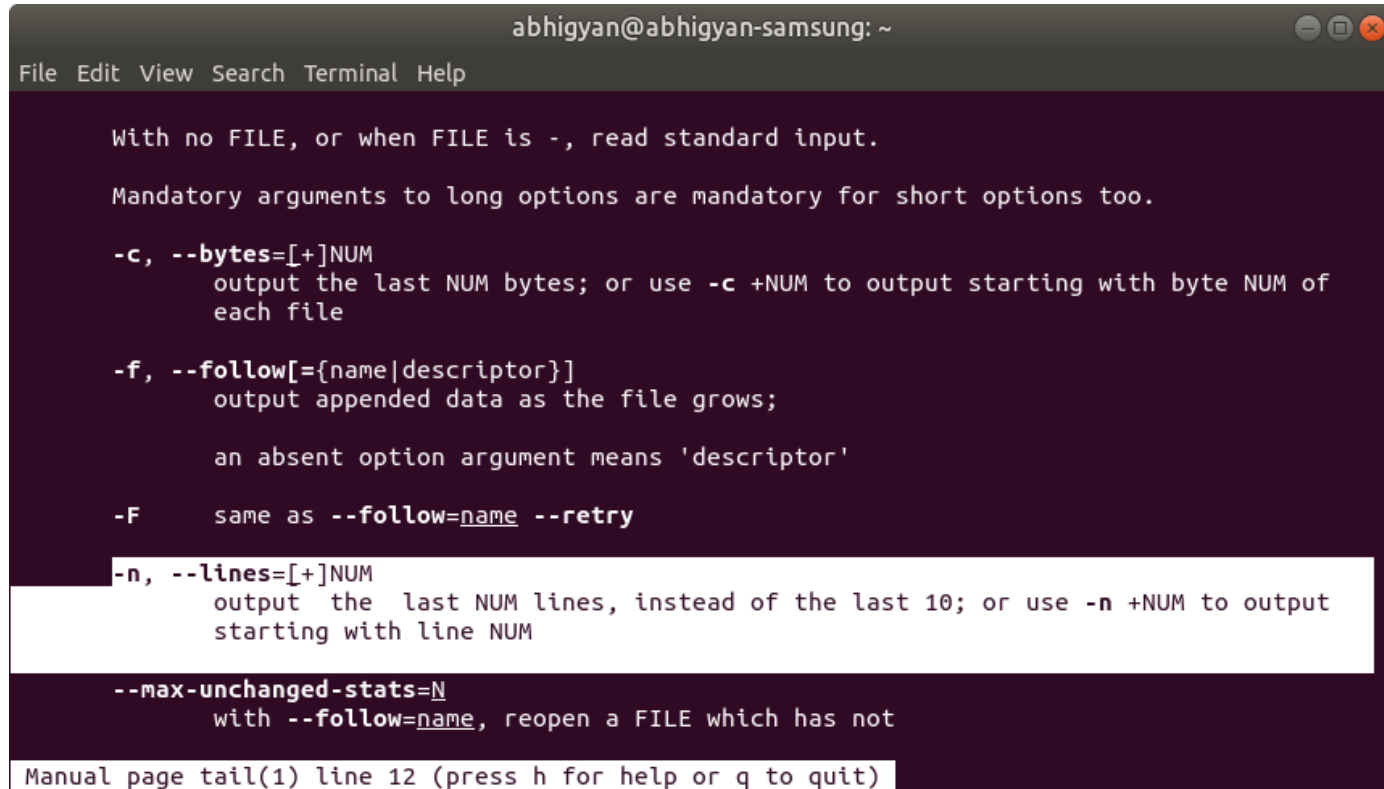
edit-sources (work-in-progress)
  edit-sources lets you edit your sources.list(5) files in your preferred
  texteditor while also providing basic sanity checks.

SCRIPT USAGE AND DIFFERENCES FROM OTHER APT TOOLS
  The apt(8) commandline is designed as an end-user tool and it may change behavior
  between versions. While it tries not to break backward compatibility this is not
  guaranteed either if a change seems beneficial for interactive use.

  All features of apt(8) are available in dedicated APT tools like apt-get(8) and apt-
  Manual page apt(8) line 78 (press h for help or q to quit)
```

## 1.4. Count the number of packages installed on your OS.

Note 3: The way to use the `tail` command with `-n` and `+` sign can be found in the manpage:



```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
  
With no FILE, or when FILE is -, read standard input.  
  
Mandatory arguments to long options are mandatory for short options too.  
  
-c, --bytes=[+]NUM  
    output the last NUM bytes; or use -c +NUM to output starting with byte NUM of  
    each file  
  
-f, --follow[={name|descriptor}]  
    output appended data as the file grows;  
  
    an absent option argument means 'descriptor'  
  
-F      same as --follow=name --retry  
  
-n, --lines=[+]NUM  
    output the last NUM lines, instead of the last 10; or use -n +NUM to output  
    starting with line NUM  
  
--max-unchanged-stats=N  
    with --follow=name, reopen a FILE which has not  
  
Manual page tail(1) line 12 (press h for help or q to quit)
```

## 1.5. Find out the difference in the IP configuration of your machine when you connect your laptop using wired LAN in the hostel room and over WiFi using IITMWiFi.

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
abhigyan@abhigyan-samsung:~$ ifconfig  
enp3s0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500  
ether e8:03:9a:af:1f:a1 txqueuelen 1000 (Ethernet)  
RX packets 0 bytes 0 (0.0 B)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 0 bytes 0 (0.0 B)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536  
inet 127.0.0.1 netmask 255.0.0.0  
inet6 ::1 prefixlen 128 scopeid 0x10<host>  
loop txqueuelen 1000 (Local Loopback)  
RX packets 2149 bytes 225815 (225.8 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 2149 bytes 225815 (225.8 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
wlp2s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
inet 10.42.184.46 netmask 255.255.252.0 broadcast 10.42.187.255  
inet6 fe80::b74f:1484:d1e:8cd1 prefixlen 64 scopeid 0x20<link>  
ether c4:85:08:14:20:c6 txqueuelen 1000 (Ethernet)  
RX packets 47827 bytes 31725270 (31.7 MB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 32060 bytes 6380447 (6.3 MB)
```

**IP with WiFi: 10.42.184.46**

(WiFi is designated as wlp2s0 in the ifconfig command)

(Just for confirmation, the netaccess.iitm.ac.in also shows the same ip address, 10.42.184.46)

## 1.5. Find out the difference in the IP configuration of your machine when you connect your laptop using wired LAN in the hostel room and over WiFi using IITMWiFi.

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
abhigyan@abhigyan-samsung:~$ ifconfig  
enp3s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet 10.22.2.125 netmask 255.255.252.0 broadcast 10.22.3.255  
    inet6 fe80::edb6:b192:1bbc:111a prefixlen 64 scopeid 0x20<link>  
    ether e8:03:9a:af:1f:a1 txqueuelen 1000 (Ethernet)  
    RX packets 14572 bytes 2431058 (2.4 MB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 4975 bytes 952670 (952.6 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536  
    inet 127.0.0.1 netmask 255.0.0.0  
    inet6 ::1 prefixlen 128 scopeid 0x10<host>  
    loop txqueuelen 1000 (Local Loopback)  
    RX packets 571 bytes 54869 (54.8 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 571 bytes 54869 (54.8 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
wlp2s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet 10.42.0.1 netmask 255.255.255.0 broadcast 10.42.0.255  
    inet6 fe80::92d:33c6:189a:6c8e prefixlen 64 scopeid 0x20<link>  
    ether c4:85:08:14:20:c6 txqueuelen 1000 (Ethernet)  
    RX packets 3503 bytes 755922 (755.9 KB)
```

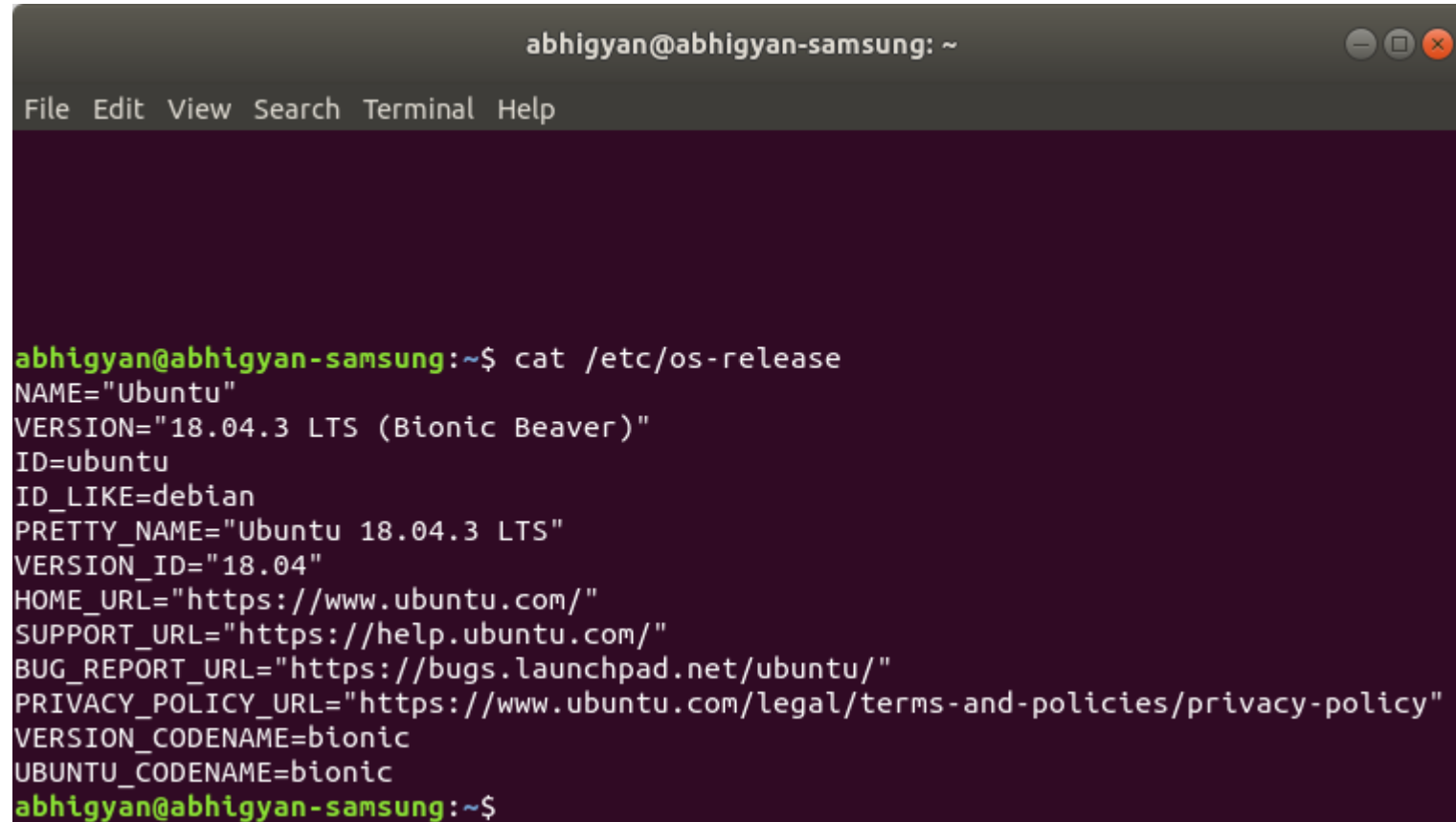
**IP with Ethernet: 10.22.2.125**

(LAN is designated as enp3s0 in the ifconfig command)

(Just for confirmation, the netaccess.iitm.ac.in also shows the same ip address, 10.22.2.125)

# Homework from Session 2

## 2.1.1. What are the other code names for OS releases of Ubuntu?

A terminal window titled 'abhigyan@abhigyan-samsung: ~' with a menu bar containing 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. The terminal has a dark purple background. The command 'cat /etc/os-release' has been executed, displaying the following output:

```
abhigyan@abhigyan-samsung:~$ cat /etc/os-release
NAME="Ubuntu"
VERSION="18.04.3 LTS (Bionic Beaver)"
ID=ubuntu
ID_LIKE=debian
PRETTY_NAME="Ubuntu 18.04.3 LTS"
VERSION_ID="18.04"
HOME_URL="https://www.ubuntu.com/"
SUPPORT_URL="https://help.ubuntu.com/"
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms-and-policies/privacy-policy"
VERSION_CODENAME=bionic
UBUNTU_CODENAME=bionic
abhigyan@abhigyan-samsung:~$
```



## 2.1.1. What are the other code names for OS releases of Ubuntu?

As we see in the previous slide, the current version of Ubuntu, Ubuntu 18.04 is called Bionic Beaver. All the Ubuntu versions are basically named as “adjective animal”, where the adjective and the animal’s name start with the same letter. Some other examples are:

- 16.04 LTS Xenial Xerus
- 14.04 LTS Trusty Tahr
- 12.04 LTS Precise Pangolin
- 10.04 LTS Lucid Lynx

The list is pretty long, considering that Ubuntu releases every year, and now since it’s 2019, they’ve even released 19.04 Disco Dingo. (Ubuntu releases are numbered as per the year in which they were released, hence the first version wasn’t actually 1.0 but 4.10, released in October, 2004, codenamed Warty Warthog.)

(source: <https://wiki.ubuntu.com/Releases>)

## 2.1.2. Which major flavour of Linux is Ubuntu based on? What are other major flavours out there?

Ubuntu is based on Debian, as it is shown in the contents of the file:

/etc/os-release, by using the cat command.

Some other major flavours of Linux are:

- Red Hat Linux (Proprietary Software)
- Fedora (The FOSS\* version of Red Hat, supported by Red Hat, Inc.)
- CentOS (Another FOSS version of Red Hat that isn't supported by Red Hat, Inc.)
- openSUSE (The FOSS version of a German Linux called SUSE)

\*Here, FOSS stands for Free and Open Source Software, where Free means freedom to do what you want to do with the source code, modify, improve, change and redistribute the software for public good. Free, as it is used here, is a matter of liberty and not of price. This was one of the chief motivations of Richard Stallman, who started the GNU project to create a freedom respecting operating system.

([source](#))

## 2.1.3. What are the other popular and lightweight flavours of Linux?

- SparkyLinux
- antiX Linux
- Bodhi Linux (based on Ubuntu, uses the Moksha desktop environment)
- CrunchBang Linux
- Lubuntu (lightweight version of Ubuntu, used the LXDE desktop environment before, now uses the LXQt desktop environment, which is even lighter)
- Xubuntu (lightweight version of Ubuntu, uses the XFCE desktop environment)

Note: The lightweight desktop environments are used to revive old PCs which are not able to run the latest and heavyweight software but are still in usable condition.

([source](#))

## 2.1.4. What are the other architectures supported by Linux?

- Intel x86
- AMD64 (x86\_64)
- ARM
- POWER (a variant of IBMs PowerPC architecture)
- S390X (IBM Mainframe systems)
- PowerPC (This happens to be the architecture that is present on many video game consoles, resulting in video game consoles running Linux)
- SPARC
- Etc.

These architectures are all different types of processors, each having a different assembly language, hence, each needs to be developed separately.

([source](#))

## 2.1.5. What are the kind of operating systems used by most of the supercomputers in the world?

Quoting Wikipedia:

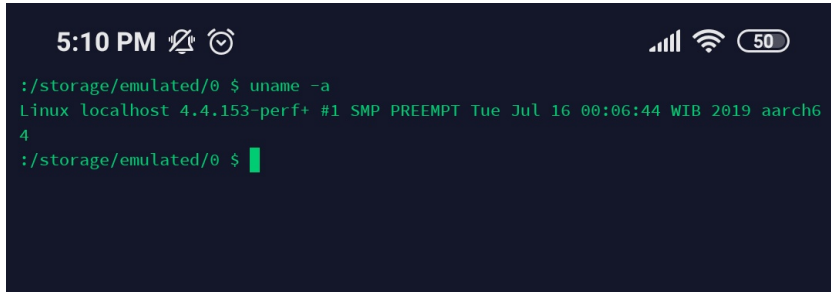
“Although most modern supercomputers use the Linux operating system, each manufacturer has made its own specific changes to the Linux-derivative they use, and no industry standard exists, partly because the differences in hardware architectures require changes to optimize the operating system to each hardware design.”

There is a small minority of supercomputers that still use Unix, but basically, \*nix(#) basically accounts for everything when it comes to high-performance computing

#\*nix refers to any operating system that is Unix-like. Some examples are BSD (Berkeley Software Distribution), Linux, Minix, and macOS.

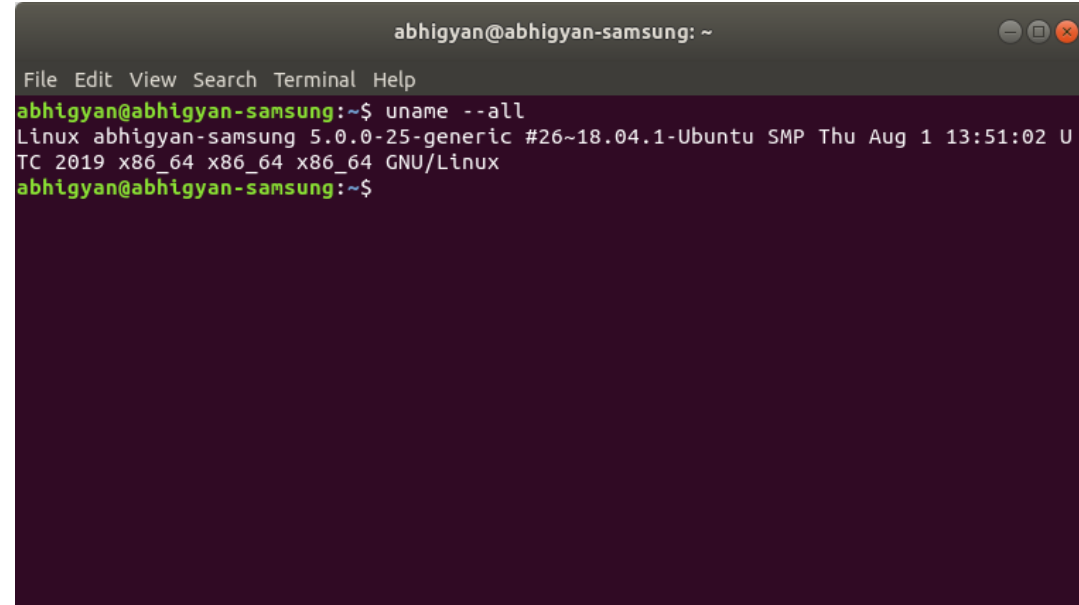
## 2.1.6. Which version of Linux kernel are the popular Android operating systems based on?

Check this information for your laptop and your mobile.



```
5:10 PM 50
:/storage/emulated/0 $ uname -a
Linux localhost 4.4.153-perf+ #1 SMP PREEMPT Tue Jul 16 00:06:44 WIB 2019 aarch64
:/storage/emulated/0 $
```

On Android Phone using Terminus app, the Linux kernel version is 4.4.153-perf+



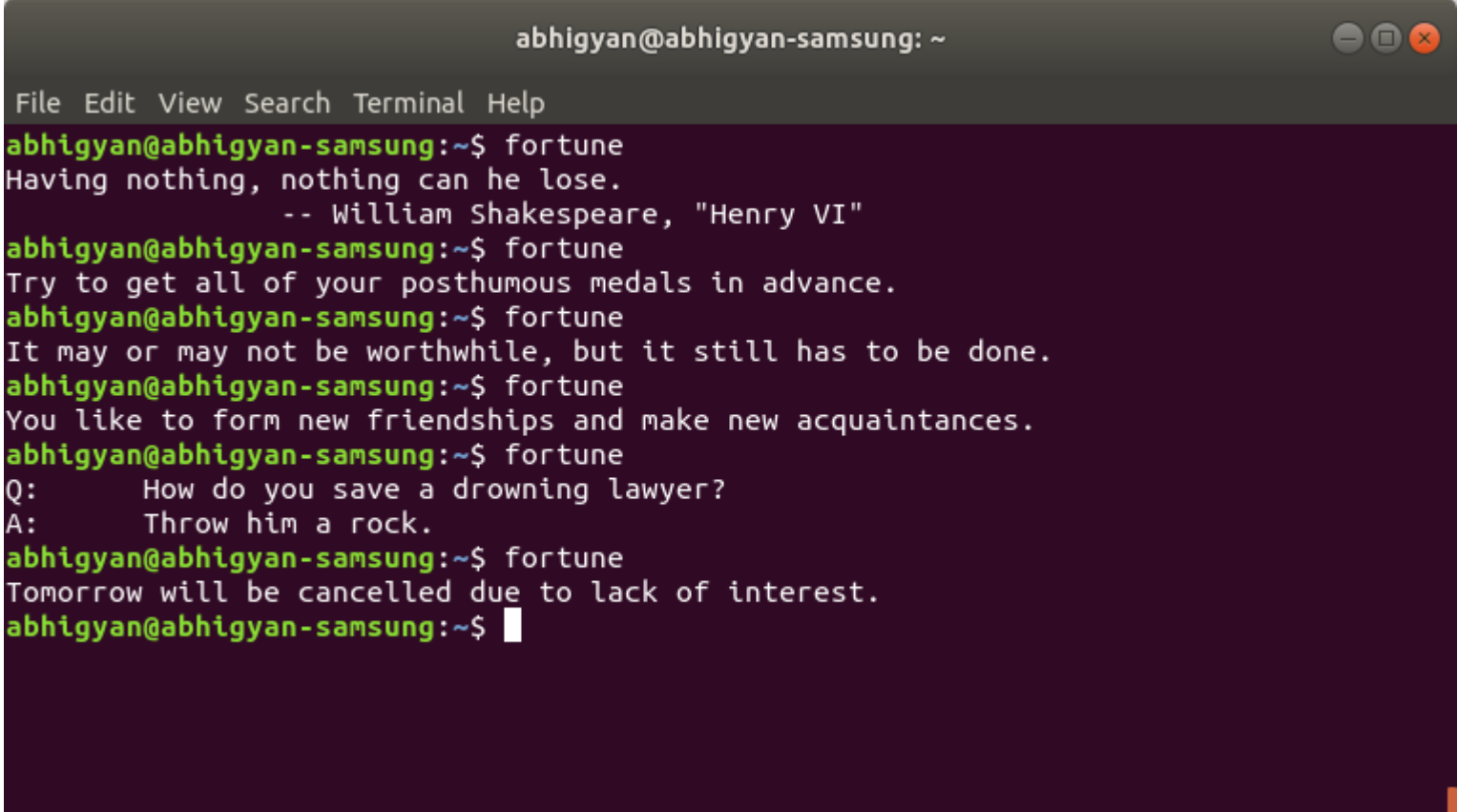
```
abhigyan@abhigyan-samsung: ~
File Edit View Search Terminal Help
abhigyan@abhigyan-samsung:~$ uname --all
Linux abhigyan-samsung 5.0.0-25-generic #26~18.04.1-Ubuntu SMP Thu Aug 1 13:51:02 UTC 2019 x86_64 x86_64 x86_64 GNU/Linux
abhigyan@abhigyan-samsung:~$
```

On Ubuntu Laptop using gnome-terminal, we find the Linux kernel version is 5.0.0-25-generic

## 2.2.1. Install packages to add the following commands to your system and explore what they do: fortune, octave, pdftk, unison, wget, curl, gftp, xfig, vlc

fortune

Outputs  
weird jokes  
:)

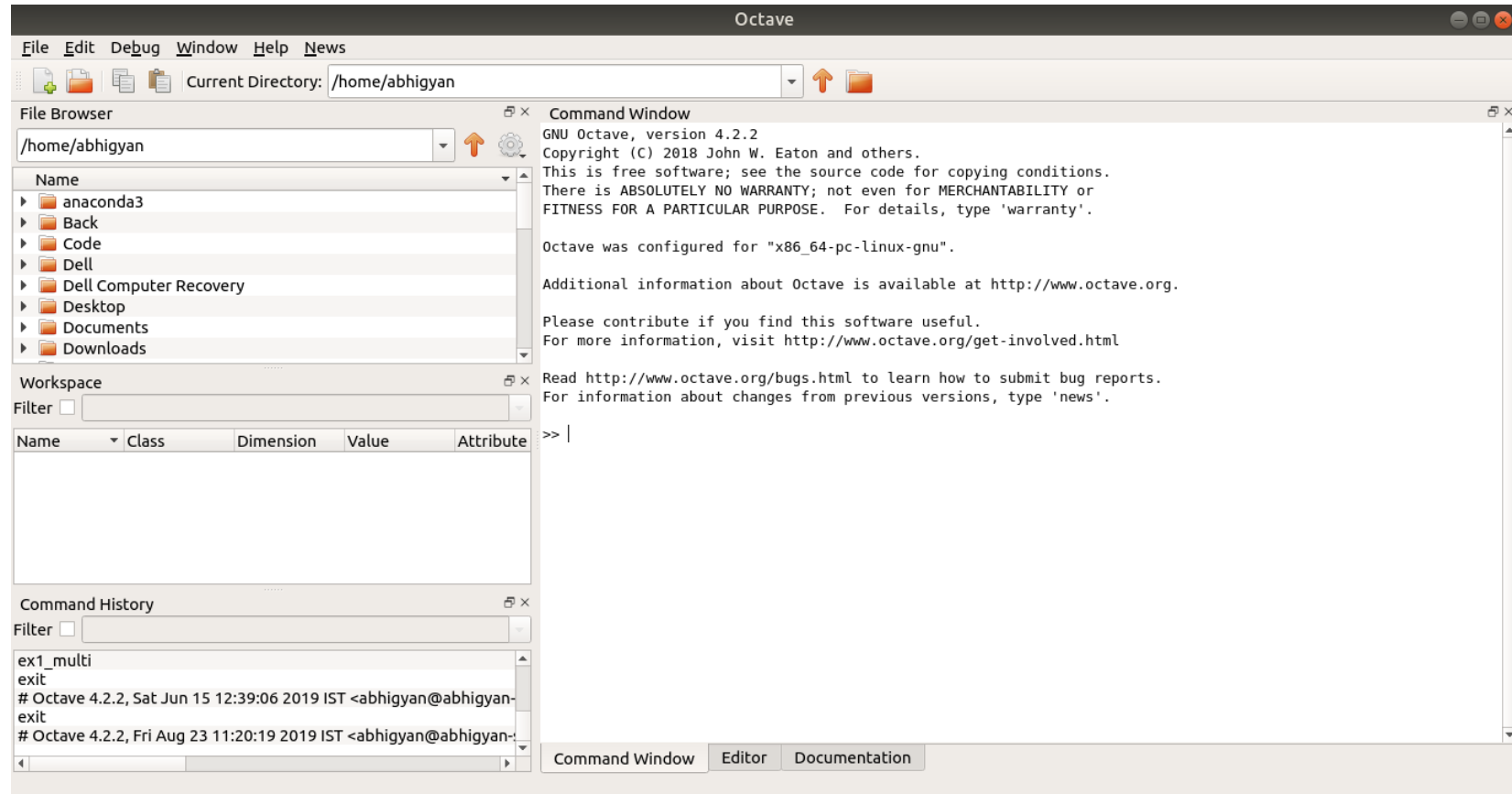
A terminal window titled 'abhigyan@abhigyan-samsung: ~' with a menu bar (File, Edit, View, Search, Terminal, Help). The terminal shows the execution of the 'fortune' command multiple times, displaying various humorous and philosophical quotes. The background is a dark purple color.

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
abhigyan@abhigyan-samsung:~$ fortune  
Having nothing, nothing can he lose.  
-- William Shakespeare, "Henry VI"  
abhigyan@abhigyan-samsung:~$ fortune  
Try to get all of your posthumous medals in advance.  
abhigyan@abhigyan-samsung:~$ fortune  
It may or may not be worthwhile, but it still has to be done.  
abhigyan@abhigyan-samsung:~$ fortune  
You like to form new friendships and make new acquaintances.  
abhigyan@abhigyan-samsung:~$ fortune  
Q:      How do you save a drowning lawyer?  
A:      Throw him a rock.  
abhigyan@abhigyan-samsung:~$ fortune  
Tomorrow will be cancelled due to lack of interest.  
abhigyan@abhigyan-samsung:~$
```

## 2.2.1. Install packages to add the following commands to your system and explore what they do: fortune, octave, pdftk, unison, wget, curl, gftp, xfig, vlc

octave

GNU version  
of Matlab,  
100%  
function-  
compatible  
with Matlab,  
supports  
more  
advanced  
features and  
syntax





## 2.2.1. Install packages to add the following commands to your system and explore what they do: fortune, octave, pdftk, unison, wget, curl, gftp, xfig, vlc

pdftk

Open-source  
toolkit to modify  
and make PDFs

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
abhigyan@abhigyan-samsung:~$ pdftk --help  
  
pdftk 2.02 a Handy Tool for Manipulating PDF Documents  
Copyright (c) 2003-13 Steward and Lee, LLC - Please Visit: www.pdftk.com  
This is free software; see the source code for copying conditions. There is  
NO warranty, not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  
  
SYNOPSIS  
pdftk <input PDF files | - | PROMPT>  
    [ input_pw <input PDF owner passwords | PROMPT> ]  
    [ <operation> <operation arguments> ]  
    [ output <output filename | - | PROMPT> ]  
    [ encrypt_40bit | encrypt_128bit ]  
    [ allow <permissions> ]  
    [ owner_pw <owner password | PROMPT> ]  
    [ user_pw <user password | PROMPT> ]  
    [ flatten ] [ need_appearances ]  
    [ compress | uncompress ]  
    [ keep_first_id | keep_final_id ] [ drop_xfa ] [ drop_xmp ]  
    [ verbose ] [ dont_ask | do_ask ]
```

## 2.2.1. Install packages to add the following commands to your system and explore what they do: fortune, octave, pdftk, unison, wget, curl, gftp, xfig, vlc

unison

A file-syncing tool, originally used in Unix, which maintains file versions over multiple computers

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
abhigyan@abhigyan-samsung:~$ unison -help  
Usage: unison [options]  
       or unison root1 root2 [options]  
       or unison profilename [options]  
  
Basic options:  
-auto           automatically accept default (nonconflicting) actions  
-batch          batch mode: ask no questions at all  
-doc xxx        show documentation ('-doc topics' lists topics)  
-fat            use appropriate options for FAT filesystems  
-group          synchronize group attributes  
-ignore xxx     add a pattern to the ignore list  
-ignorenot xxx  add a pattern to the ignorenot list  
-nocreation xxx prevent file creations on one replica  
-nodeletion xxx prevent file deletions on one replica  
-nouupdate xxx  prevent file updates and deletions on one replica  
-owner          synchronize owner  
-path xxx       path to synchronize  
-perms n        part of the permissions which is synchronized  
-root xxx       root of a replica (should be used exactly twice)
```

## 2.2.1. Install packages to add the following commands to your system and explore what they do: fortune, octave, pdftk, unison, wget, curl, gftp, xfig, vlc

wget

Used to download files from the internet, it can be used to make an offline repository of many important webpages when used recursively

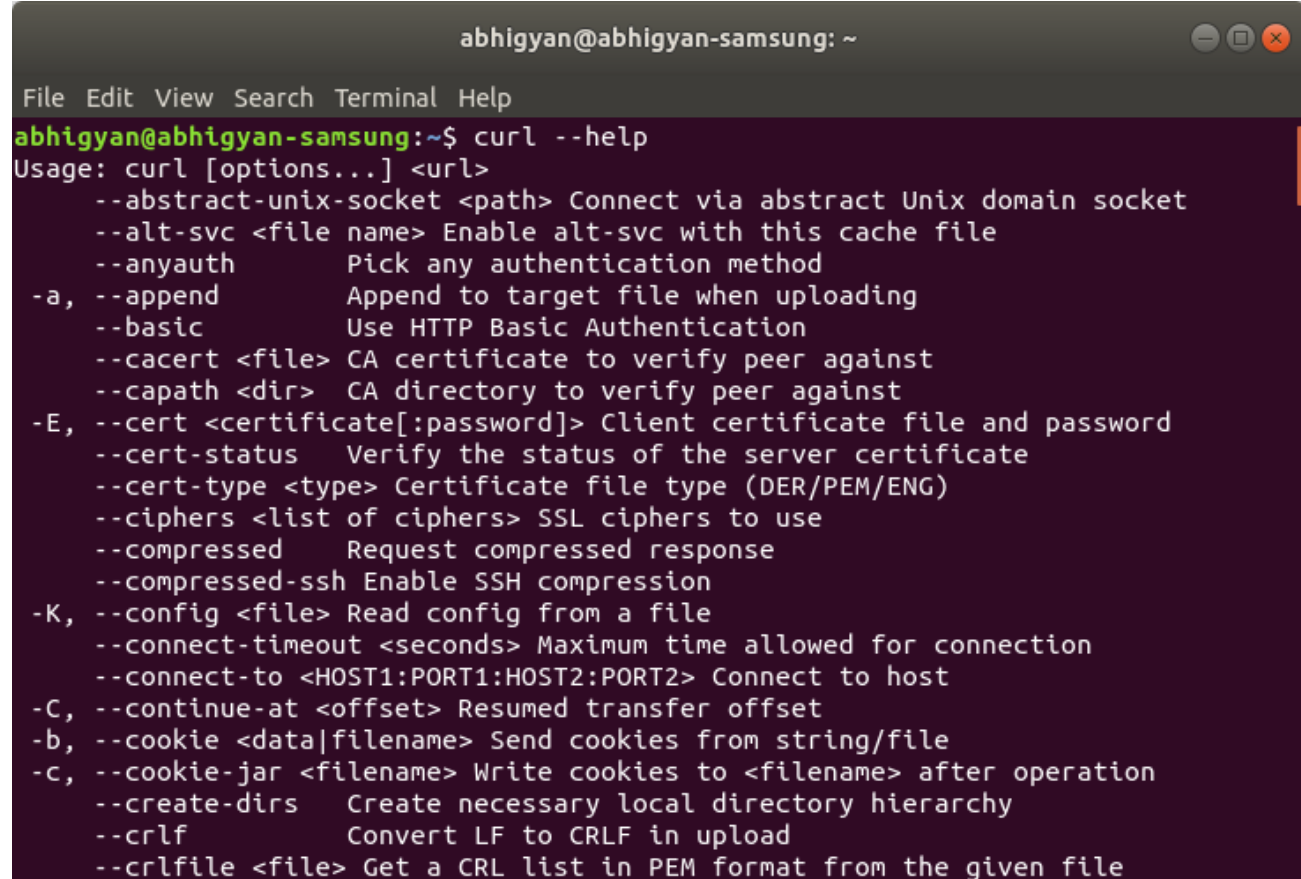
```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
abhigyan@abhigyan-samsung:~$ wget https://en.wikipedia.org/wiki/Supercomputer_operating_systems  
--2019-08-23 17:26:23-- https://en.wikipedia.org/wiki/Supercomputer_operating_systems  
Resolving en.wikipedia.org (en.wikipedia.org)... 103.102.166.224, 2001:df2:e500:ed1a::1  
Connecting to en.wikipedia.org (en.wikipedia.org)|103.102.166.224|:443... connected.  
HTTP request sent, awaiting response... 200 OK  
Length: 82421 (80K) [text/html]  
Saving to: 'Supercomputer_operating_systems'  
  
Supercomputer_operating_ 100%[=====] 80.49K --.-KB/s in 0.1s  
  
2019-08-23 17:26:23 (747 KB/s) - 'Supercomputer_operating_systems' saved [82421/82421]  
  
abhigyan@abhigyan-samsung:~$
```

## 2.2.1. Install packages to add the following commands to your system and explore what they do: fortune, octave, pdftk, unison, wget, curl, gftp, xfig, vlc

### curl

The curl command transfers data to or from a network server, using one of the supported protocols (HTTP, HTTPS, FTP, FTPS, SCP, SFTP, TFTP, DICT, TELNET, LDAP or FILE). It is designed to work without user interaction, so it is ideal for use in a shell script.

([source](#))

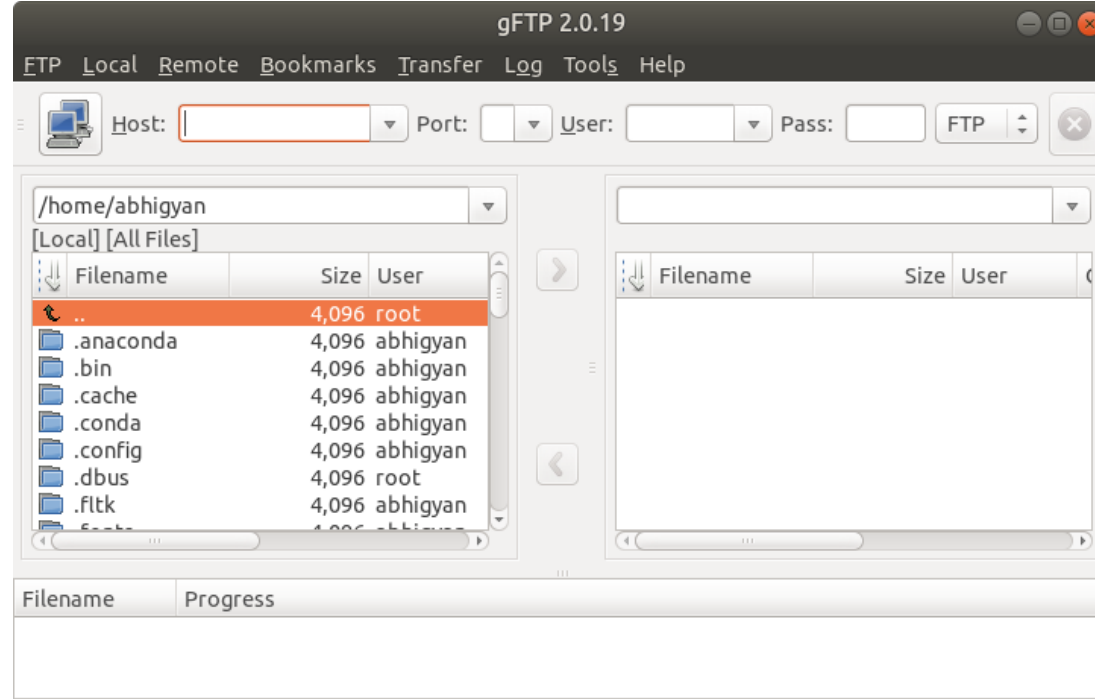
A terminal window titled 'abhigyan@abhigyan-samsung: ~' with standard window controls. The terminal shows the command 'curl --help' and its output, which lists various options for the curl command. The options are grouped with letters -a, -E, -K, -C, -b, and -c, and include descriptions for each. The terminal has a dark background with light-colored text.

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
abhigyan@abhigyan-samsung:~$ curl --help  
Usage: curl [options...] <url>  
  --abstract-unix-socket <path> Connect via abstract Unix domain socket  
  --alt-svc <file name> Enable alt-svc with this cache file  
  --anyauth Pick any authentication method  
-a, --append Append to target file when uploading  
  --basic Use HTTP Basic Authentication  
  --cacert <file> CA certificate to verify peer against  
  --capath <dir> CA directory to verify peer against  
-E, --cert <certificate[:password]> Client certificate file and password  
  --cert-status Verify the status of the server certificate  
  --cert-type <type> Certificate file type (DER/PEM/ENG)  
  --ciphers <list of ciphers> SSL ciphers to use  
  --compressed Request compressed response  
  --compressed-ssh Enable SSH compression  
-K, --config <file> Read config from a file  
  --connect-timeout <seconds> Maximum time allowed for connection  
  --connect-to <HOST1:PORT1:HOST2:PORT2> Connect to host  
-C, --continue-at <offset> Resumed transfer offset  
-b, --cookie <data|filename> Send cookies from string/file  
-c, --cookie-jar <filename> Write cookies to <filename> after operation  
  --create-dirs Create necessary local directory hierarchy  
  --crlf Convert LF to CRLF in upload  
  --crlfile <file> Get a CRL list in PEM format from the given file
```

## 2.2.1. Install packages to add the following commands to your system and explore what they do: fortune, octave, pdftk, unison, wget, curl, gftp, xfig, vlc

gftp

Used for transferring files across computers using FTP (File Transfer Protocol)

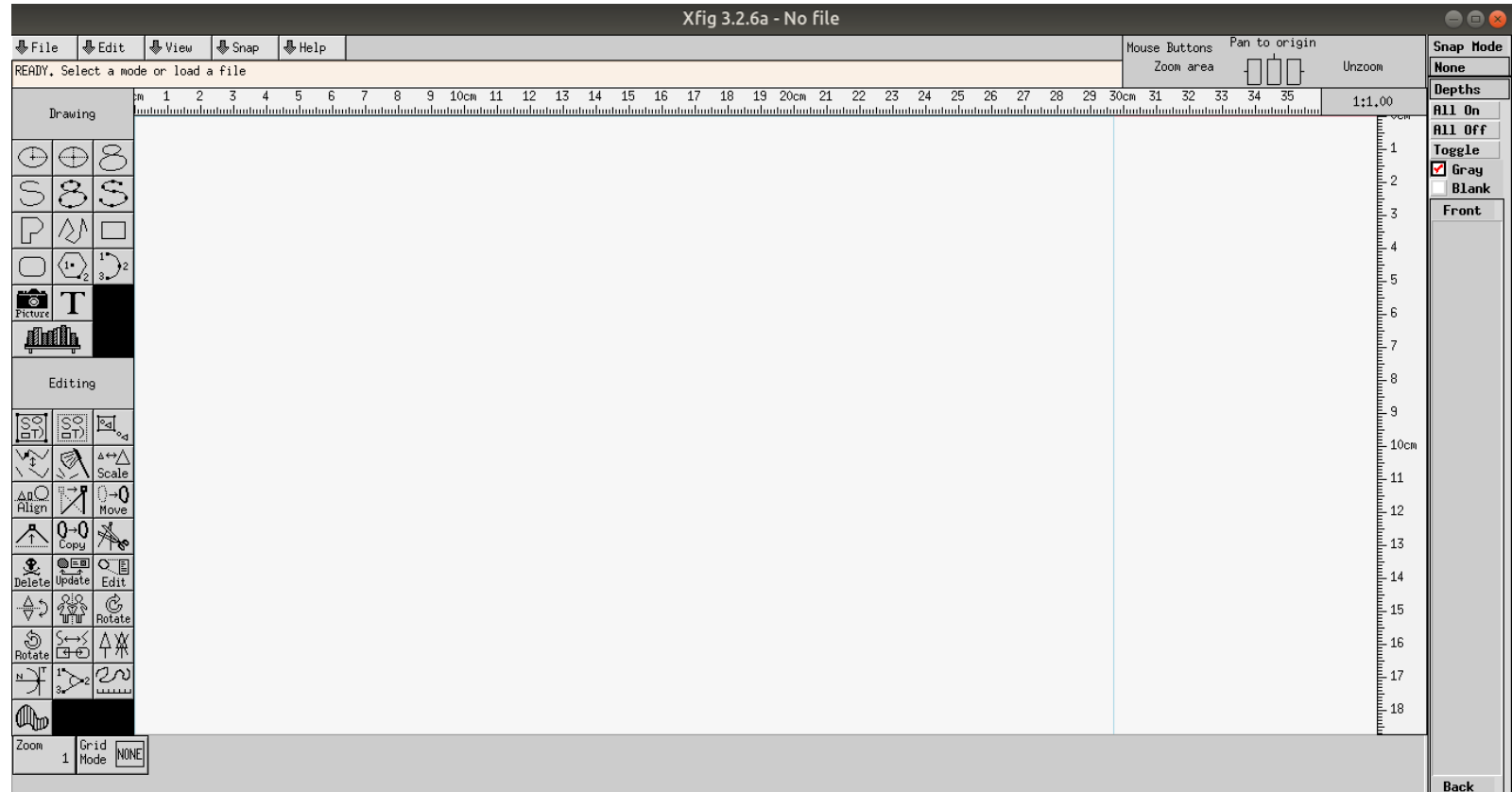


gFTP 2.0.19, Copyright (C) 1998-2008 Brian Masney <masneyb@gftp.org>. If you have any questions, comments, or suggestions about this program, please feel free to email them to me. You can always find out the latest news about gFTP from my website at <http://www.gftp.org/>  
gFTP comes with ABSOLUTELY NO WARRANTY; for details, see the COPYING file. This is free software, and you are welcome to redistribute it under certain conditions; for details, see the COPYING file

## 2.2.1. Install packages to add the following commands to your system and explore what they do: fortune, octave, pdftk, unison, wget, curl, gftp, xfig, vlc

xfig

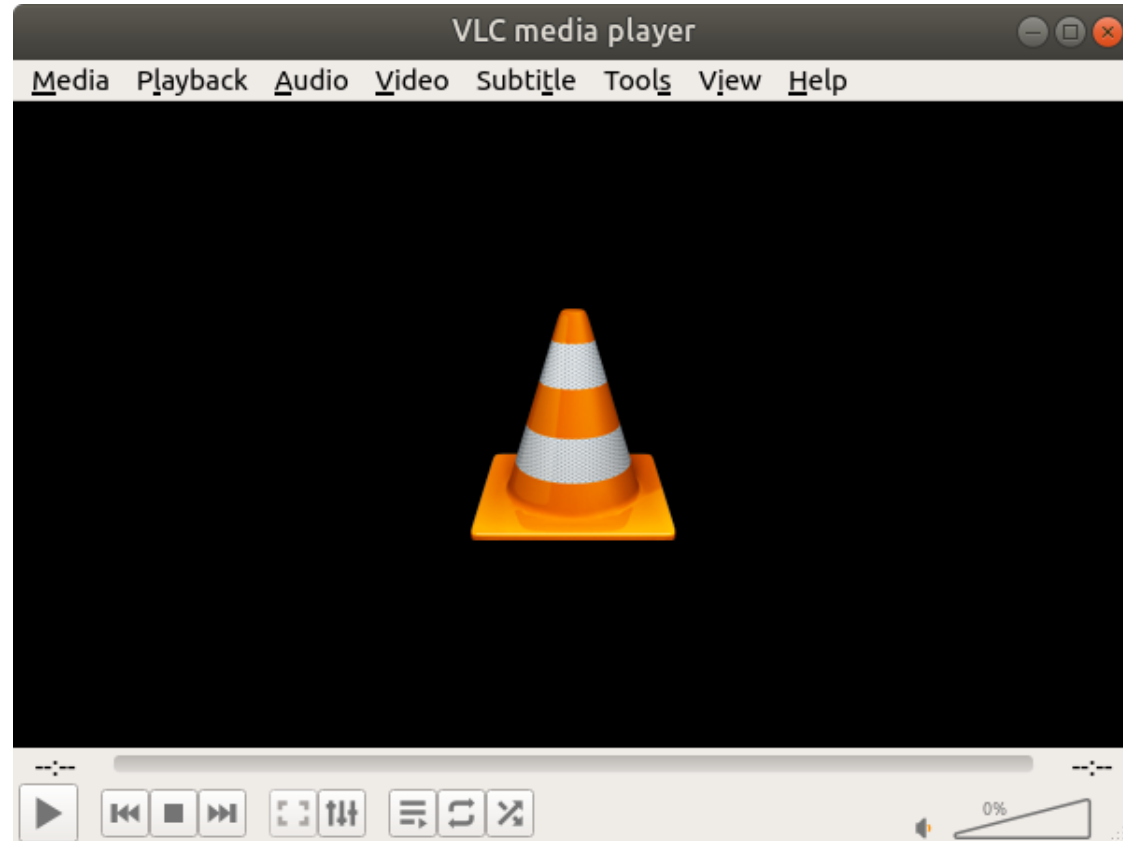
It is a drawing utility which uses the X Windows System, hence it is known as xfig



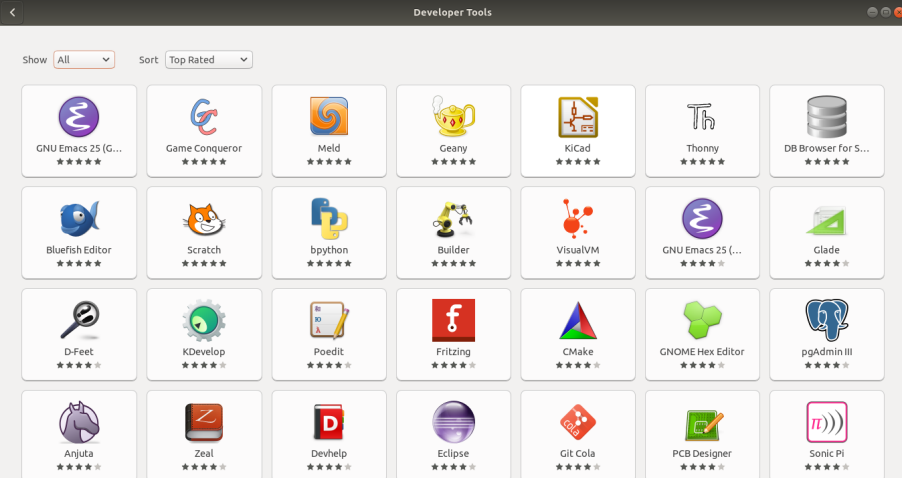
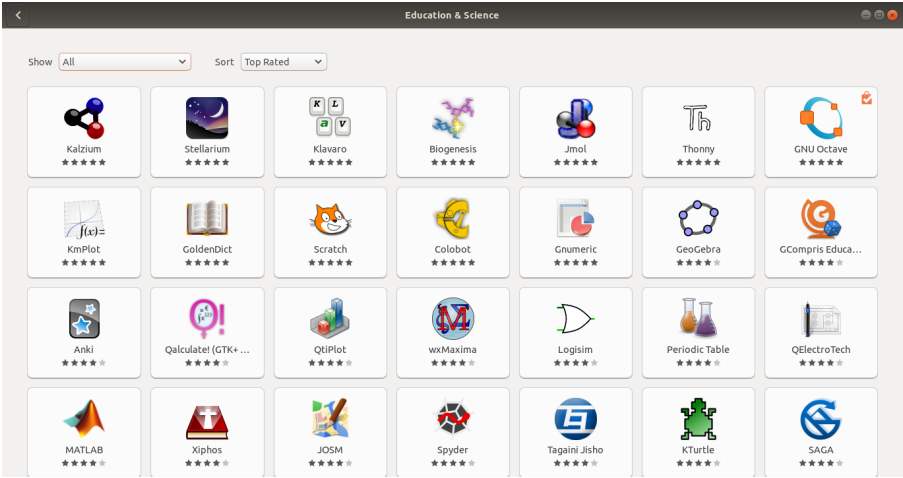
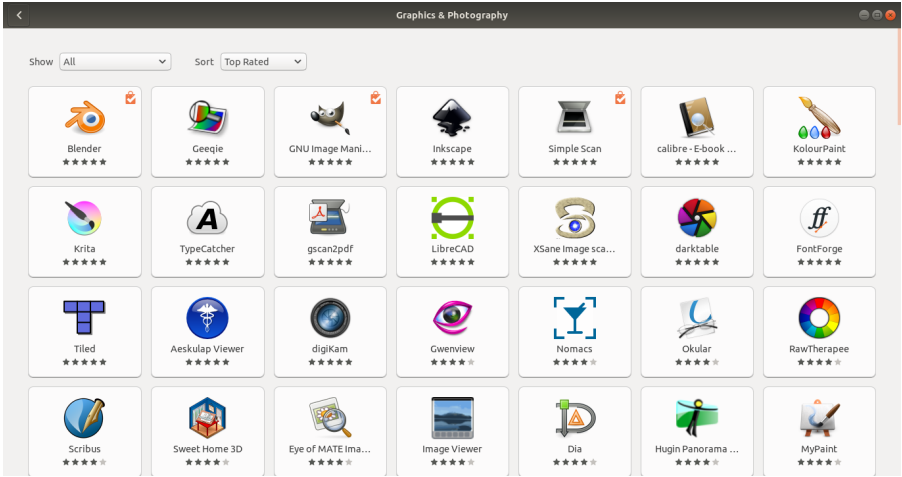
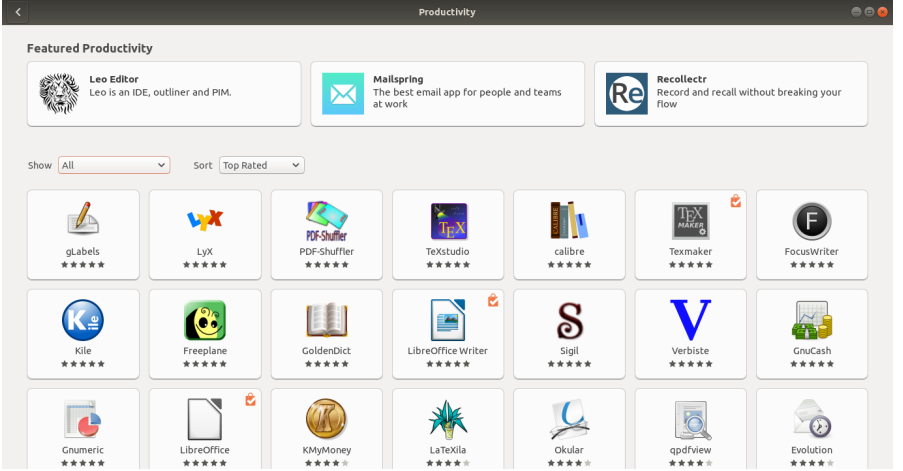
## 2.2.1. Install packages to add the following commands to your system and explore what they do: fortune, octave, pdftk, unison, wget, curl, gftp, xfig, vlc

vlc

It is a FOSS media player, which supports various file formats and supports converting between them with ease



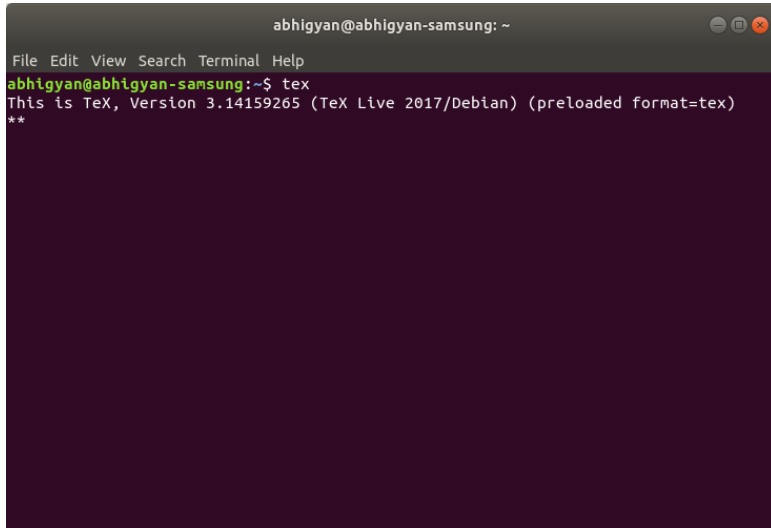
## 2.2.2 Packages come as groups too. Explore the GUI feature for Ubuntu Software to see what those groups are – in the topics under categories like “Productivity”, “Education and Science”.





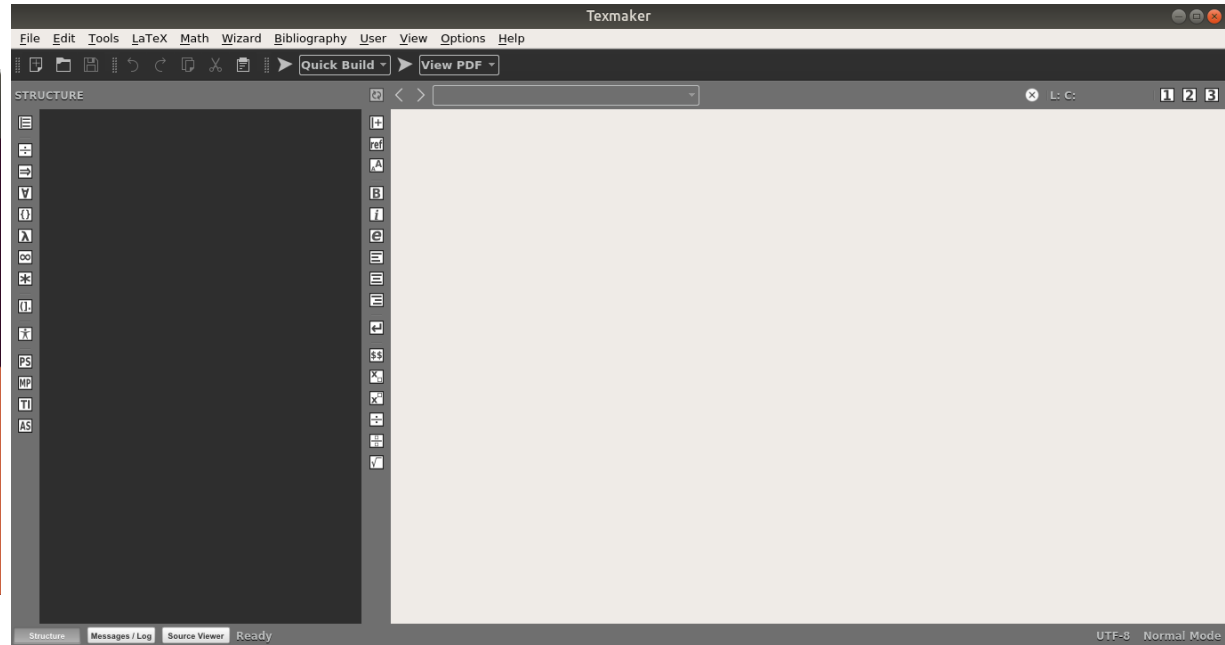
## 2.2.3 Try and get the entire TeX document preparation software toolset installed on your machine

tex CLI



```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
abhigyan@abhigyan-samsung:~$ tex  
This is TeX, Version 3.14159265 (TeX Live 2017/Debian) (preloaded format=tex)  
**
```

TexMaker application to create tex files with ease



## 2.3.1. Add a command like echo “Hello” at the bottom of your \$HOME/.bashrc file and open a new shell to see for yourself.

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
Hello, Abhigyan!  
Welcome to the terminal on Fri Aug 23 17:48:40 IST 2019  
Your fortune for today is:  
Your lucky color has faded.  
abhigyan@abhigyan-samsung:~$
```

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
# >>> conda initialize >>>  
# !! Contents within this block are managed by 'conda init' !!  
__conda_setup="$('/home/abhigyan/anaconda3/bin/conda' 'shell.bash' 'hook' 2> /dev/null)"  
if [ $? -eq 0 ]; then  
    eval "$__conda_setup"  
else  
    if [ -f "/home/abhigyan/anaconda3/etc/profile.d/conda.sh" ]; then  
        . "/home/abhigyan/anaconda3/etc/profile.d/conda.sh"  
    else  
        export PATH="/home/abhigyan/anaconda3/bin:$PATH"  
    fi  
fi  
unset __conda_setup  
# <<< conda initialize <<<  
  
PS1='\[\e\;\u@\h: \w\a\]${debian_chroot:+($debian_chroot)}\[\033[01;32m\]\u@\h\[\033[00m\]:\[\033[01;34m\]\w\[\033[00m\]\$ '  
  
echo "Hello, Abhigyan!"  
echo "Welcome to the terminal on `date`"  
echo "Your fortune for today is:"  
fortune  
  
139,7 Bot
```

## **2.3.2. Discover say three new commands you did not know about and list their uses**

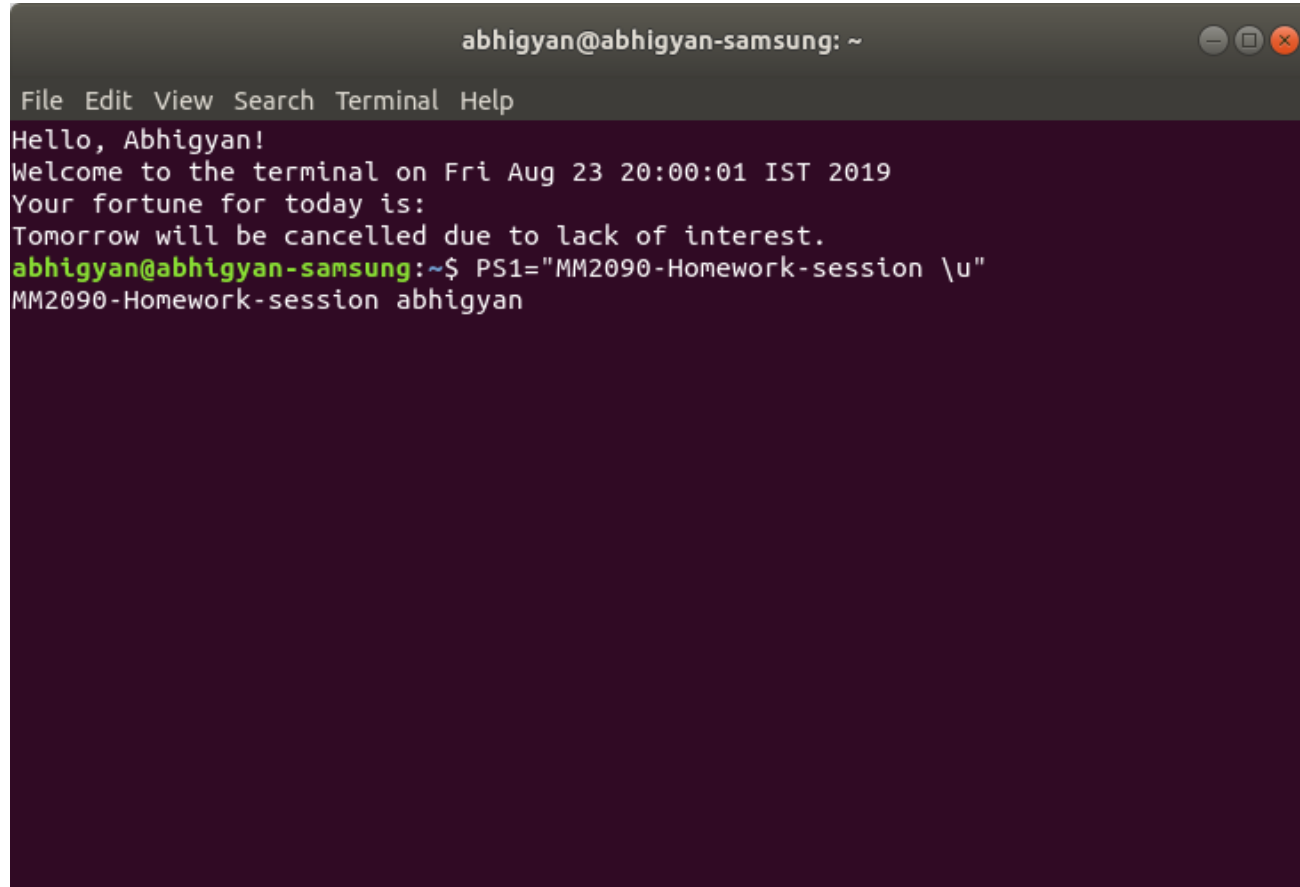
RANDOM => It produces some random integer between 0 and 32767

dd => converts and copies files

tee => used to append values to a file

ar => used to create archives, append to archives, and extract data from archives

## 2.3.3. Change the command prompts to something else and see

A terminal window titled 'abhigyan@abhigyan-samsung: ~' with standard window controls. The terminal has a menu bar with 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. The output shows a greeting, a welcome message with a timestamp, a fortune, and a cancelled event. The prompt is then changed to 'MM2090-Homework-session \u' and the user 'abhigyan' is shown at the prompt.

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
Hello, Abhigyan!  
Welcome to the terminal on Fri Aug 23 20:00:01 IST 2019  
Your fortune for today is:  
Tomorrow will be cancelled due to lack of interest.  
abhigyan@abhigyan-samsung:~$ PS1="MM2090-Homework-session \u"  
MM2090-Homework-session abhigyan
```

## 2.3.4. Create an alias that displays the hard discs currently mounted in the system.

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
# !! Contents within this block are managed by 'conda init' !!  
__conda_setup="$('/home/abhigyan/anaconda3/bin/conda' 'shell.bash' 'hook' 2> /dev/null)"  
if [ $? -eq 0 ]; then  
    eval "$__conda_setup"  
else  
    if [ -f "/home/abhigyan/anaconda3/etc/profile.d/conda.sh" ]; then  
        . "/home/abhigyan/anaconda3/etc/profile.d/conda.sh"  
    else  
        export PATH="/home/abhigyan/anaconda3/bin:$PATH"  
    fi  
fi  
unset __conda_setup  
# <<< conda initialize <<<  
  
PS1='[\e]0;\u@h: \w\a\]\${debian_chroot:+($debian_chroot)}\[\033[01;32m\]\u@h\[\033[00m\]:\[\033[01;34m\]\w\[\033[00m\]\$ '  
  
echo "Hello, Abhigyan!"  
echo "Welcome to the terminal on `date`"  
echo "Your fortune for today is:"  
fortune  
alias mounted-disks='cat /proc/mounts'  
140,38 Bot
```

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
  
abhigyan@abhigyan-samsung:~$ mounted-disks  
sysfs /sys sysfs rw,nosuid,nodev,noexec,relatime 0 0  
proc /proc proc rw,nosuid,nodev,noexec,relatime 0 0  
udev /dev devtmpfs rw,nosuid,relatime,size=3946920k,nr_inodes=986730,mode=755 0 0  
devpts /dev/pts devpts rw,nosuid,noexec,relatime,gid=5,mode=620,ptmxmode=000 0 0  
tmpfs /run tmpfs rw,nosuid,noexec,relatime,size=794160k,mode=755 0 0  
/dev/sda6 / ext4 rw,relatime,errors=remount-ro 0 0  
securityfs /sys/kernel/security securityfs rw,nosuid,nodev,noexec,relatime 0 0  
tmpfs /dev/shm tmpfs rw,nosuid,nodev 0 0  
tmpfs /run/lock tmpfs rw,nosuid,nodev,noexec,relatime,size=5120k 0 0  
tmpfs /sys/fs/cgroup tmpfs ro,nosuid,nodev,noexec,mode=755 0 0  
cgroup /sys/fs/cgroup/unified cgroup2 rw,nosuid,nodev,noexec,relatime,nsdelegate 0 0  
cgroup /sys/fs/cgroup/systemd cgroup rw,nosuid,nodev,noexec,relatime,xattr,name=systemd 0 0  
pstore /sys/fs/pstore pstore rw,nosuid,nodev,noexec,relatime 0 0  
cgroup /sys/fs/cgroup/freezer cgroup rw,nosuid,nodev,noexec,relatime,freezer 0 0  
cgroup /sys/fs/cgroup/devices cgroup rw,nosuid,nodev,noexec,relatime,devices 0 0  
cgroup /sys/fs/cgroup/net_cls,net_prio cgroup rw,nosuid,nodev,noexec,relatime,net_cls,net_prio 0 0  
cgroup /sys/fs/cgroup/blkio cgroup rw,nosuid,nodev,noexec,relatime,blkio 0 0  
cgroup /sys/fs/cgroup/pids cgroup rw,nosuid,nodev,noexec,relatime,pids 0 0
```

### 2.4.1. Create a file with a command inside it, change its permission to executable and see if you are able to create a new command for yourself.

```

abhigyan@abhigyan-samsung: ~
File Edit View Search Terminal Help
#!/bin/bash
echo "now let us see the date"
date
echo "How many files are in this directory"
ls -l | wc -l

```

"myscript" 6L, 106C 1,1 All

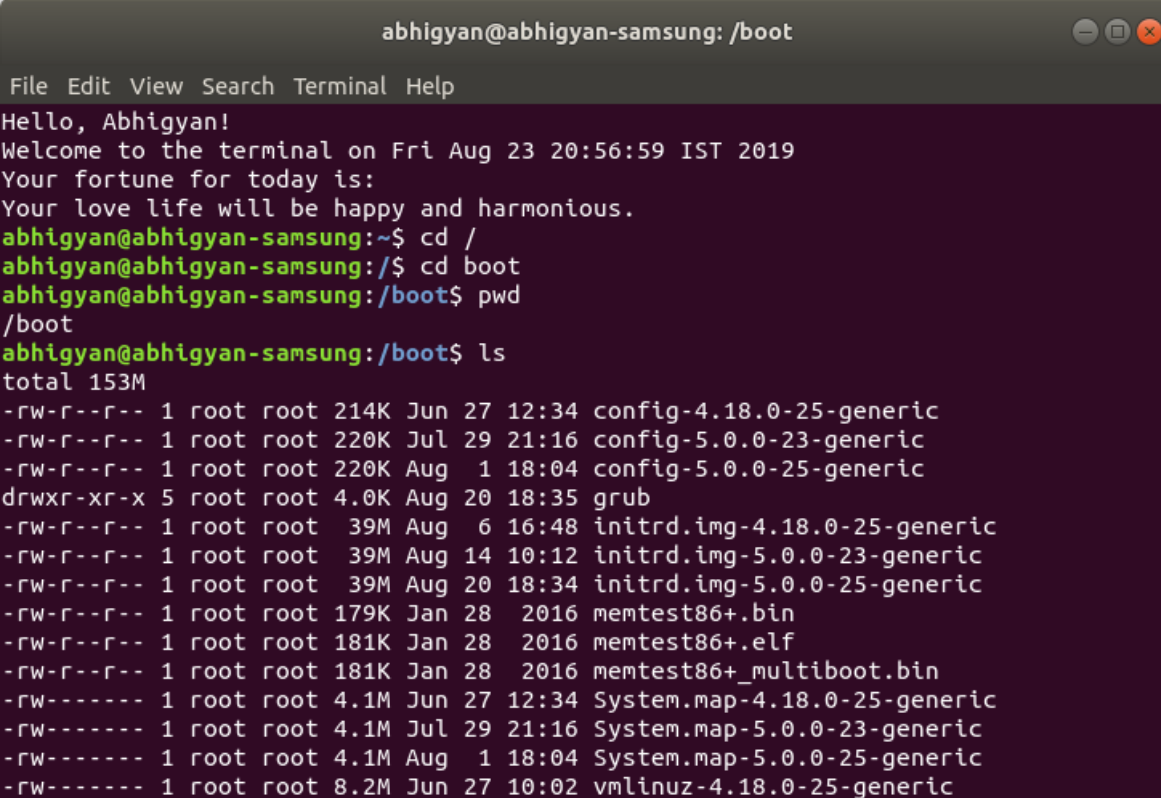
```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
abhigyan@abhigyan-samsung:~$ vi myscript  
abhigyan@abhigyan-samsung:~$ chmod 755 myscript  
abhigyan@abhigyan-samsung:~$ ./myscript  
now let us see the date  
Fri Aug 23 20:47:48 IST 2019  
How many files are in this directory  
32  
abhigyan@abhigyan-samsung:~$
```

## 2.4.2. Create an alias for a command your favorite options so that the output is what you desire. Eg: the directory listing with file size in human readable form.

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
__conda_setup="$('/home/abhigyan/anaconda3/bin/conda' 'shell.bash' 'hook' 2> /dev/null)"  
if [ $? -eq 0 ]; then  
    eval "$__conda_setup"  
else  
    if [ -f "/home/abhigyan/anaconda3/etc/profile.d/conda.sh" ]; then  
        . "/home/abhigyan/anaconda3/etc/profile.d/conda.sh"  
    else  
        export PATH="/home/abhigyan/anaconda3/bin:$PATH"  
    fi  
fi  
unset __conda_setup  
# <<< conda initialize <<<  
PS1='\[\e\];\u@\h: \w\a\${debian_chroot:+($debian_chroot)}\[\033[01;32m\]\u@\h\[\033[00m\]:\[\033[01;34m\]\w\[\033[00m\]\$ '  
  
echo "Hello, Abhigyan!"  
echo "Welcome to the terminal on `date`"  
echo "Your fortune for today is:"  
fortune  
alias mounted-disks='cat /proc/mounts'  
alias ls='ls -lh'  
-- INSERT --
```

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
Hello, Abhigyan!  
Welcome to the terminal on Fri Aug 23 20:53:47 IST 2019  
Your fortune for today is:  
You two ought to be more careful--your love could drag on for years and years.  
abhigyan@abhigyan-samsung:~$ ls  
total 252K  
drwxr-xr-x 86 abhigyan abhigyan 4.0K Aug  6 18:17 anaconda3  
-rw-r--r--  1 abhigyan abhigyan 270 Aug 22 09:50 awkscript  
drwxr-xr-x  2 abhigyan abhigyan 4.0K Aug  9 08:49 Back  
-rw-r--r--  1 abhigyan abhigyan 389 Jul 18 22:10 charCheck.class  
drwxr-xr-x  4 abhigyan abhigyan 4.0K Jun 11 15:11 Code  
-rw-r-xr-x  1 abhigyan abhigyan  89 Aug 23 08:51 csv-generator.sh  
drwxr-xr-x  5 abhigyan abhigyan 4.0K Jun 24 12:09 Dell  
drwxr-xr-x 190 abhigyan abhigyan 20K Jun 24 12:33 'Dell Computer Recovery'  
drwxr-xr-x 11 abhigyan abhigyan 4.0K Aug 23 13:16 Desktop  
drwxr-xr-x  5 abhigyan abhigyan 4.0K Aug 23 20:48 Documents  
drwxr-xr-x  5 abhigyan abhigyan 4.0K Aug 23 17:12 Downloads  
-rw-r--r--  1 abhigyan abhigyan 8.8K May  6 13:21 examples.desktop  
-rw-r--r--  1 abhigyan abhigyan 124 Aug 22 16:17 fact.py  
-rw-r--r--  1 abhigyan abhigyan 1.3K Aug 17 12:19 grub_configuration.txt  
-rw-rw-r--  1 abhigyan abhigyan  36 Aug  9 08:59 hw.txt  
drwxr-xr-x  3 abhigyan abhigyan 4.0K Jun 12 15:39 Music  
-rw-r-xr-x  1 abhigyan abhigyan 106 Aug 23 20:47 myscript  
-rw-r--r--  1 abhigyan abhigyan  0 Aug 23 08:40 new.csv
```

**2.4.3. Use the commands “cd” and “pwd” to navigate around the file system and locate configuration files for your system eg., for graphics, network, file systems to be mounted during booting and system service programs that run automatically when the machine is booted up.**

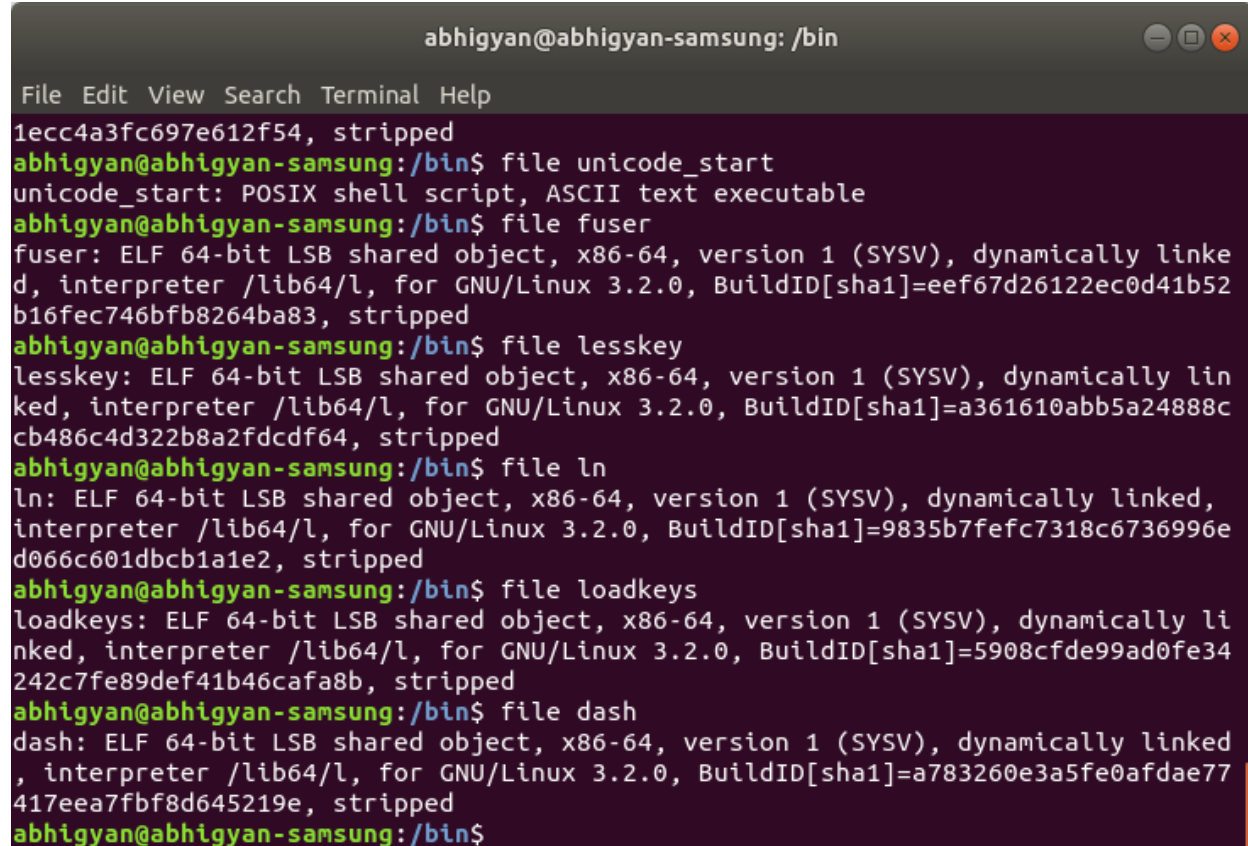
A terminal window titled 'abhigyan@abhigyan-samsung: /boot' with standard window controls. The terminal shows a series of commands and their outputs. It starts with a greeting, then the user navigates from the home directory to the /boot directory using 'cd /' and 'cd boot'. The 'pwd' command confirms the current directory is /boot. Finally, the 'ls' command lists the contents of the /boot directory, showing various kernel configuration files, initrd images, and the vmlinuz file.

```
abhigyan@abhigyan-samsung: /boot
File Edit View Search Terminal Help
Hello, Abhigyan!
Welcome to the terminal on Fri Aug 23 20:56:59 IST 2019
Your fortune for today is:
Your love life will be happy and harmonious.
abhigyan@abhigyan-samsung:~$ cd /
abhigyan@abhigyan-samsung:/$ cd boot
abhigyan@abhigyan-samsung:/boot$ pwd
/boot
abhigyan@abhigyan-samsung:/boot$ ls
total 153M
-rw-r--r-- 1 root root 214K Jun 27 12:34 config-4.18.0-25-generic
-rw-r--r-- 1 root root 220K Jul 29 21:16 config-5.0.0-23-generic
-rw-r--r-- 1 root root 220K Aug  1 18:04 config-5.0.0-25-generic
drwxr-xr-x 5 root root 4.0K Aug 20 18:35 grub
-rw-r--r-- 1 root root 39M Aug  6 16:48 initrd.img-4.18.0-25-generic
-rw-r--r-- 1 root root 39M Aug 14 10:12 initrd.img-5.0.0-23-generic
-rw-r--r-- 1 root root 39M Aug 20 18:34 initrd.img-5.0.0-25-generic
-rw-r--r-- 1 root root 179K Jan 28 2016 memtest86+.bin
-rw-r--r-- 1 root root 181K Jan 28 2016 memtest86+.elf
-rw-r--r-- 1 root root 181K Jan 28 2016 memtest86+_multiboot.bin
-rw----- 1 root root 4.1M Jun 27 12:34 System.map-4.18.0-25-generic
-rw----- 1 root root 4.1M Jul 29 21:16 System.map-5.0.0-23-generic
-rw----- 1 root root 4.1M Aug  1 18:04 System.map-5.0.0-25-generic
-rw----- 1 root root 8.2M Jun 27 10:02 vmlinuz-4.18.0-25-generic
```



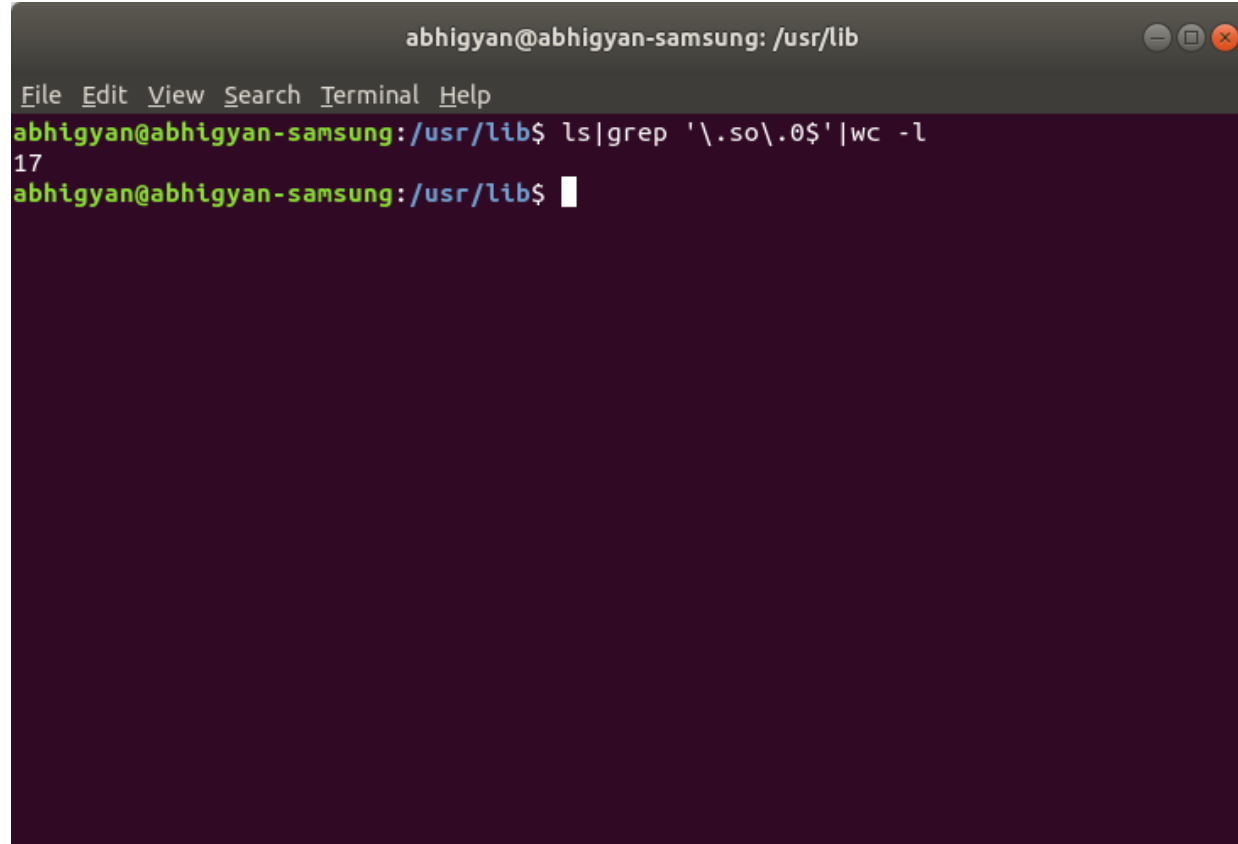
# Homework – Session 3

### 3.1.1. Use “file” command in the /bin directory and see what type of executables are out there.



```
abhigyan@abhigyan-samsung: /bin
File Edit View Search Terminal Help
1ecc4a3fc697e612f54, stripped
abhigyan@abhigyan-samsung:/bin$ file unicode_start
unicode_start: POSIX shell script, ASCII text executable
abhigyan@abhigyan-samsung:/bin$ file fuser
fuser: ELF 64-bit LSB shared object, x86-64, version 1 (SYSV), dynamically linked, interpreter /lib64/ld, for GNU/Linux 3.2.0, BuildID[sha1]=eef67d26122ec0d41b52b16fec746bfb8264ba83, stripped
abhigyan@abhigyan-samsung:/bin$ file lesskey
lesskey: ELF 64-bit LSB shared object, x86-64, version 1 (SYSV), dynamically linked, interpreter /lib64/ld, for GNU/Linux 3.2.0, BuildID[sha1]=a361610abb5a24888cb486c4d322b8a2fdcdf64, stripped
abhigyan@abhigyan-samsung:/bin$ file ln
ln: ELF 64-bit LSB shared object, x86-64, version 1 (SYSV), dynamically linked, interpreter /lib64/ld, for GNU/Linux 3.2.0, BuildID[sha1]=9835b7fefc7318c6736996d066c601dbcb1a1e2, stripped
abhigyan@abhigyan-samsung:/bin$ file loadkeys
loadkeys: ELF 64-bit LSB shared object, x86-64, version 1 (SYSV), dynamically linked, interpreter /lib64/ld, for GNU/Linux 3.2.0, BuildID[sha1]=5908cfde99ad0fe34242c7fe89def41b46cafa8b, stripped
abhigyan@abhigyan-samsung:/bin$ file dash
dash: ELF 64-bit LSB shared object, x86-64, version 1 (SYSV), dynamically linked, interpreter /lib64/ld, for GNU/Linux 3.2.0, BuildID[sha1]=a783260e3a5fe0afdae77417eea7fbf8d645219e, stripped
abhigyan@abhigyan-samsung:/bin$
```

### 3.1.2. Count the number of library files that have their names ending with “.so.0” in /usr/lib directory.



```
abhigyan@abhigyan-samsung: /usr/lib
File Edit View Search Terminal Help
abhigyan@abhigyan-samsung:/usr/lib$ ls|grep '\.so\.$'|wc -l
17
abhigyan@abhigyan-samsung:/usr/lib$
```

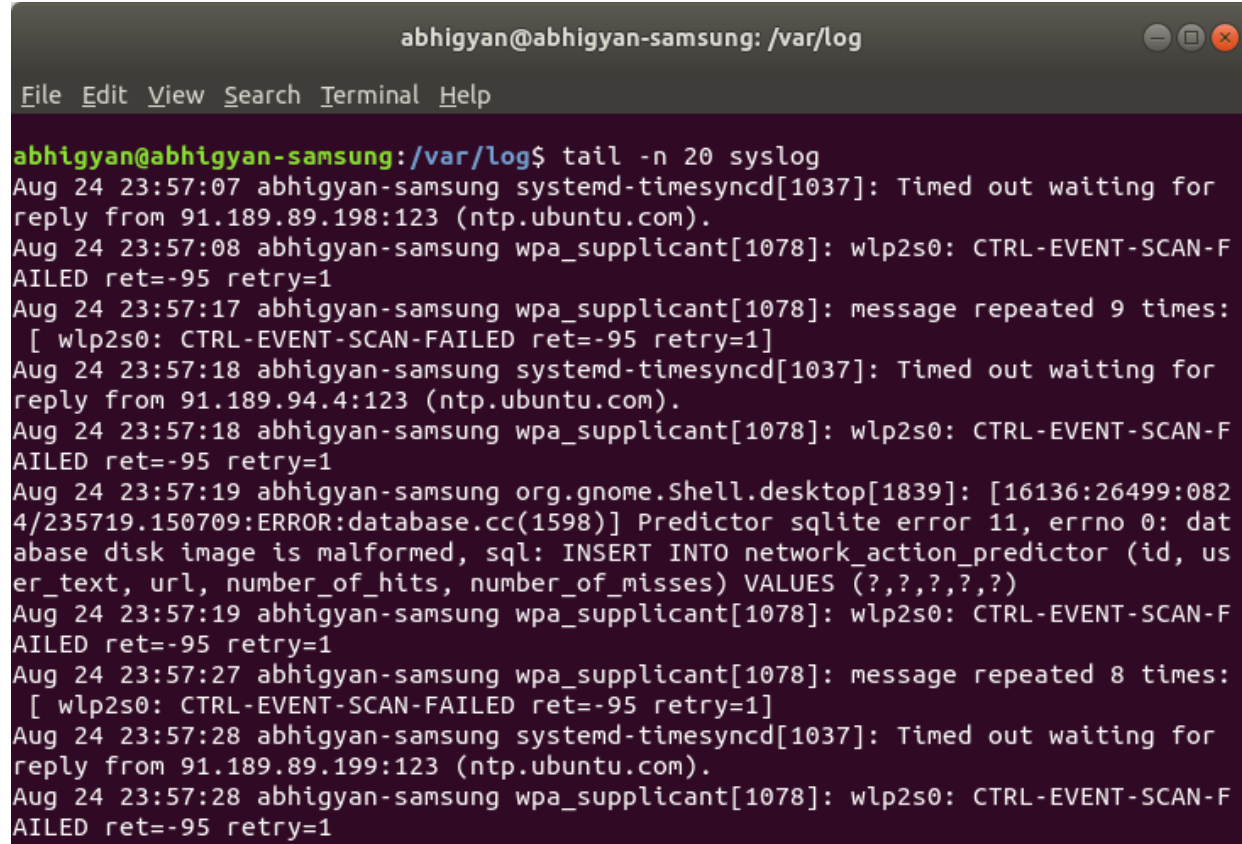
A terminal window with a dark purple background. The title bar shows the user 'abhigyan' on a machine named 'abhigyan-samsung' in the directory '/usr/lib'. The menu bar includes 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. The command prompt shows the user is in the '/usr/lib' directory. The command 'ls|grep '\.so\.\$'|wc -l' is entered and executed, resulting in the output '17'. The prompt is now ready for the next command.

### 3.1.3. Count the number of shell scripts in /bin directory

```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
#!/bin/bash  
c=0;  
x=0;  
for a_file in /bin/*; do  
    if grep -q '#!/bin/sh' <<< cat $a_file; then  
        ((c++));  
    fi  
    if grep -q '#!/bin/bash' <<< cat $a_file; then  
        ((c++));  
    fi  
    if grep -q '#!/bin/dash' <<< cat $a_file; then  
        ((c++));  
    fi  
done;  
echo $c;  
#echo $x;  
~  
~  
~  
~  
"count-scripts.sh" 19L, 272C 1,1 All
```

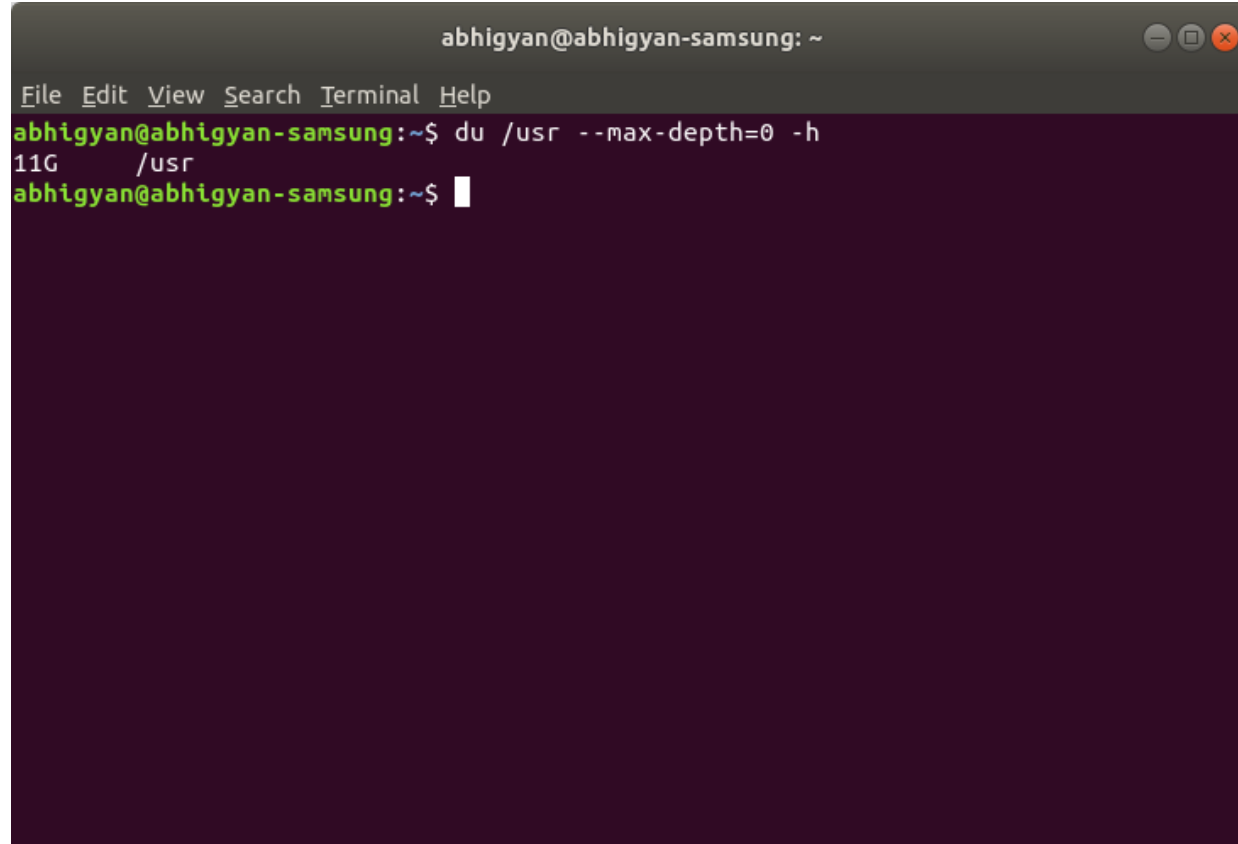
```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
abhigyan@abhigyan-samsung:~$ ./count-scripts.sh  
27  
abhigyan@abhigyan-samsung:~$
```

### 3.1.4. Explore /var/log folder and see which file is for what purpose. Look at the latest 20 lines of “syslog” and write down what details of system activity is being logged.



```
abhigyan@abhigyan-samsung: /var/log
File Edit View Search Terminal Help
abhigyan@abhigyan-samsung:/var/log$ tail -n 20 syslog
Aug 24 23:57:07 abhigyan-samsung systemd-timesyncd[1037]: Timed out waiting for
reply from 91.189.89.198:123 (ntp.ubuntu.com).
Aug 24 23:57:08 abhigyan-samsung wpa_supplicant[1078]: wlp2s0: CTRL-EVENT-SCAN-F
AILED ret=-95 retry=1
Aug 24 23:57:17 abhigyan-samsung wpa_supplicant[1078]: message repeated 9 times:
[ wlp2s0: CTRL-EVENT-SCAN-FAILED ret=-95 retry=1]
Aug 24 23:57:18 abhigyan-samsung systemd-timesyncd[1037]: Timed out waiting for
reply from 91.189.94.4:123 (ntp.ubuntu.com).
Aug 24 23:57:18 abhigyan-samsung wpa_supplicant[1078]: wlp2s0: CTRL-EVENT-SCAN-F
AILED ret=-95 retry=1
Aug 24 23:57:19 abhigyan-samsung org.gnome.Shell.desktop[1839]: [16136:26499:082
4/235719.150709:ERROR:database.cc(1598)] Predictor sqlite error 11, errno 0: dat
abase disk image is malformed, sql: INSERT INTO network_action_predictor (id, us
er_text, url, number_of_hits, number_of_misses) VALUES (?, ?, ?, ?, ?)
Aug 24 23:57:19 abhigyan-samsung wpa_supplicant[1078]: wlp2s0: CTRL-EVENT-SCAN-F
AILED ret=-95 retry=1
Aug 24 23:57:27 abhigyan-samsung wpa_supplicant[1078]: message repeated 8 times:
[ wlp2s0: CTRL-EVENT-SCAN-FAILED ret=-95 retry=1]
Aug 24 23:57:28 abhigyan-samsung systemd-timesyncd[1037]: Timed out waiting for
reply from 91.189.89.199:123 (ntp.ubuntu.com).
Aug 24 23:57:28 abhigyan-samsung wpa_supplicant[1078]: wlp2s0: CTRL-EVENT-SCAN-F
AILED ret=-95 retry=1
```

### 3.1.5. Estimate how much storage is occupied by your /usr directory using a command

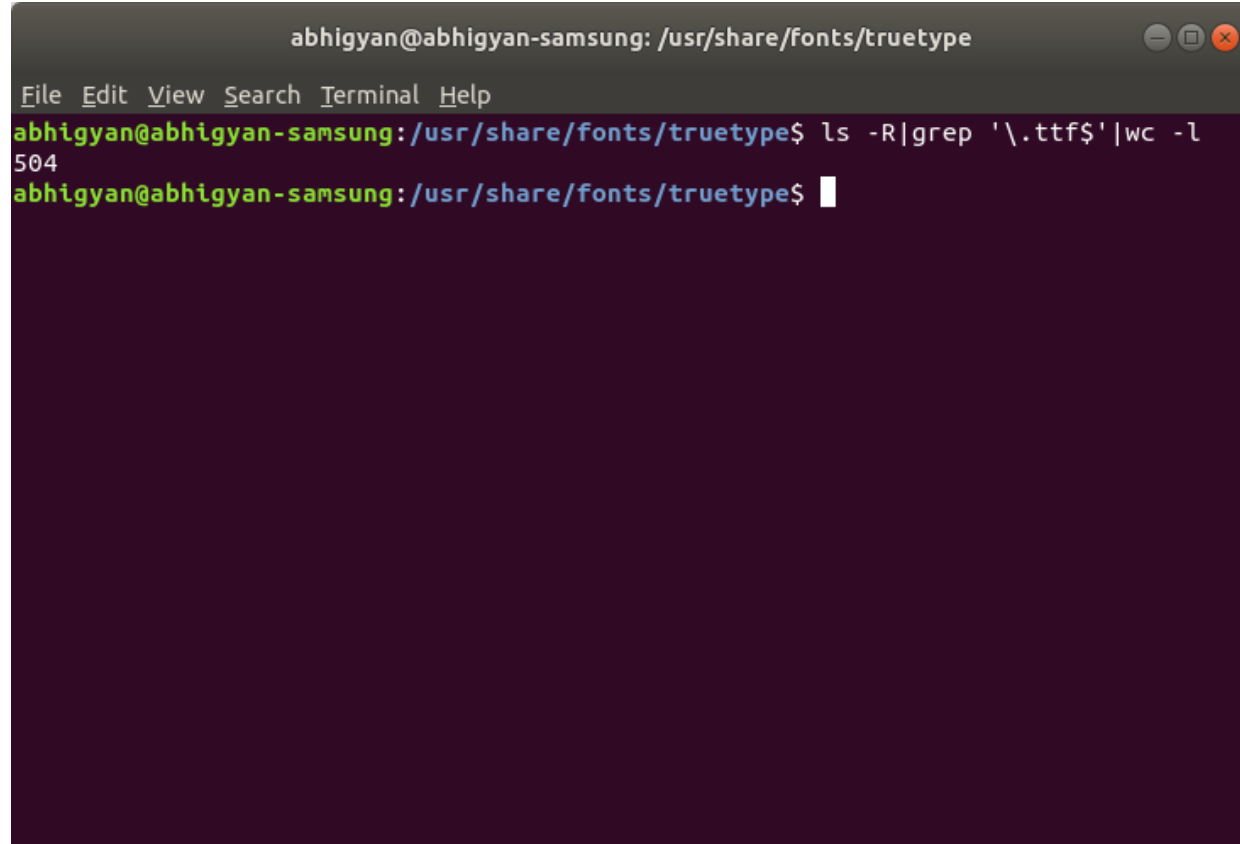


```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
abhigyan@abhigyan-samsung:~$ du /usr --max-depth=0 -h  
11G    /usr  
abhigyan@abhigyan-samsung:~$
```

--max-depth=0  
prevents  
recursive  
searching into  
sub-directories

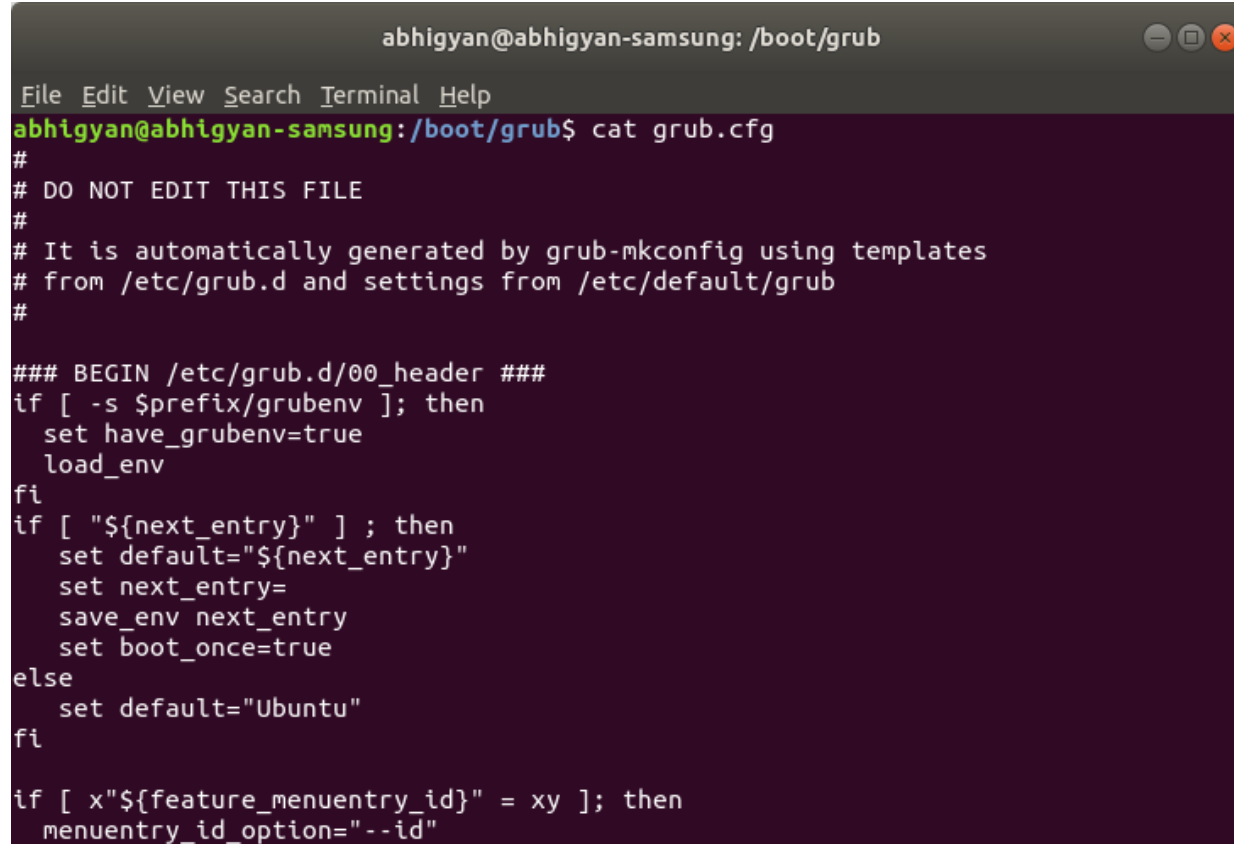
-h presents the  
size in human  
readable  
format

3.1.6. Go to `/usr/share/fonts/truetype` folder. Using the recursive option of `ls` command, find out how many truetype fonts (ending with `ttf`) are out there in your system.

A terminal window titled 'abhigyan@abhigyan-samsung: /usr/share/fonts/truetype' with standard window controls. The terminal shows the command 'ls -R|grep '\.ttf\$'|wc -l' being executed, which returns the output '504'. The prompt is then ready for the next command.

```
abhigyan@abhigyan-samsung: /usr/share/fonts/truetype
File Edit View Search Terminal Help
abhigyan@abhigyan-samsung:/usr/share/fonts/truetype$ ls -R|grep '\.ttf$'|wc -l
504
abhigyan@abhigyan-samsung:/usr/share/fonts/truetype$
```

3.2.1. When the machine is booting, there is a boot menu shown. The items listed in the boot menu are part of so-called grub menu. Which file has this configuration? Convince yourself that the boot menu shown for your machine is same as what is listed in the configuration file.

A terminal window titled 'abhigyan@abhigyan-samsung: /boot/grub' with a menu bar (File, Edit, View, Search, Terminal, Help). The command 'cat grub.cfg' has been executed, displaying the following text:

```
abhigyan@abhigyan-samsung:/boot/grub$ cat grub.cfg
#
# DO NOT EDIT THIS FILE
#
# It is automatically generated by grub-mkconfig using templates
# from /etc/grub.d and settings from /etc/default/grub
#

### BEGIN /etc/grub.d/00_header ###
if [ -s $prefix/grubenv ]; then
  set have_grubenv=true
  load_env
fi
if [ "${next_entry}" ] ; then
  set default="${next_entry}"
  set next_entry=
  save_env next_entry
  set boot_once=true
else
  set default="Ubuntu"
fi

if [ x"${feature_menuentry_id}" = xy ]; then
  menuentry_id_option="--id"
```

The file:

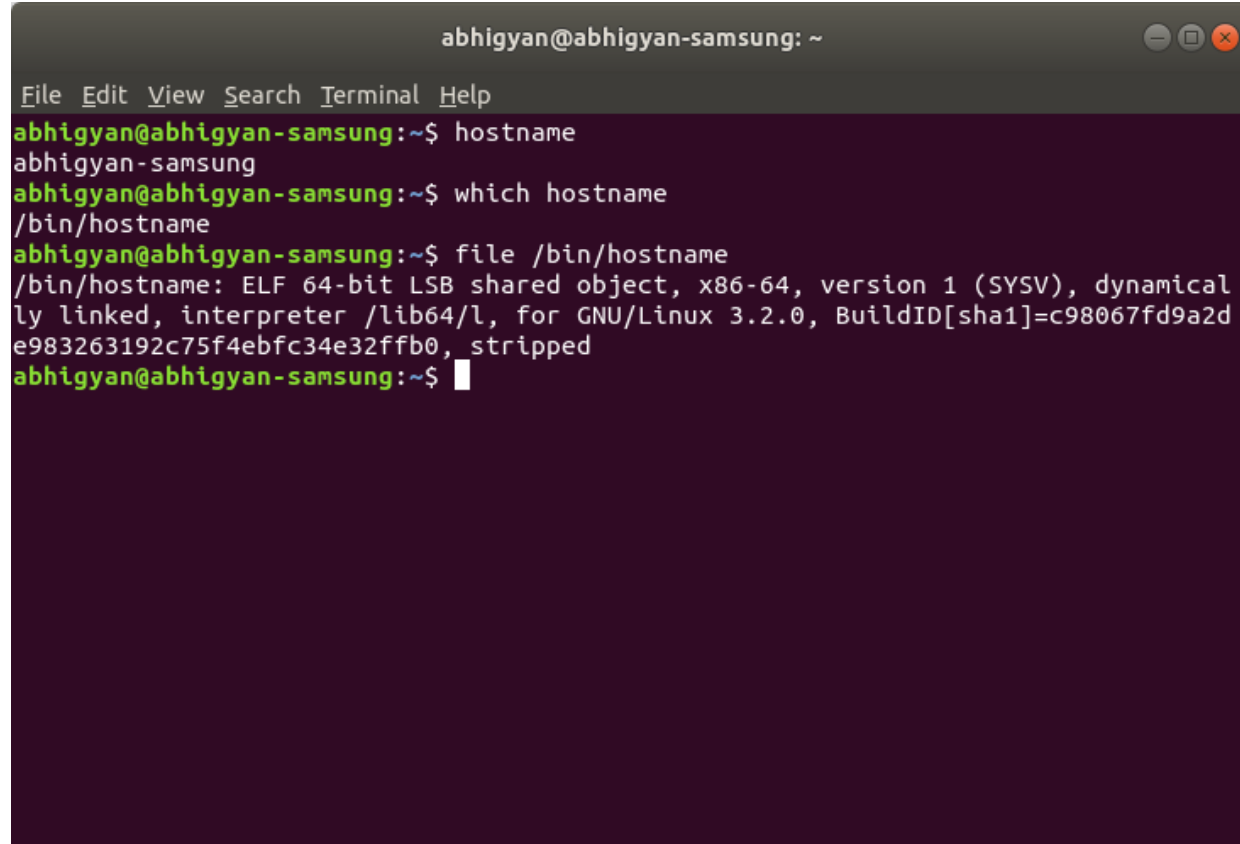
/boot/grub/grub.cfg

contains the information on which options are shown in the grub bootloader, as it contains menu entries for each of the items that are shown in the grub menu.

*GNU Grub => GNU GRand Unified Bootloader*



### 3.2.2. Which file has the name of the host (the name of your machine) written down?



```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
abhigyan@abhigyan-samsung:~$ hostname  
abhigyan-samsung  
abhigyan@abhigyan-samsung:~$ which hostname  
/bin/hostname  
abhigyan@abhigyan-samsung:~$ file /bin/hostname  
/bin/hostname: ELF 64-bit LSB shared object, x86-64, version 1 (SYSV), dynamical  
ly linked, interpreter /lib64/l, for GNU/Linux 3.2.0, BuildID[sha1]=c98067fd9a2d  
e983263192c75f4ebfc34e32ffb0, stripped  
abhigyan@abhigyan-samsung:~$
```

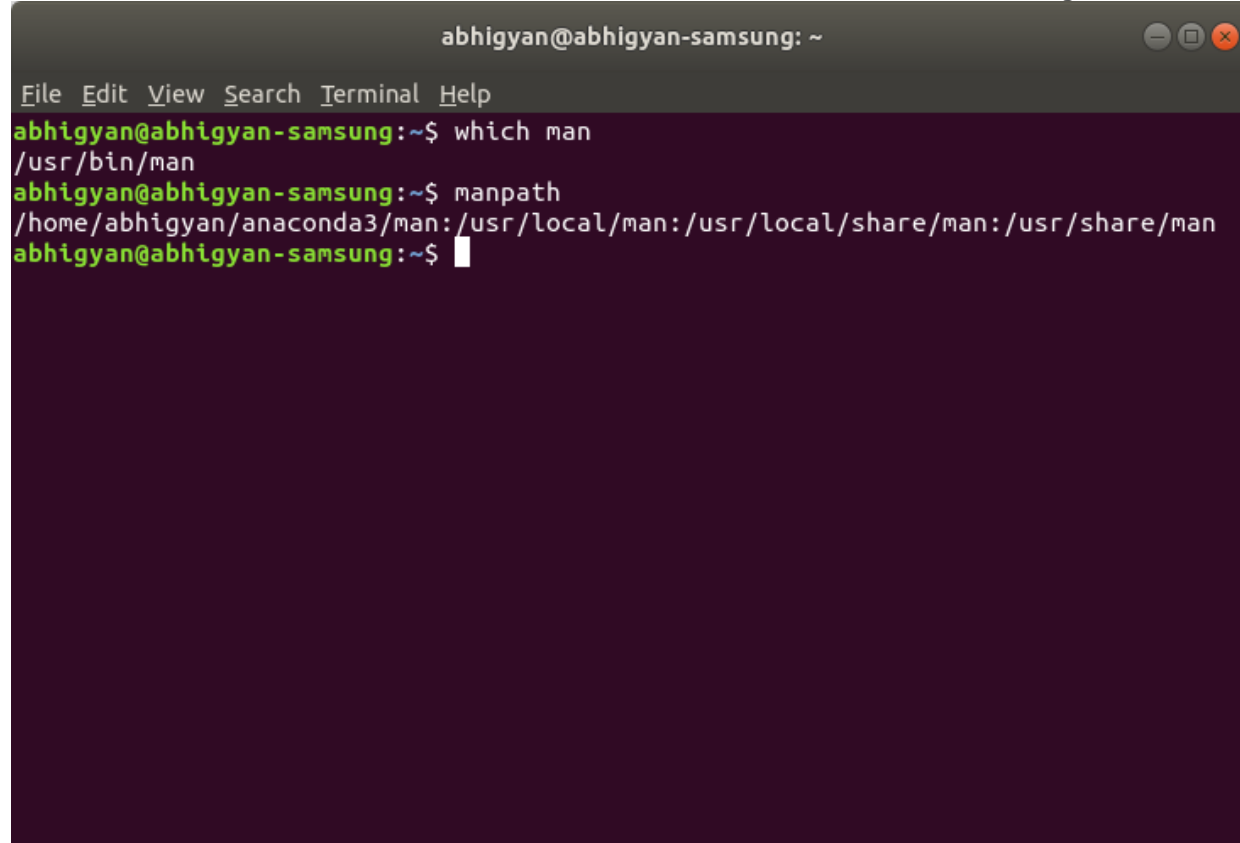
The file:

/bin/hostname

contains the  
information on the  
name of the host.

It is not a POSIX  
shell script, rather it  
is an ELF 64-bit  
LSB shared object.

### 3.2.3. There is so much of information that the “man” command shows us about commands. Where is all this information stored in the system?



```
abhigyan@abhigyan-samsung: ~  
File Edit View Search Terminal Help  
abhigyan@abhigyan-samsung:~$ which man  
/usr/bin/man  
abhigyan@abhigyan-samsung:~$ manpath  
/home/abhigyan/anaconda3/man:/usr/local/man:/usr/local/share/man:/usr/share/man  
abhigyan@abhigyan-samsung:~$
```

The file:

/usr/bin/man

Is the command that displays the respective manual page, while the actual information is stored in the directories:

/usr/local/man  
/usr/local/share/man  
/usr/share/man  
/home/abhigyan/anaconda3/man

3.2.4. When you compile a c program, you often use “-lm” to link the math library. This library file is typically named “libm.so.X” where X is a number. Where is this file located in your system?

```
abhigyan@abhigyan-samsung: ~/Desktop
File Edit View Search Terminal Help
abhigyan@abhigyan-samsung:/$ find / -iname *libm.so* -type f > ~/Desktop/found.txt 2> ~/Desktop/err.txt
abhigyan@abhigyan-samsung:/$ cd Desktop
bash: cd: Desktop: No such file or directory
abhigyan@abhigyan-samsung:/$ cd ~/Desktop
abhigyan@abhigyan-samsung:~/Desktop$ cat found.txt
/usr/lib/x86_64-linux-gnu/libm.so
abhigyan@abhigyan-samsung:~/Desktop$
```

The file “libm.so” is present in the directory:

/usr/lib/x86\_64-linux-gnu/

3.2.5. Type “who” to see which terminal you are logged in. The terminal numbers start with tty. Look at the file in /dev/ folder with same name and the owner of that file. What does that mean?

```
abhigyan@abhigyan-samsung: /dev
File Edit View Search Terminal Help
abhigyan@abhigyan-samsung:/dev$ who
abhigyan tty2          2019-08-25 13:00 (tty2)
abhigyan tty3          2019-08-25 14:56
abhigyan tty4          2019-08-25 15:03
abhigyan@abhigyan-samsung:/dev$ ls -l|grep 'tty2$'
crw--w---- 1 abhigyan tty      4,  2 Aug 25 12:58 tty2
abhigyan@abhigyan-samsung:/dev$ ls -l|grep 'tty3$'
crw----- 1 abhigyan tty      4,  3 Aug 25 14:58 tty3
abhigyan@abhigyan-samsung:/dev$ ls -l|grep 'tty4$'
crw----- 1 abhigyan tty      4,  4 Aug 25 15:03 tty4
abhigyan@abhigyan-samsung:/dev$ ls -l|grep 'tty0$'
crw--w---- 1 root      tty      4,  0 Aug 25 12:58 tty0
abhigyan@abhigyan-samsung:/dev$
```

The ttys in which the user is logged in are owned by that user, while the ttys to which the user has not logged in belong to the root user.