Homework 1

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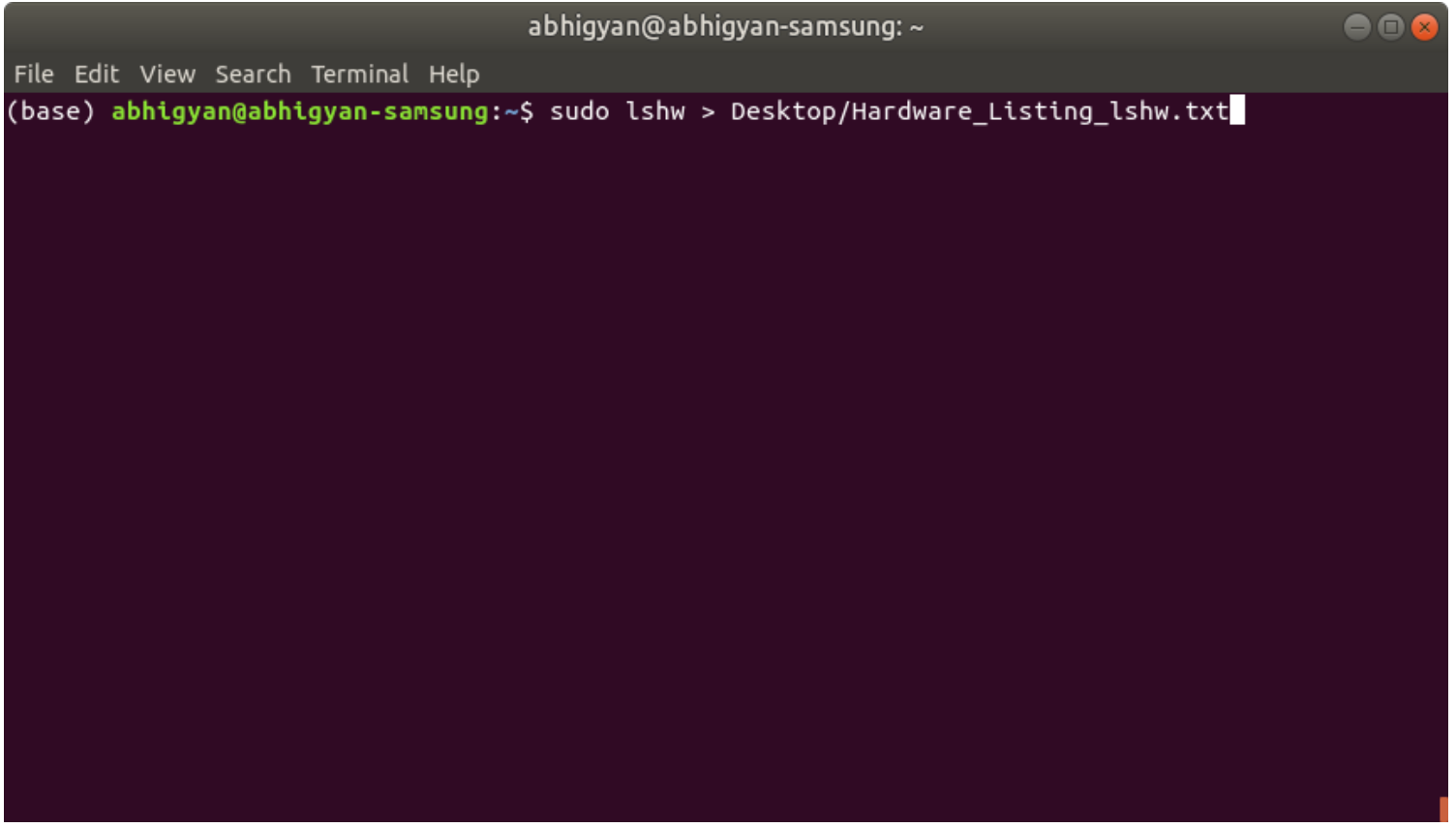
ME19B001

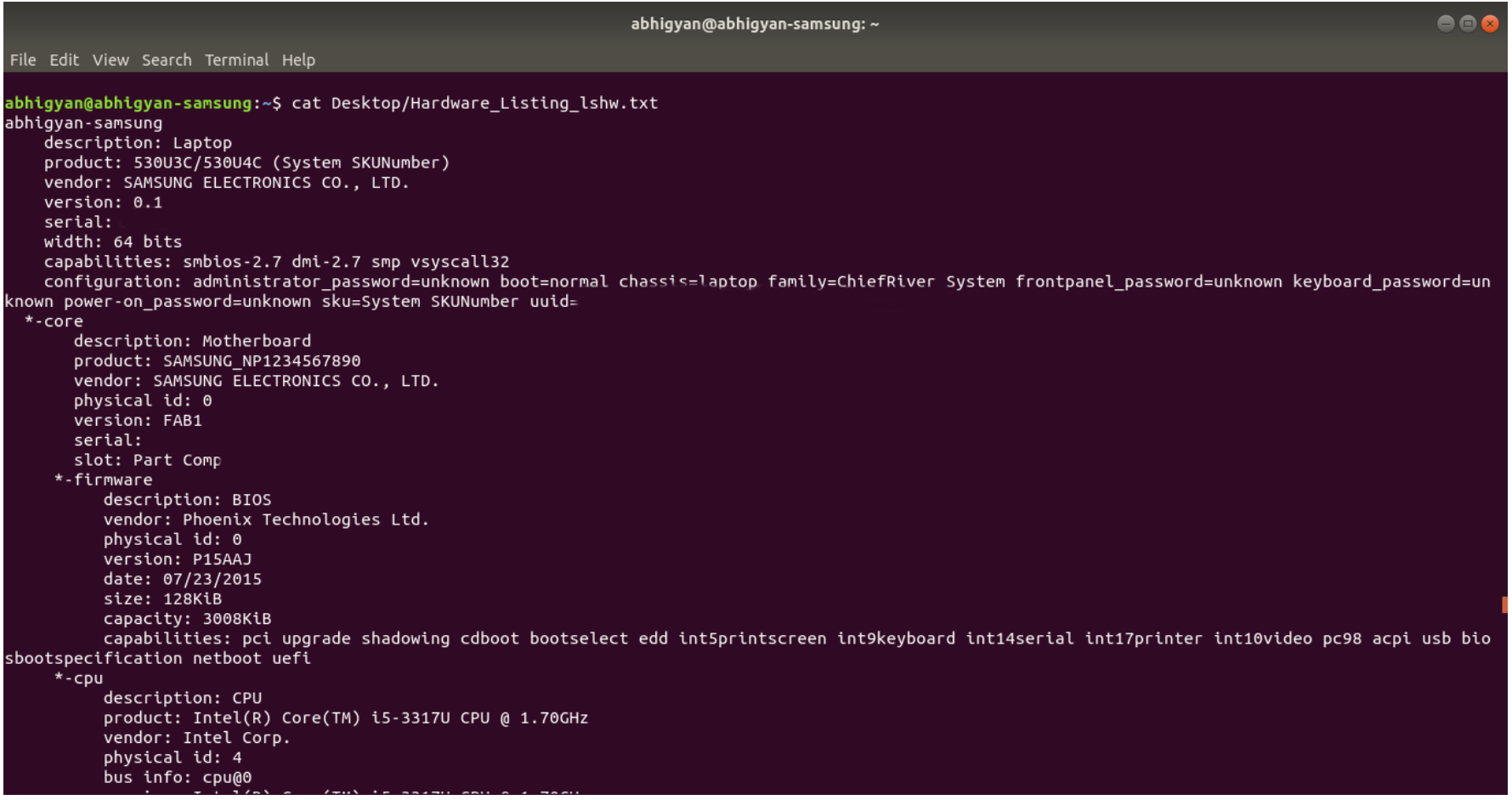
Homework from Session 1

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

Command used:



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



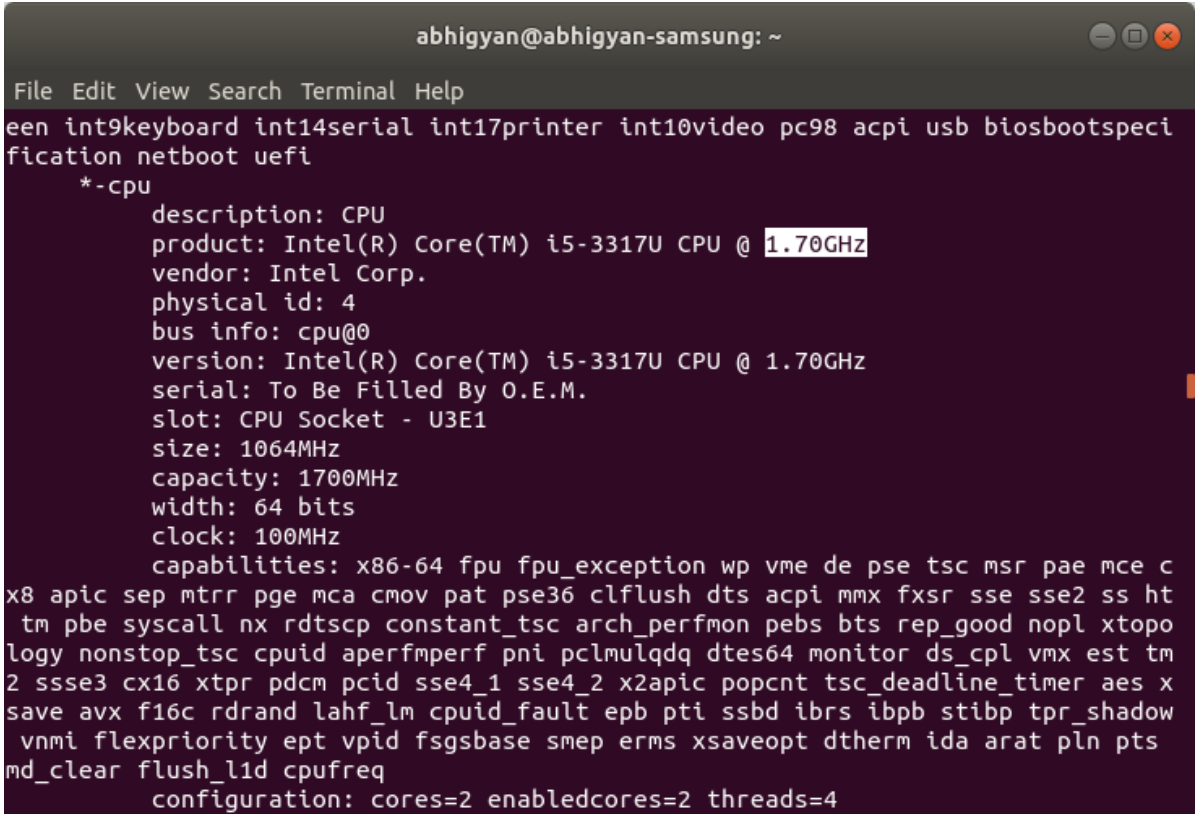
Contents of file Hardware_Listing_lshw.txt

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 tranfer 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 tranfer 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 tranfer. 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:



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 cores)*(2.60 GHz)*(8 FLOPC) = 41.2 GFLOPS

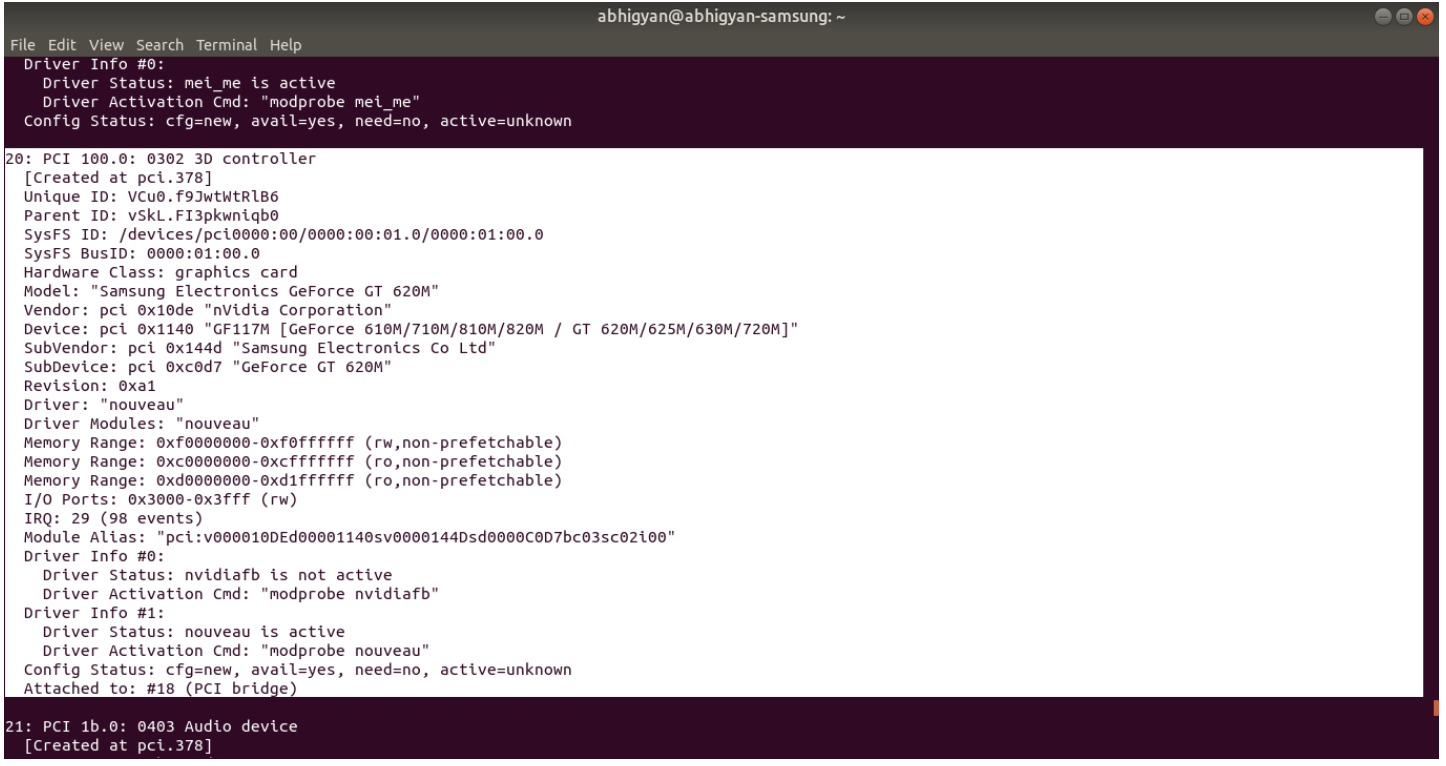
(FLOPC = Floating-point operations per cycle, FLOPS = Floating-point operations per second, prefix G means Giga)

Note: The theoretical FLOPs is given by the formula:
(Number of Cores)*(Average Frequency)*(Operations per cycle) (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:

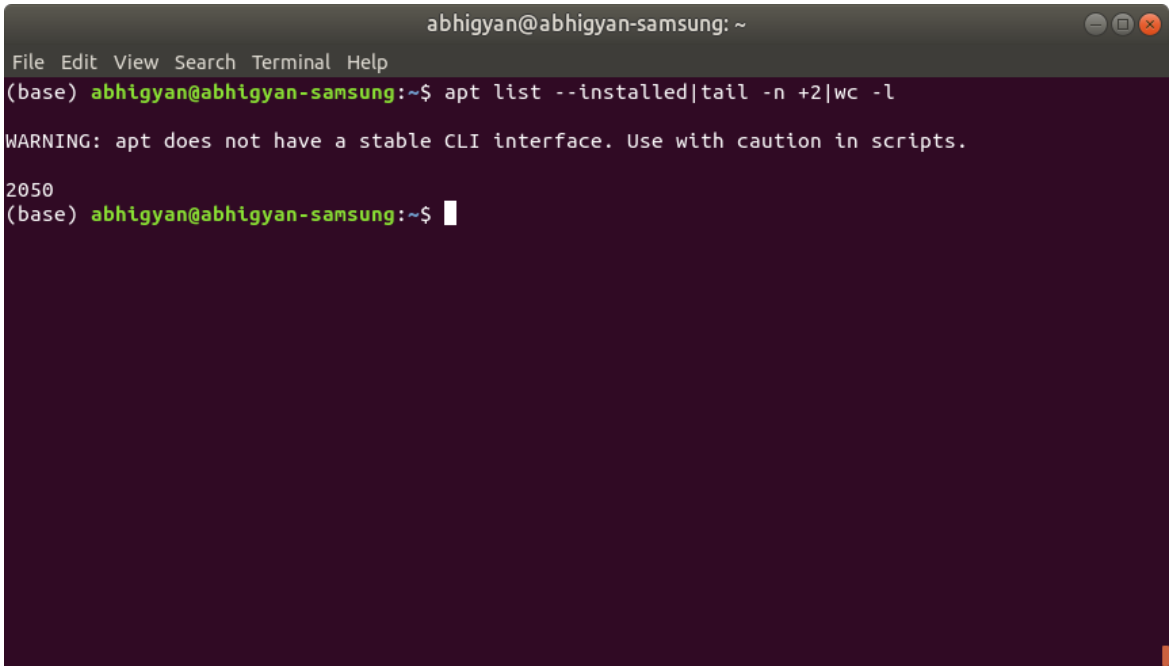
GPU Information from hwinfo:



According to this website, the theoretical performance of this GPU is 240.0 GFLOPS.

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

Command used:

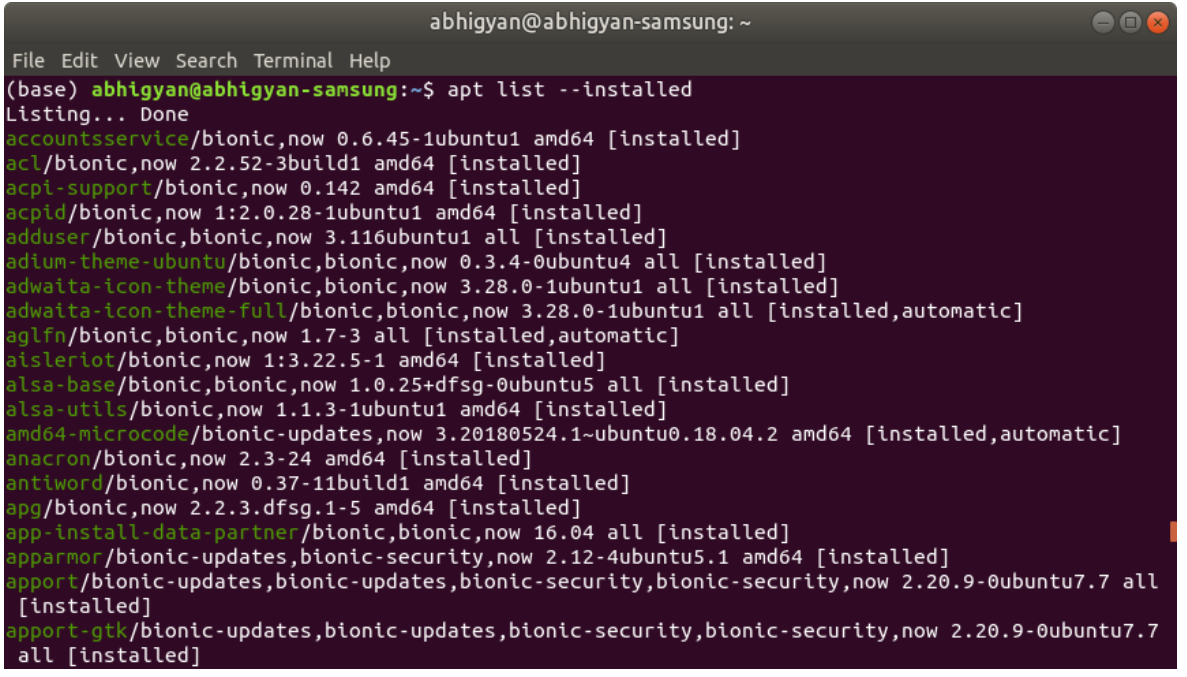


Thus, number of packages installed is **2050**, as the command `wc -l` counts the number of lines in the output of

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

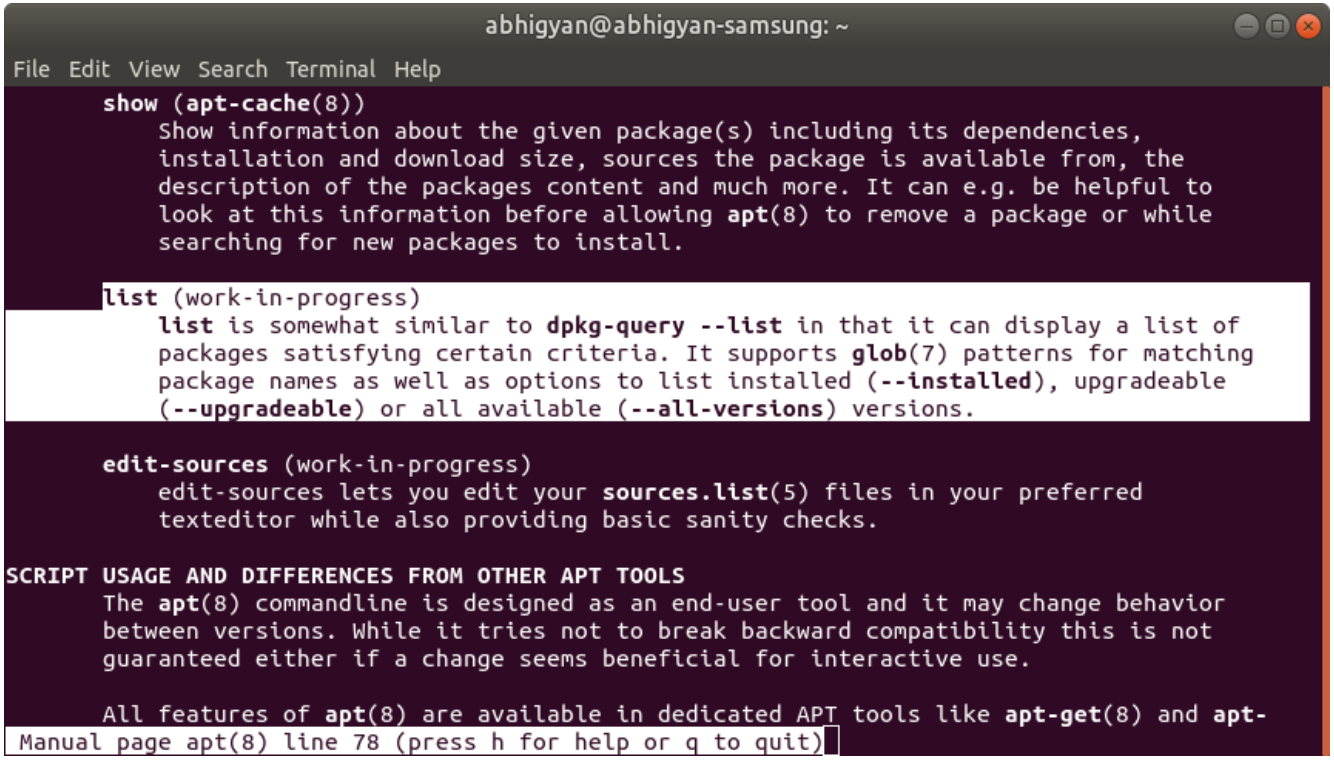
1.4. Count the number of packages installed on your OS.

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



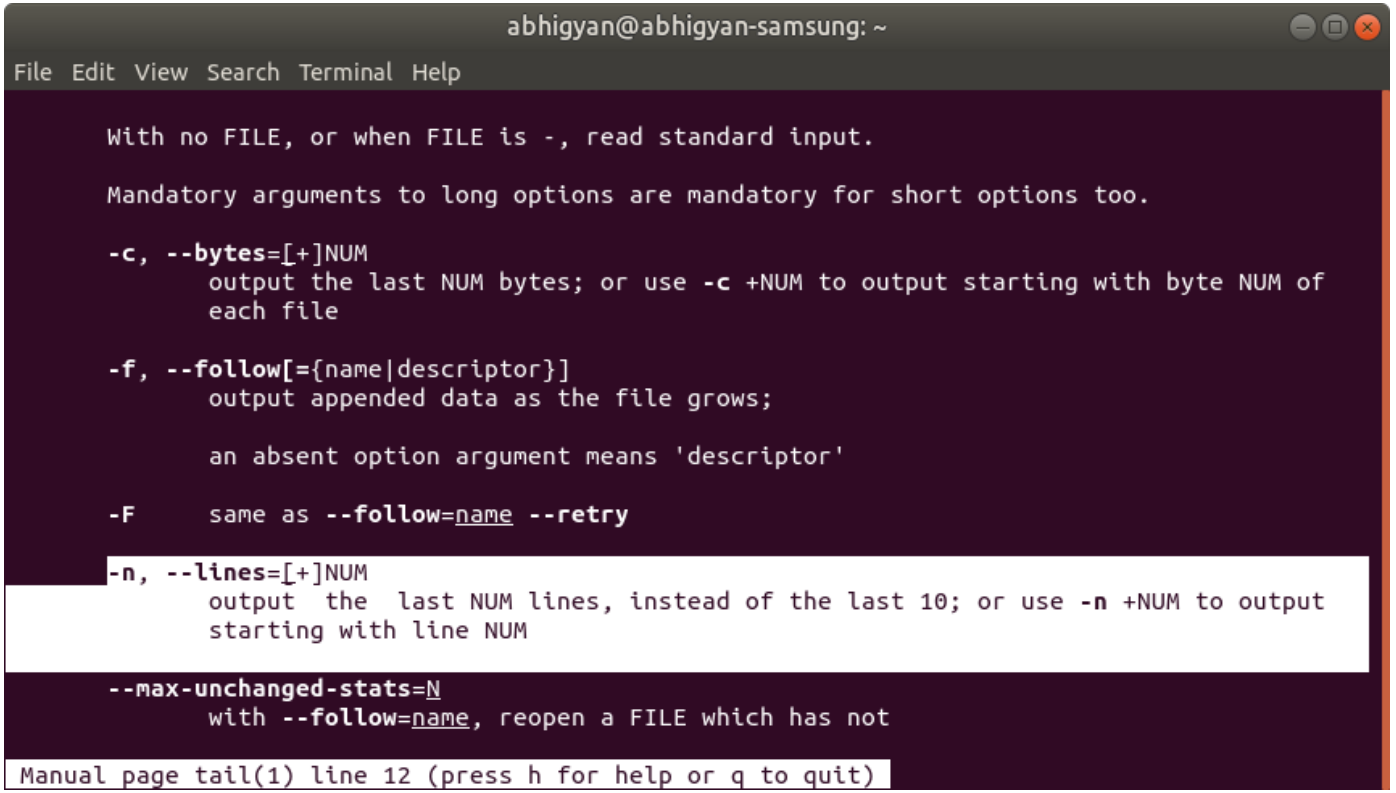
1.4. Count the number of packages installed on your OS.

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

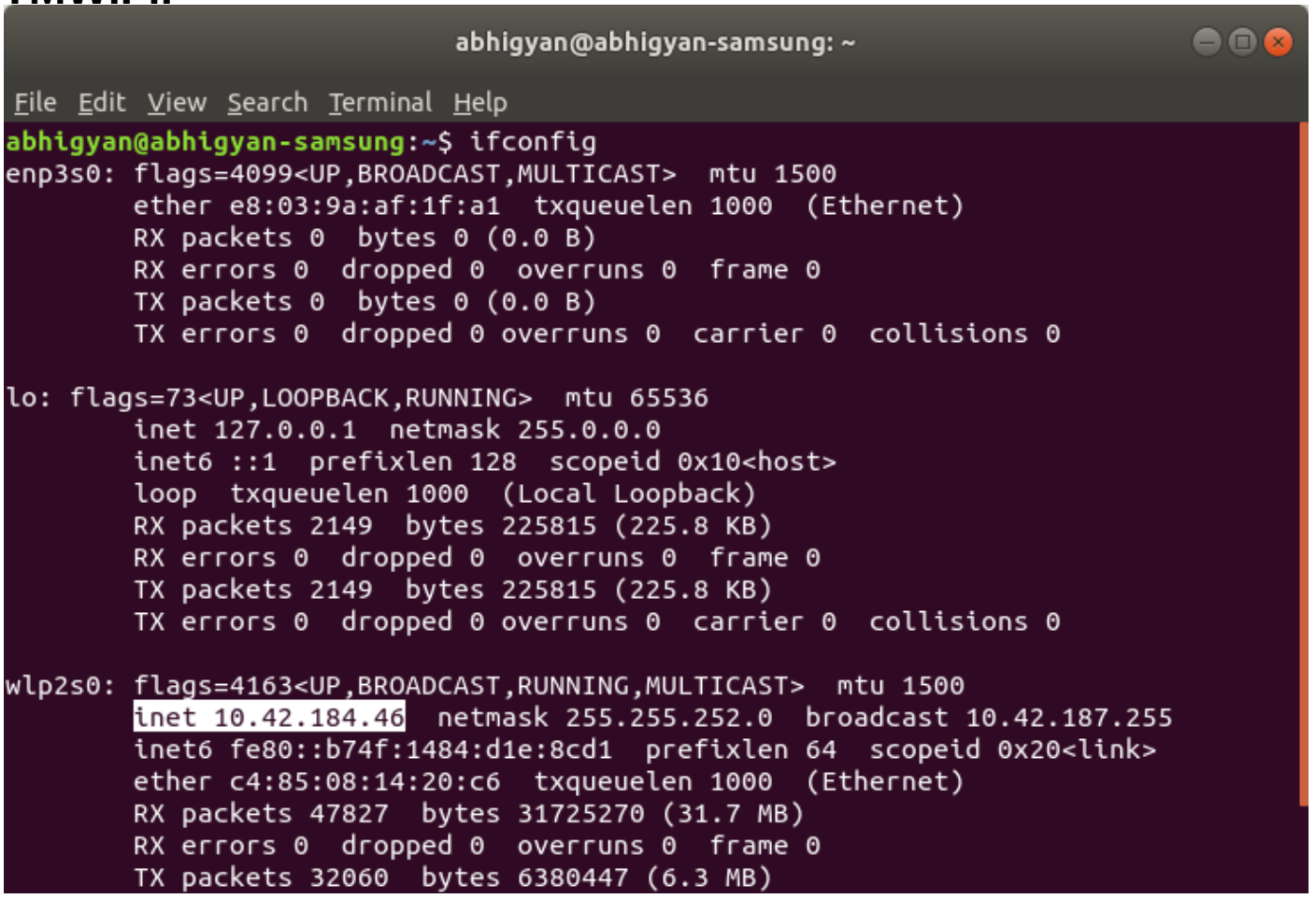


1.4. Count the number of packages installed on your OS.

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



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.

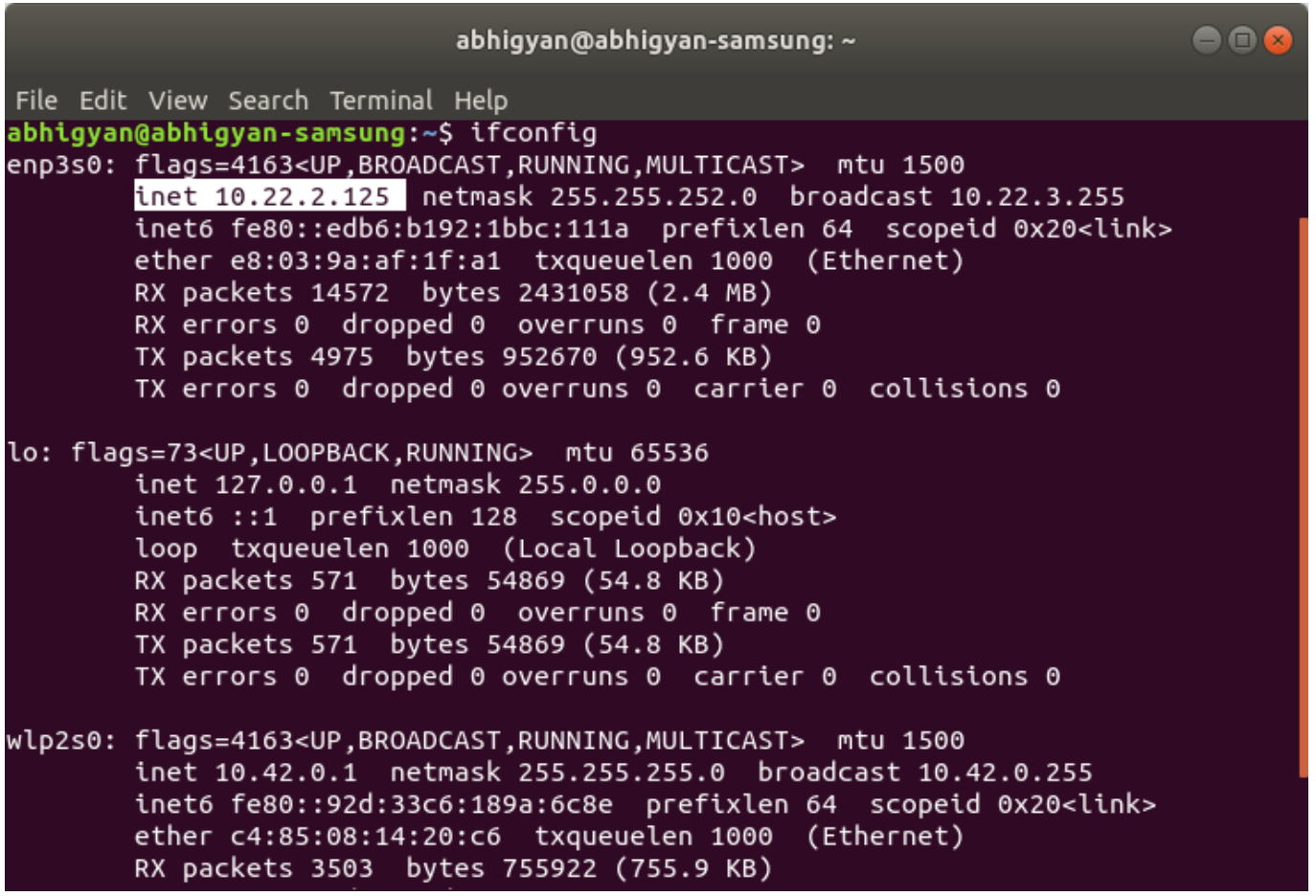


IP with WiFi: 10.42.184.46

(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.



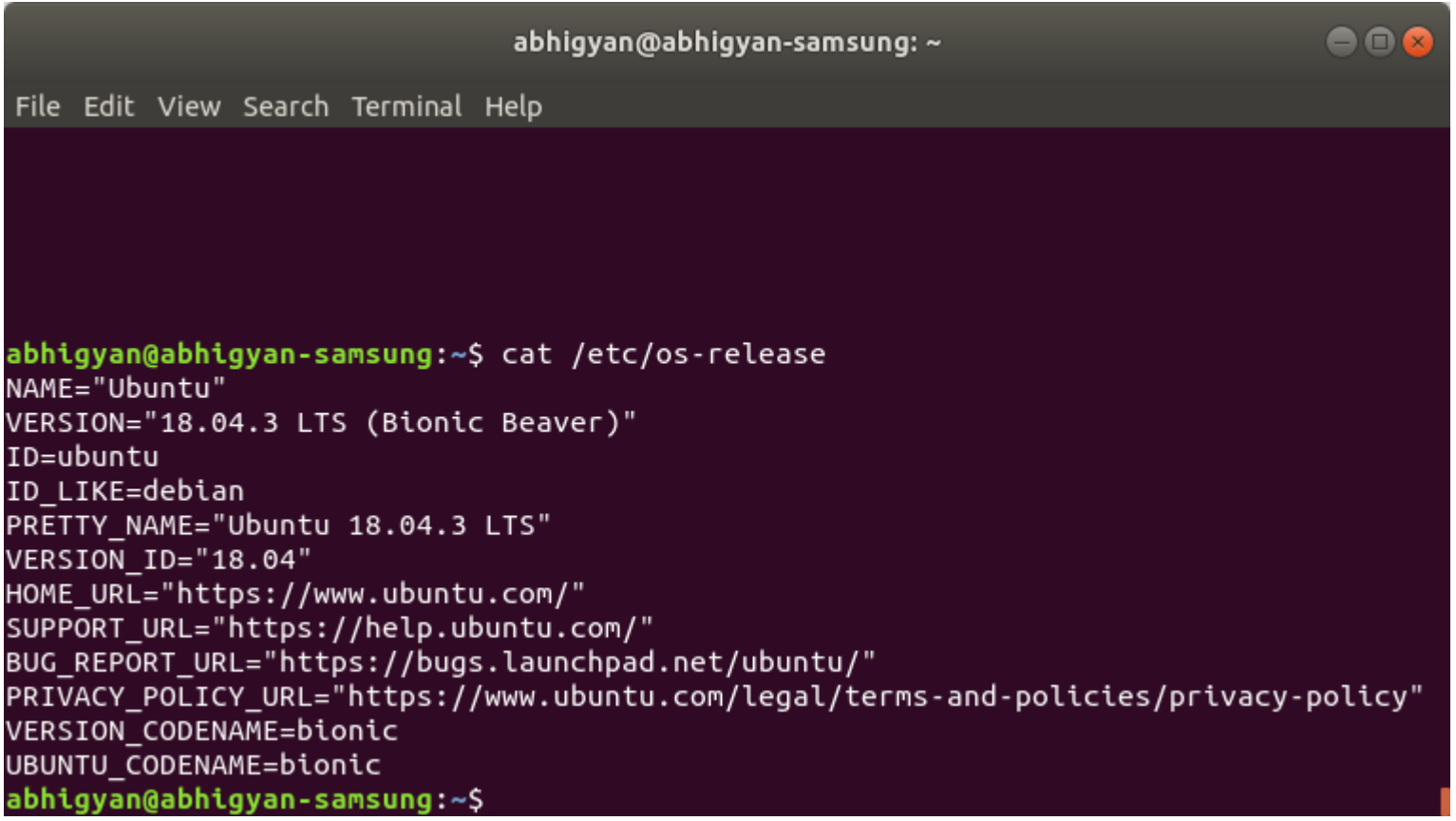
IP with Ethernet: 10.22.2.125

(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?



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?

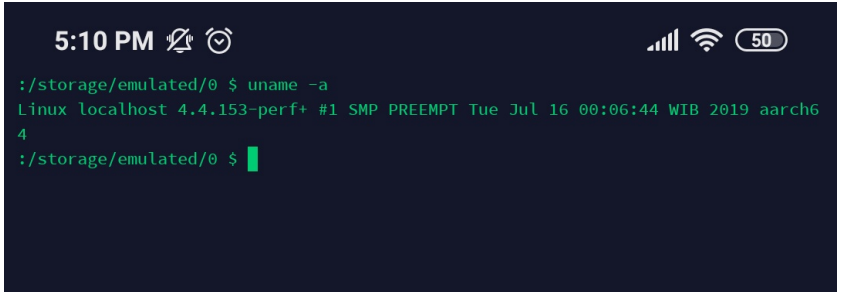
Quoting Wikipedia:

“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.”

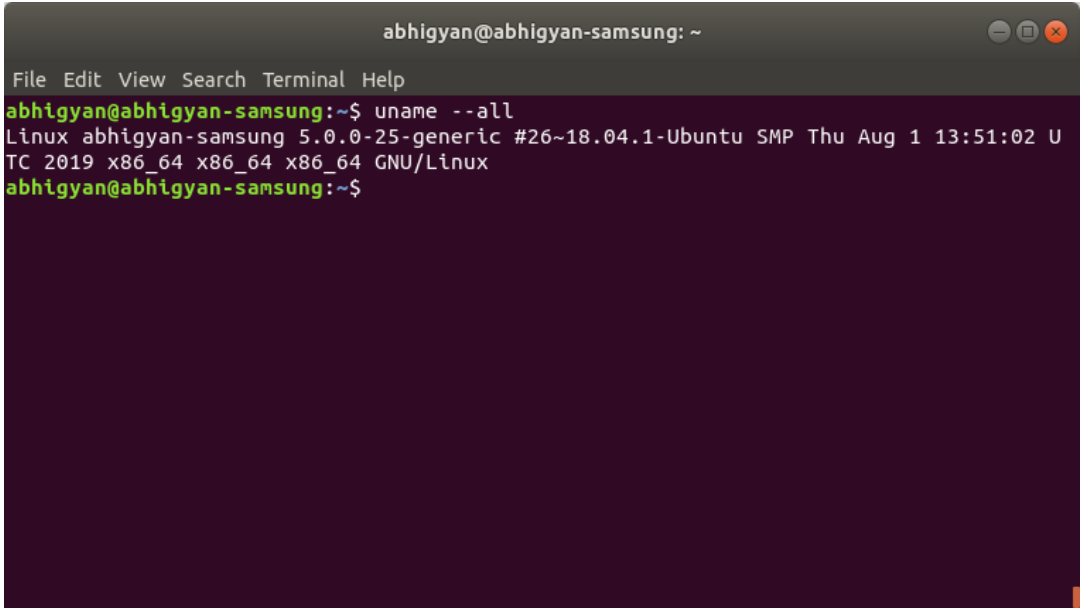
There is a small minority of supercomputers that still use Unix, but basically, *nix(#) basically accounts for everything when it comes to high-performance computing

#*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.



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

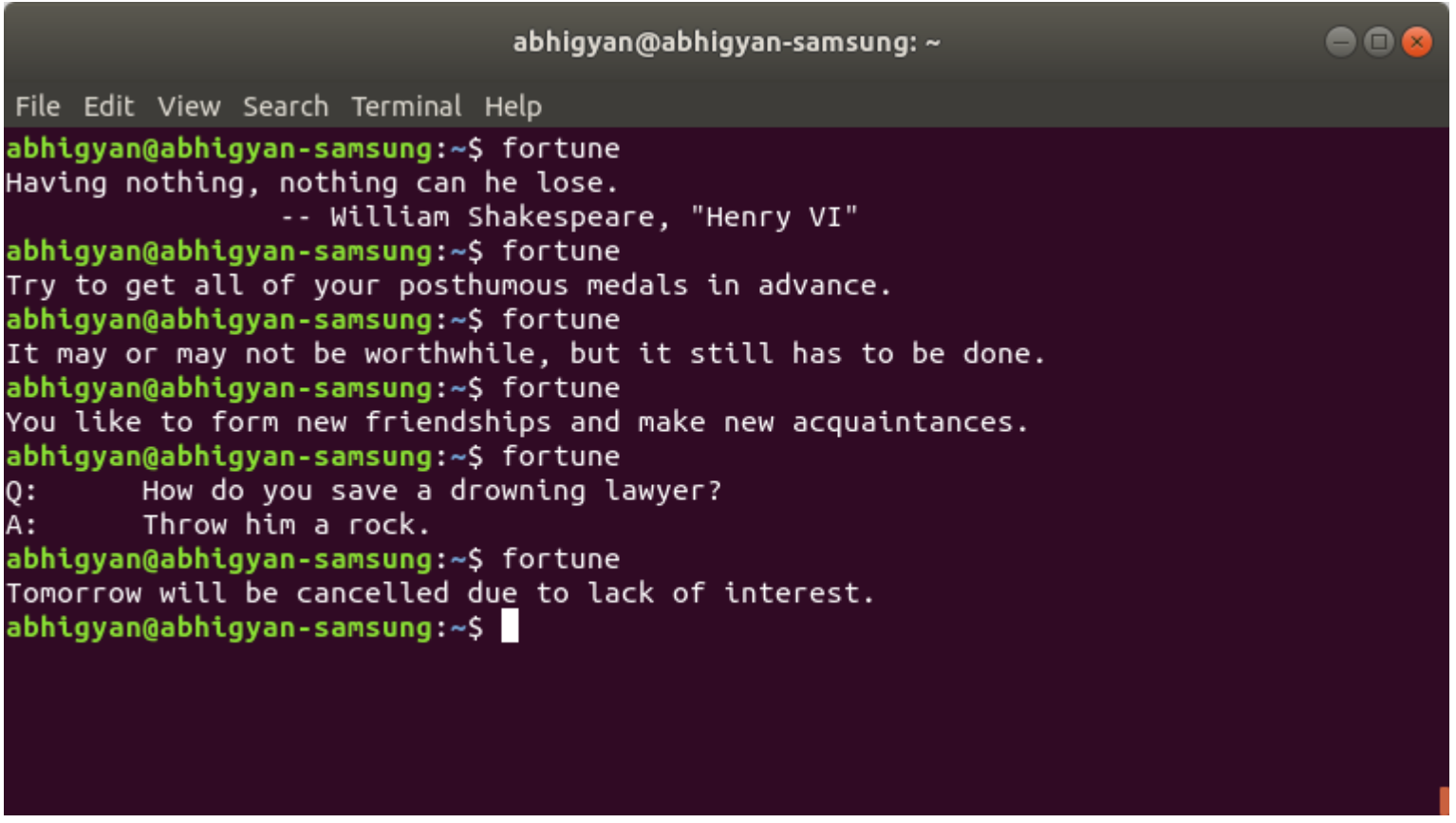


On Ubuntu Laptop using gnome-terminal, we find the Linux kernel version is 5.0.0-25-generic

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 :)



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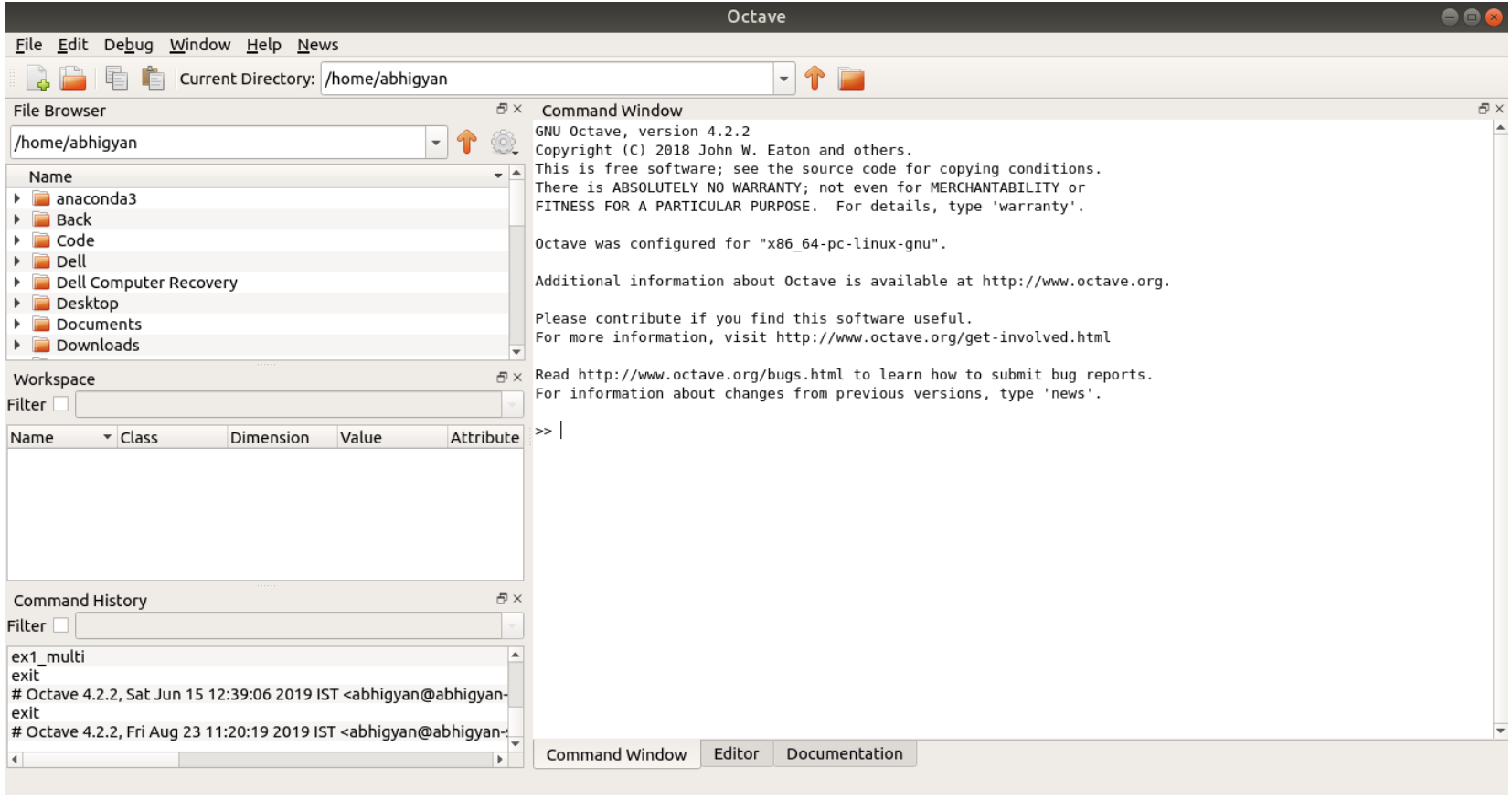
octave

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



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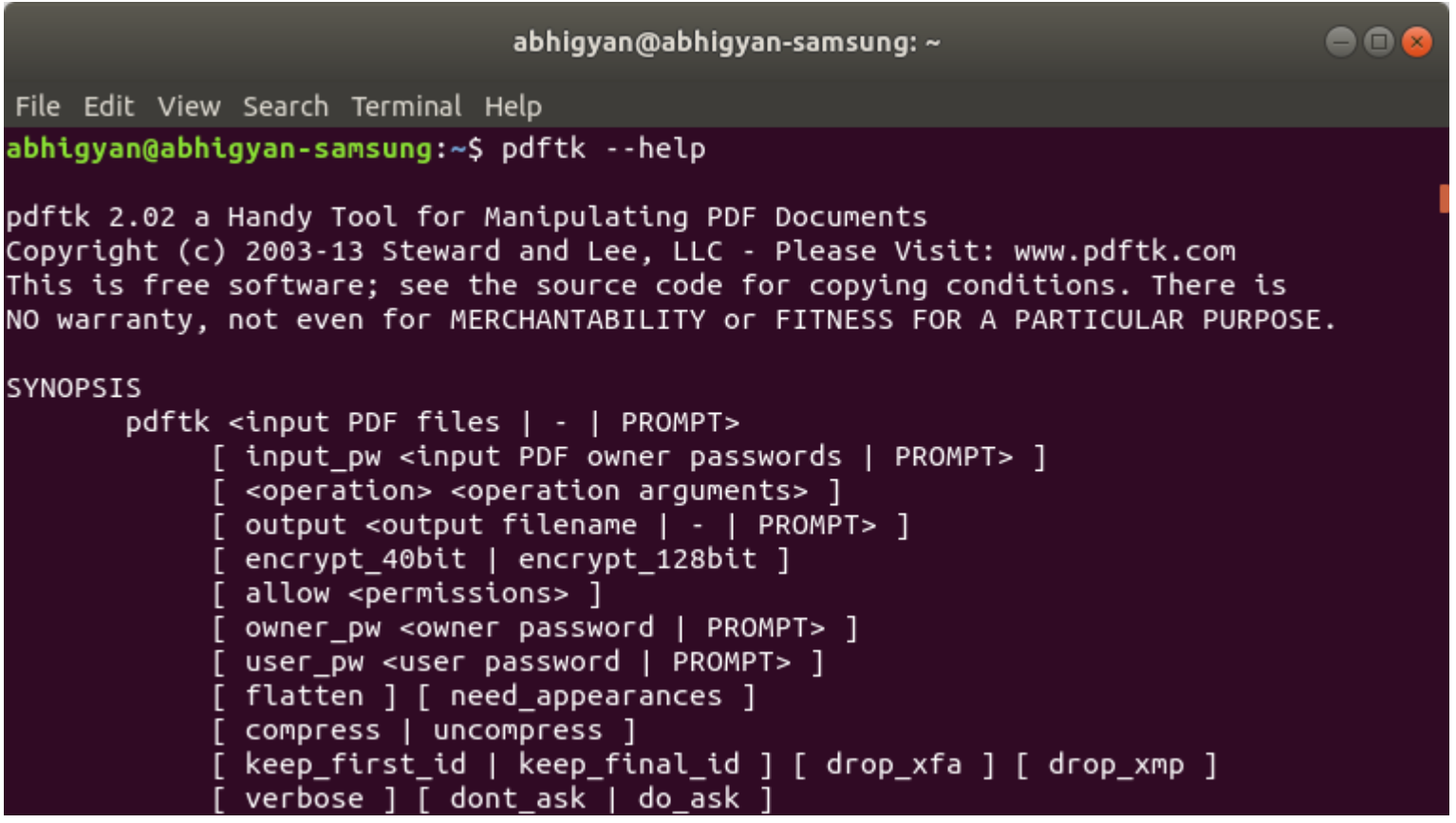
pdftk

Open-source toolkit to modify and make PDFs



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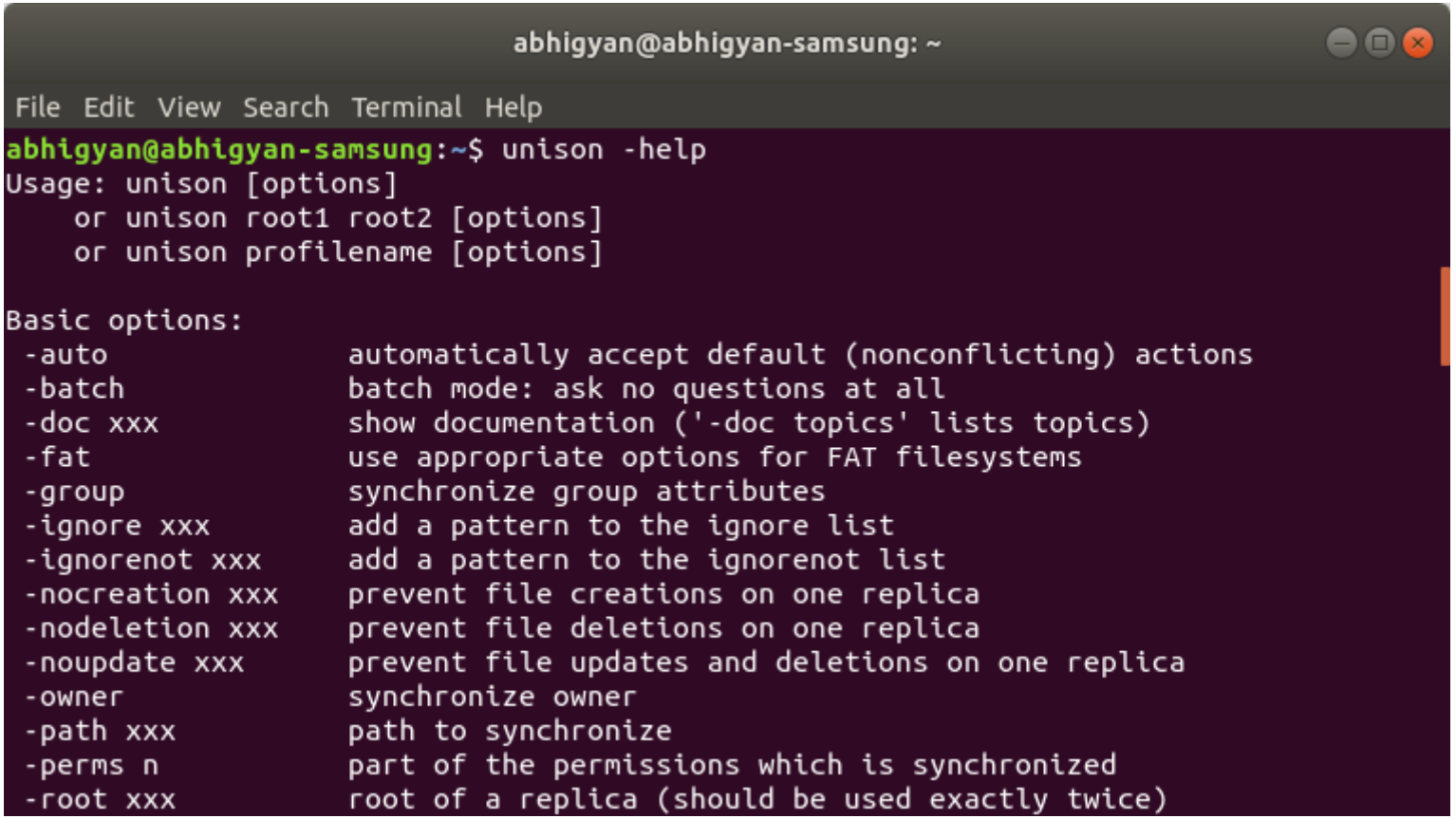
unison

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



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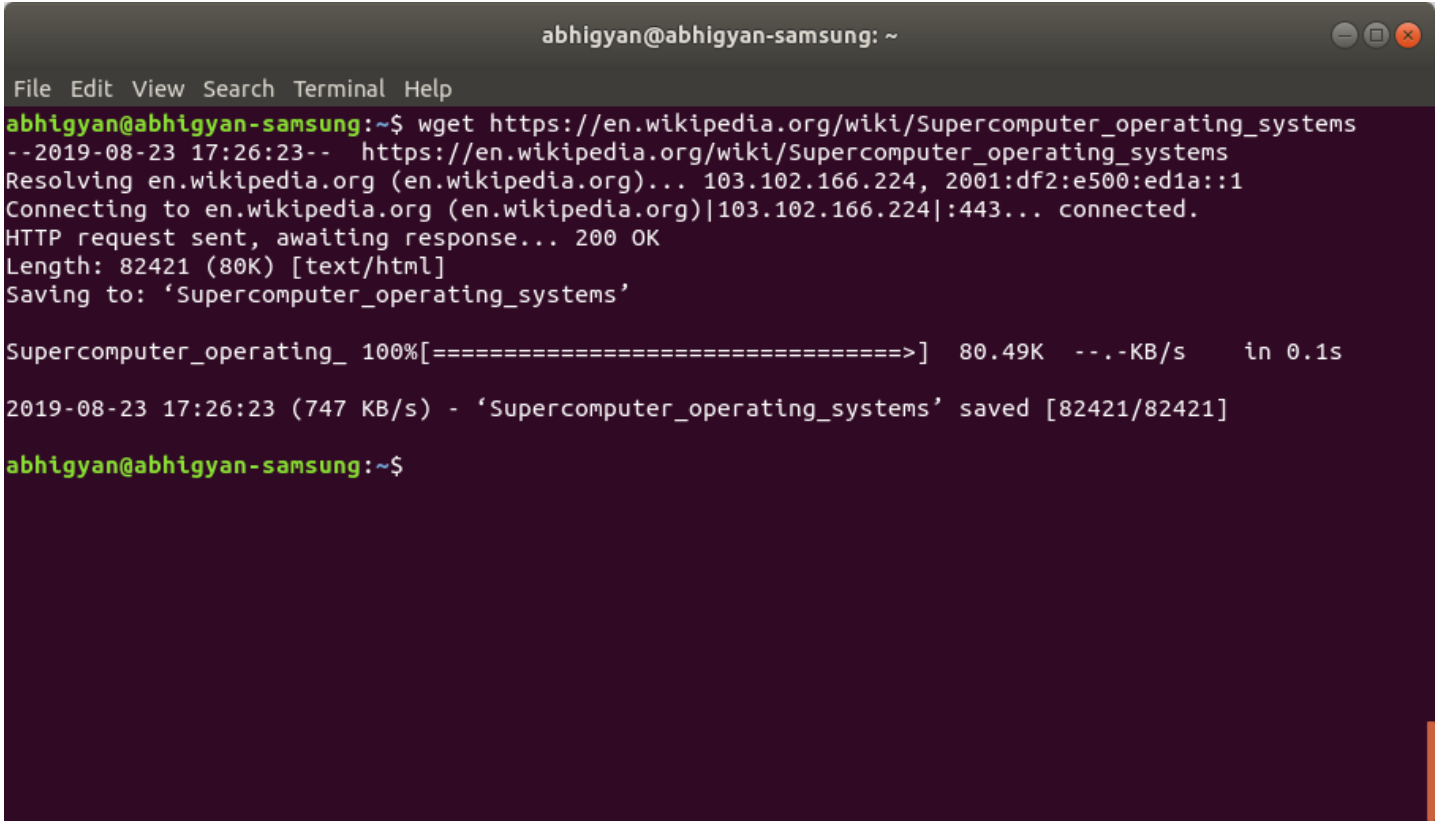
wget

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



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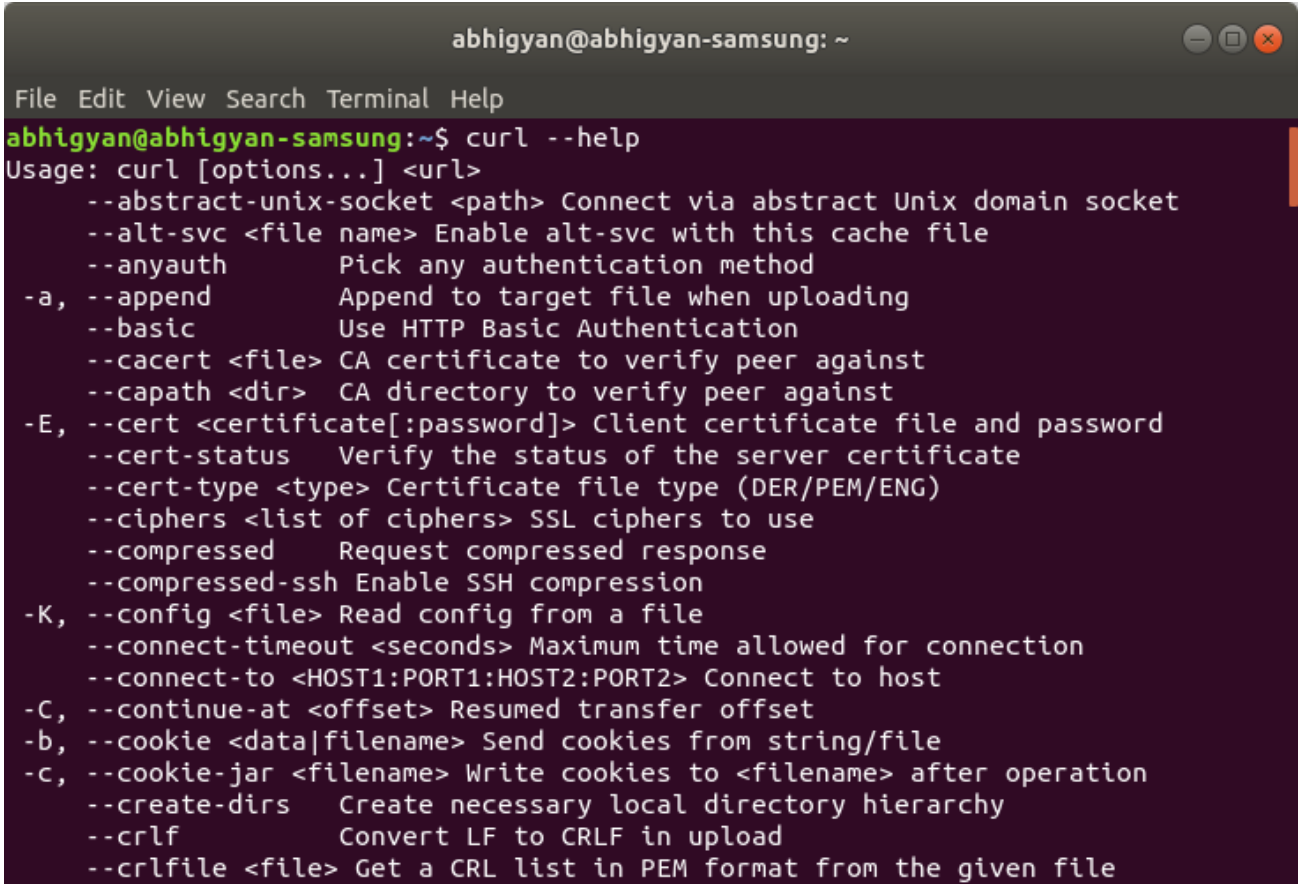
curl

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)



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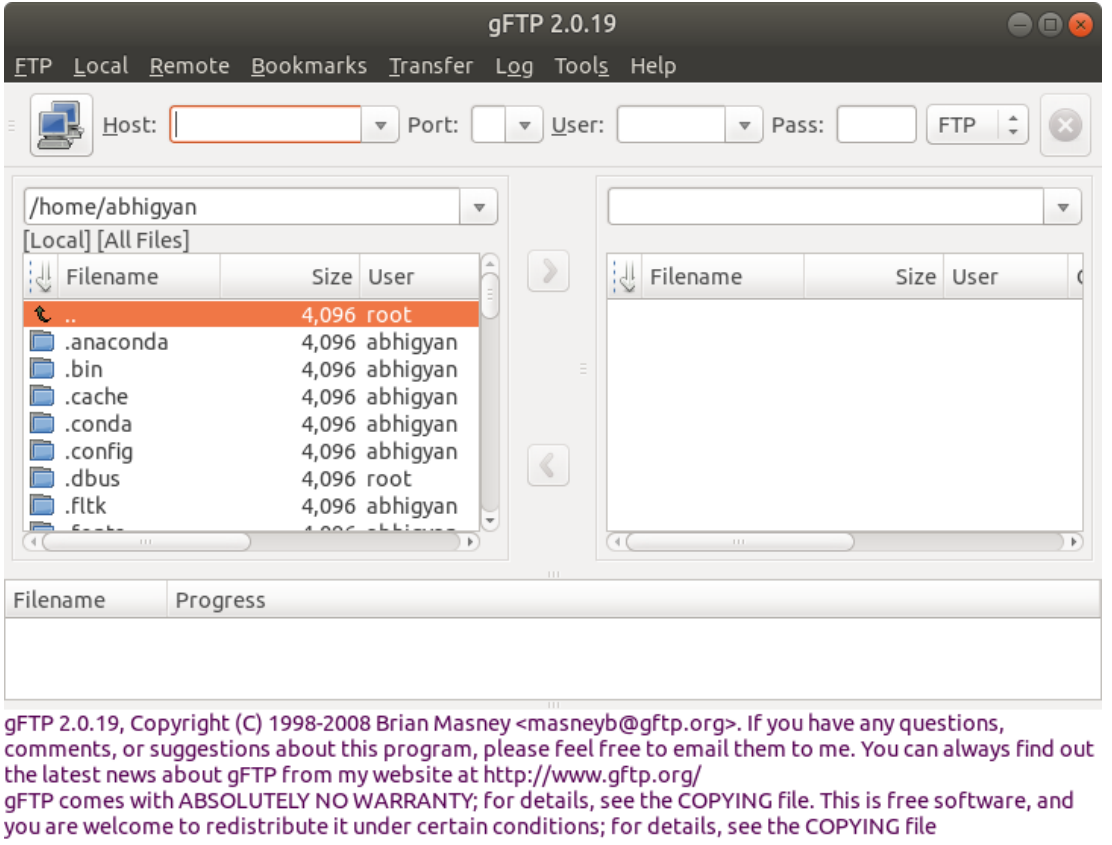
gftp

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



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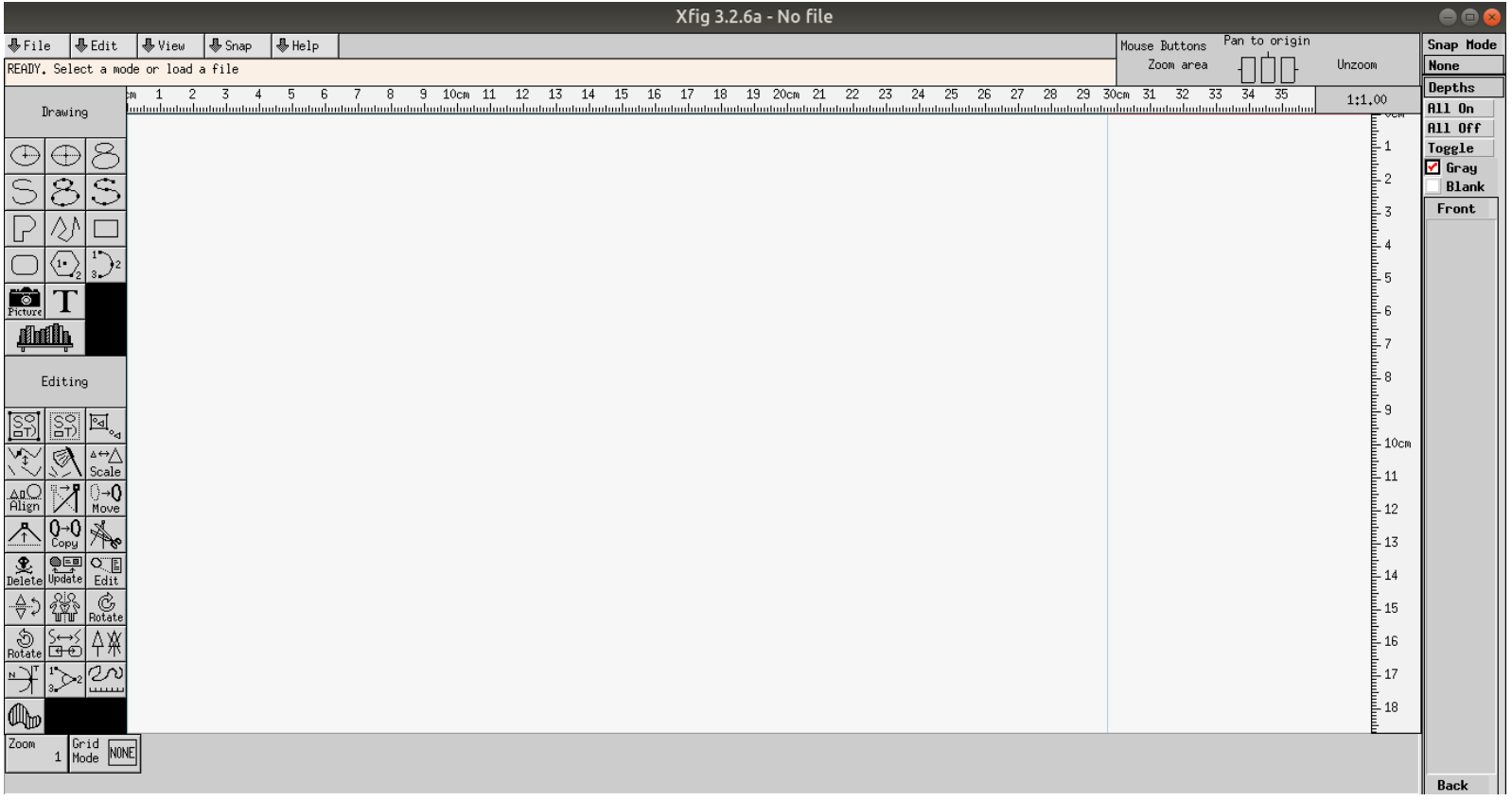
xfig

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



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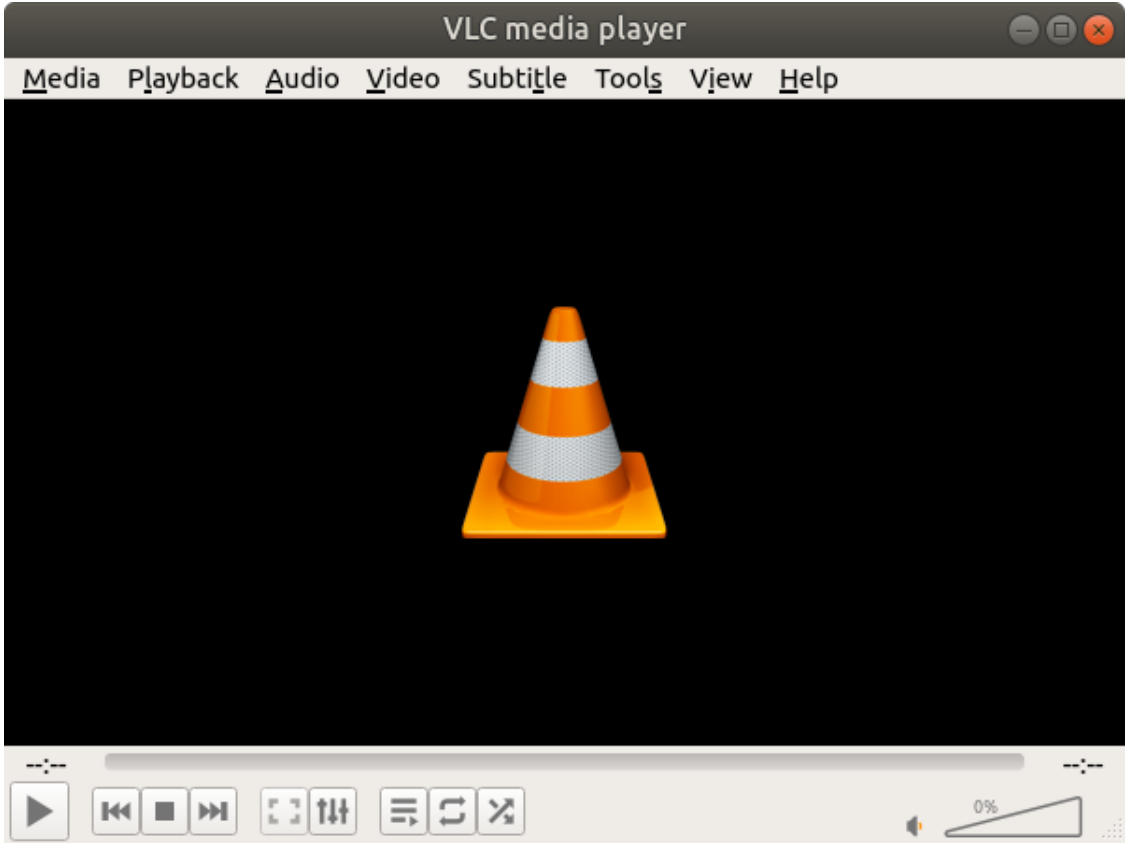
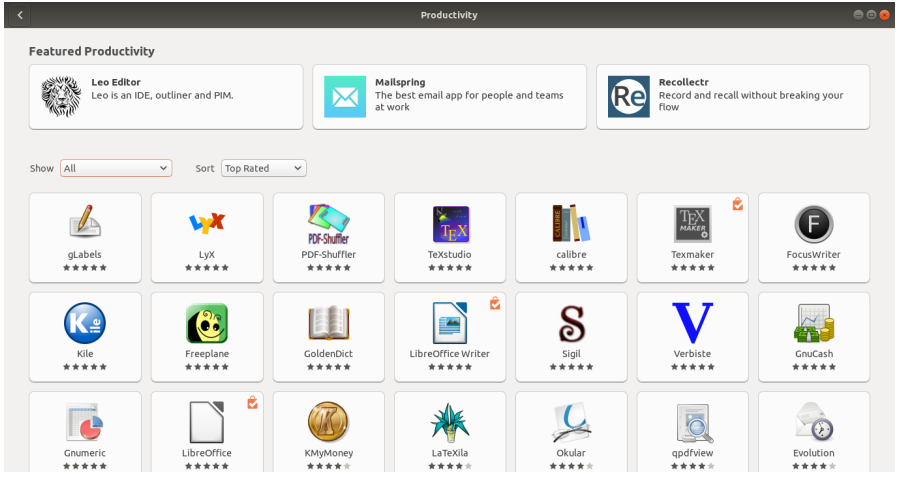
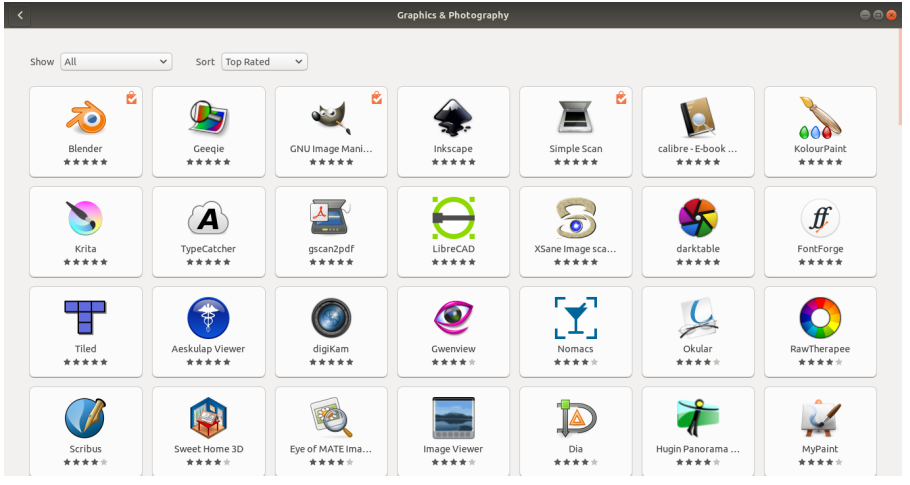
vlc

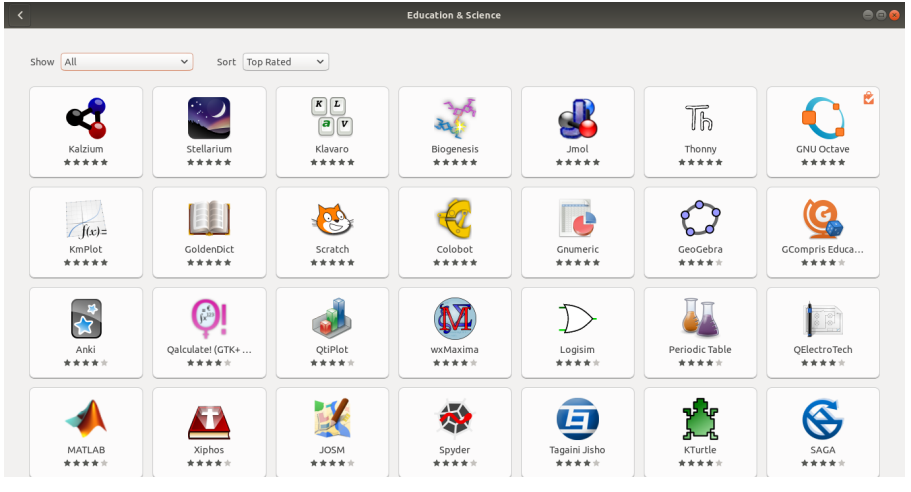
It is a FOSS media player, which supports various file formats and supports converting between them with ease

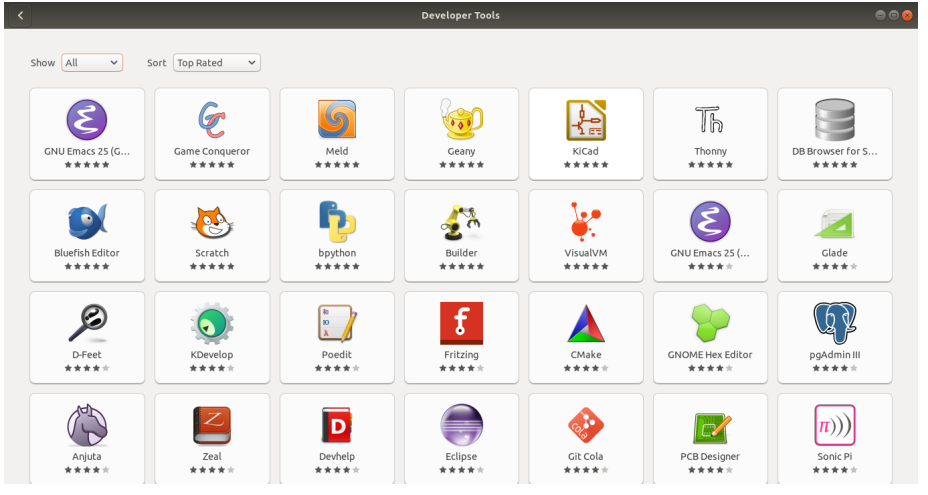


2.2.2 Packages come as groups too. Explore the GUI feature for Ubuntu Software to see what those groups are – in the topics under categories like “Productivity”, “Education and Science”.



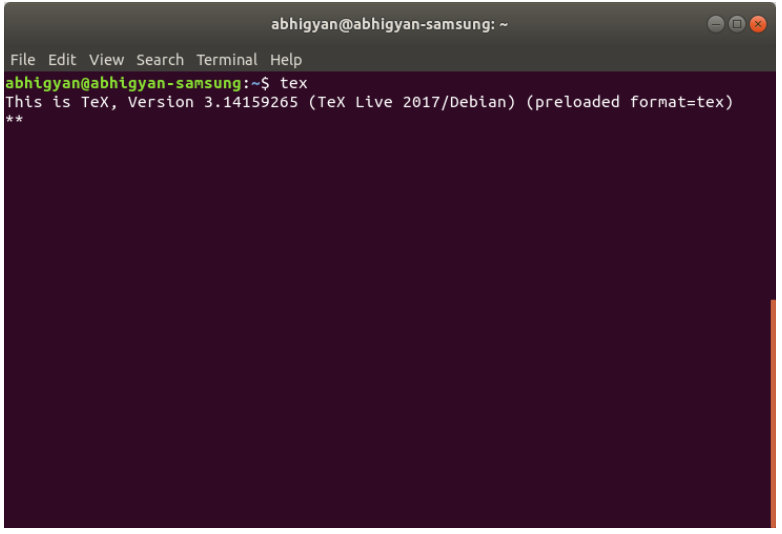




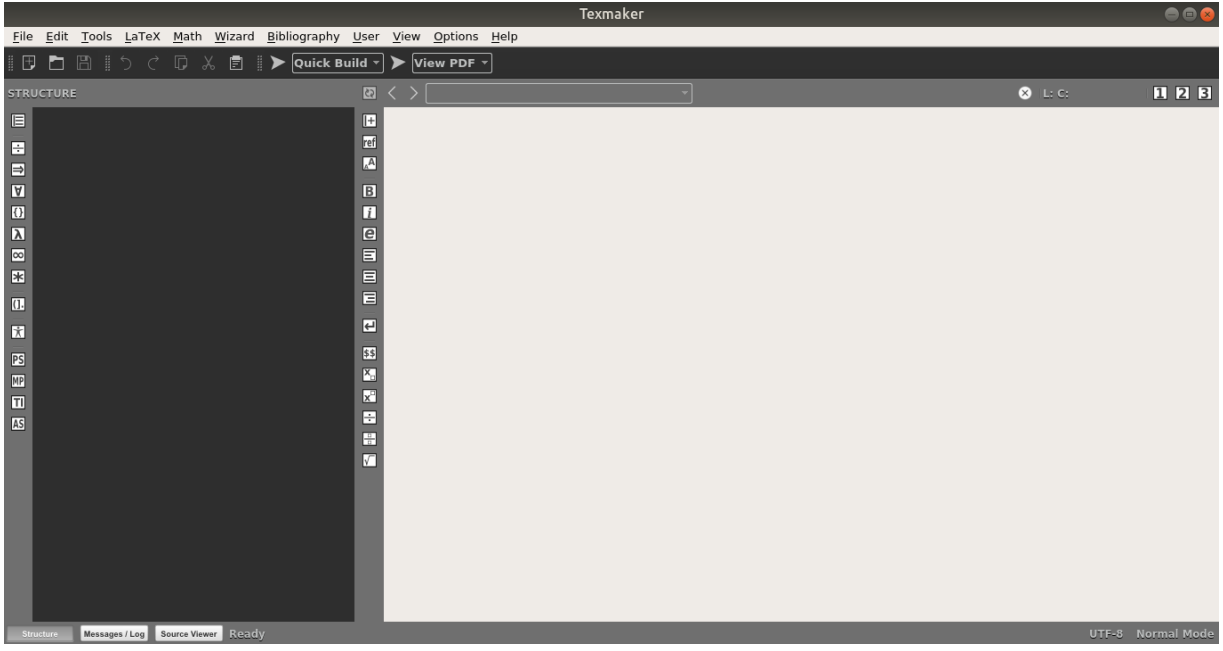


2.2.3 Try and get the entire TeX document preparation software toolset installed on your machine

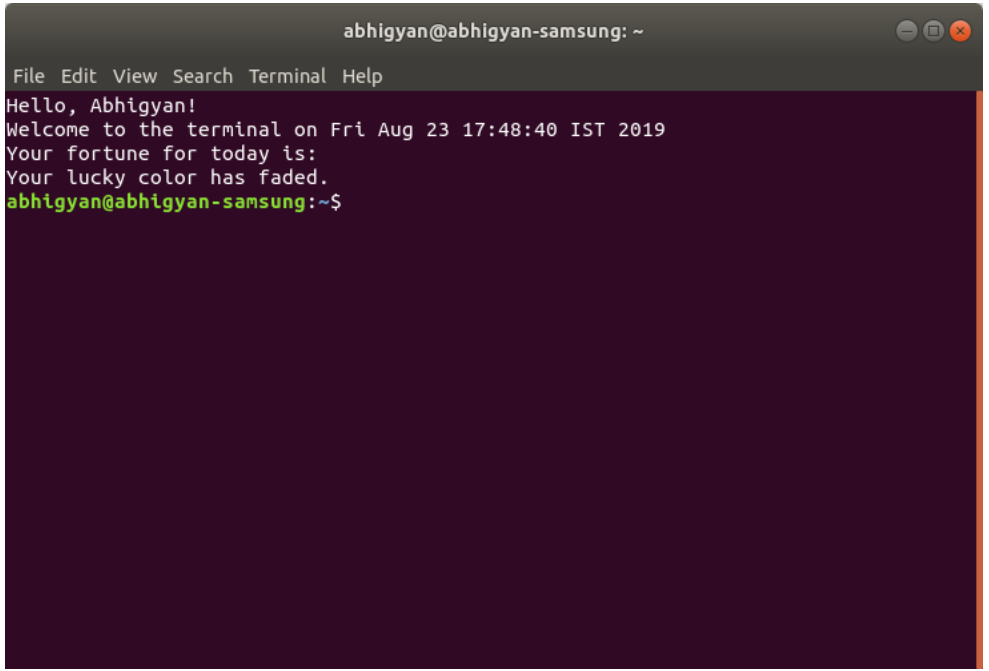
tex CLI

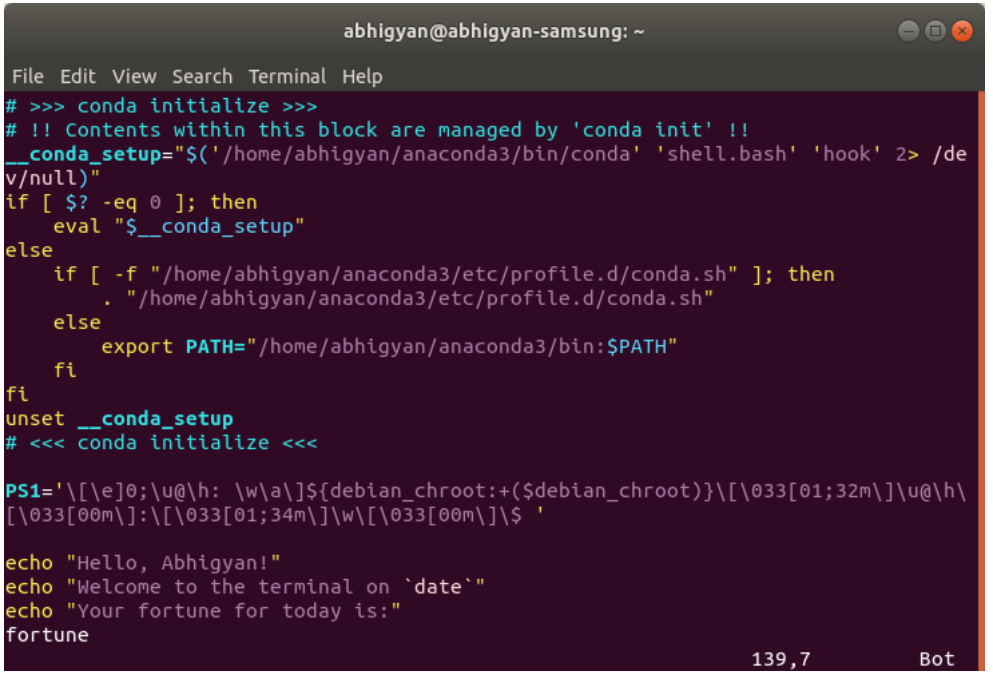


TexMaker application to create tex files with ease



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.





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

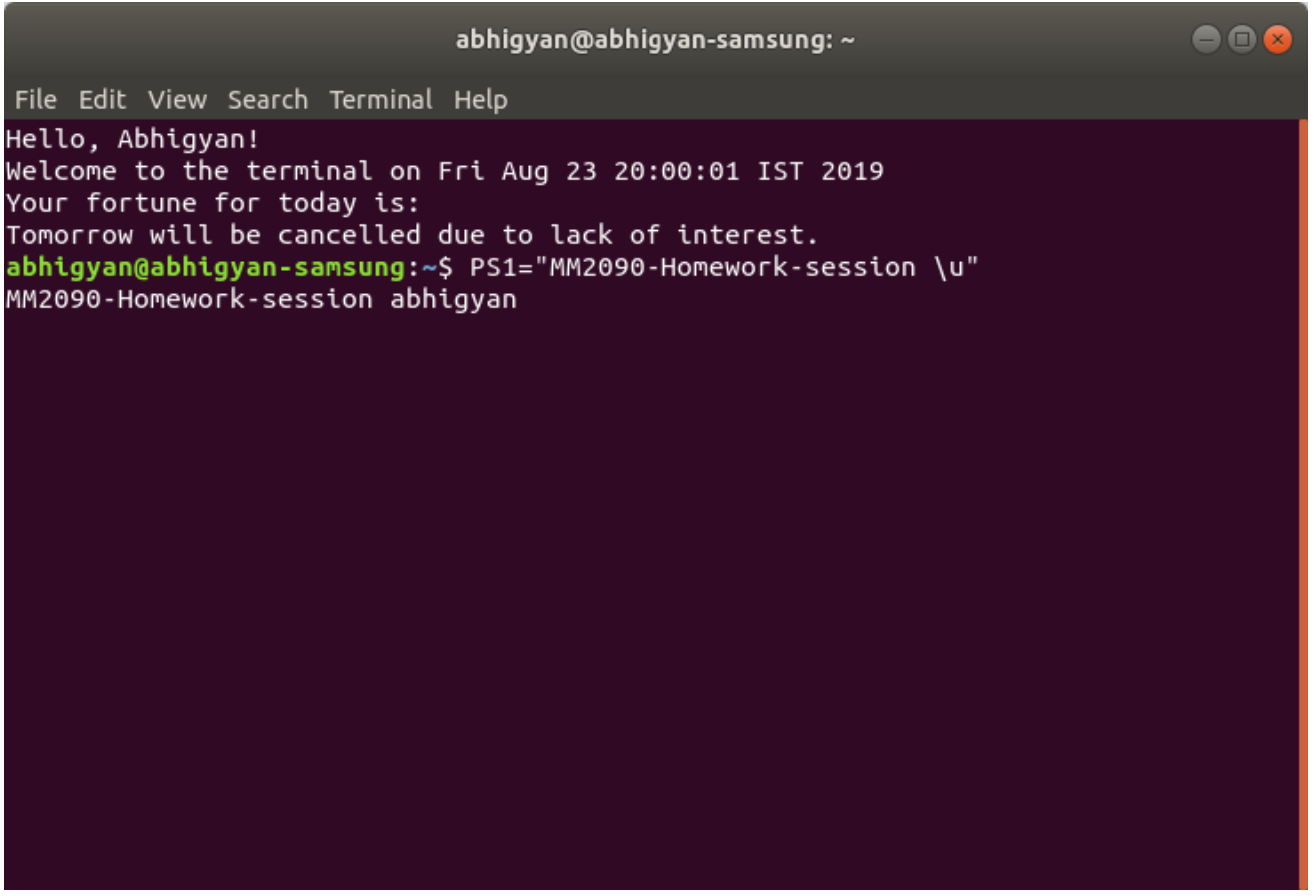
RANDOM => It produces some random integer between 0 and 32767

dd => converts and copies files

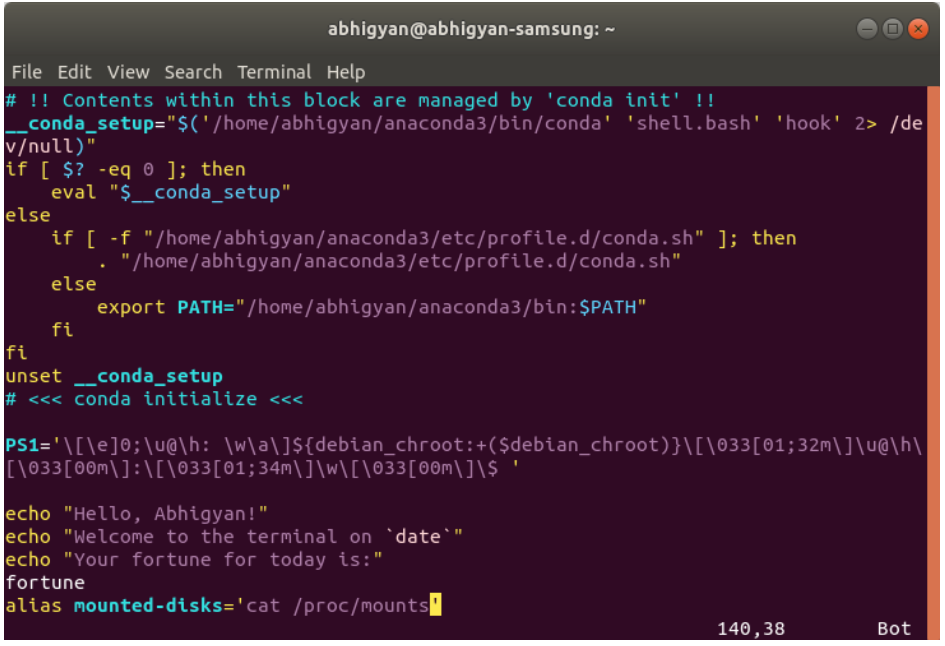
tee => used to append values to a file

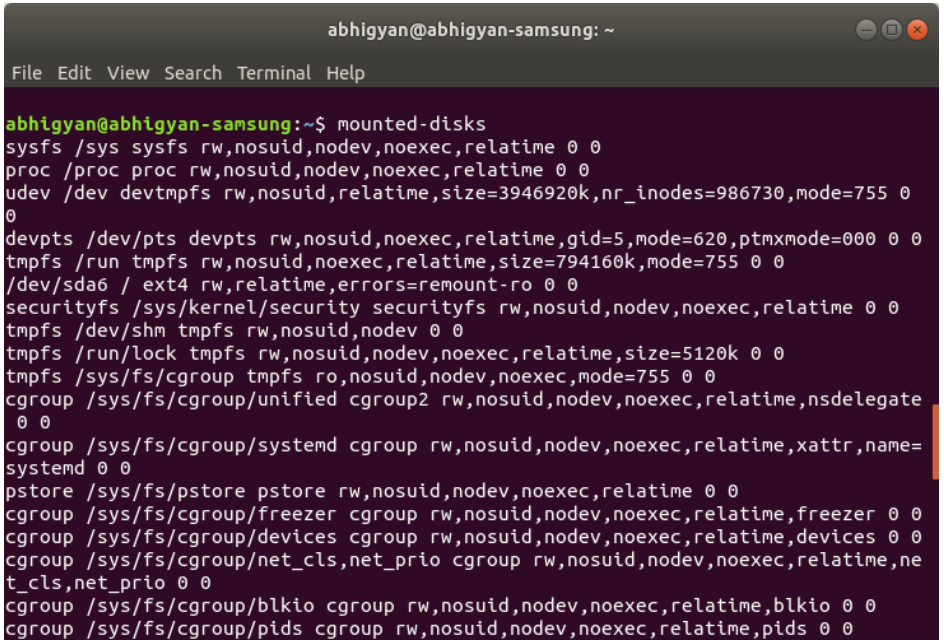
ar => used to create archives, append to archives, and extract data from archives

2.3.3. Change the command prompts to something else and see

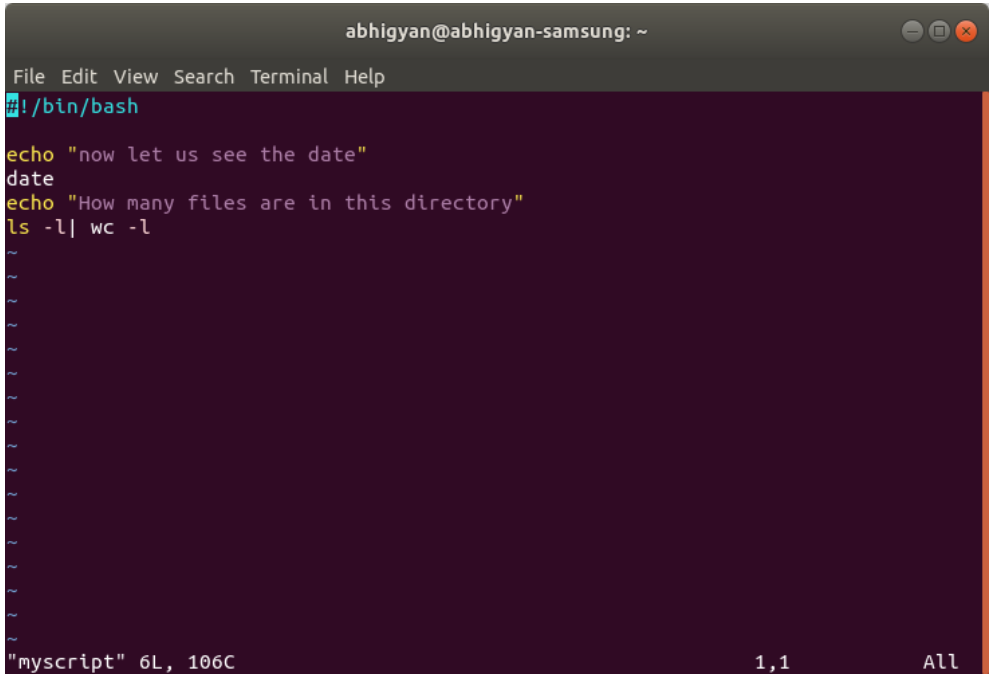


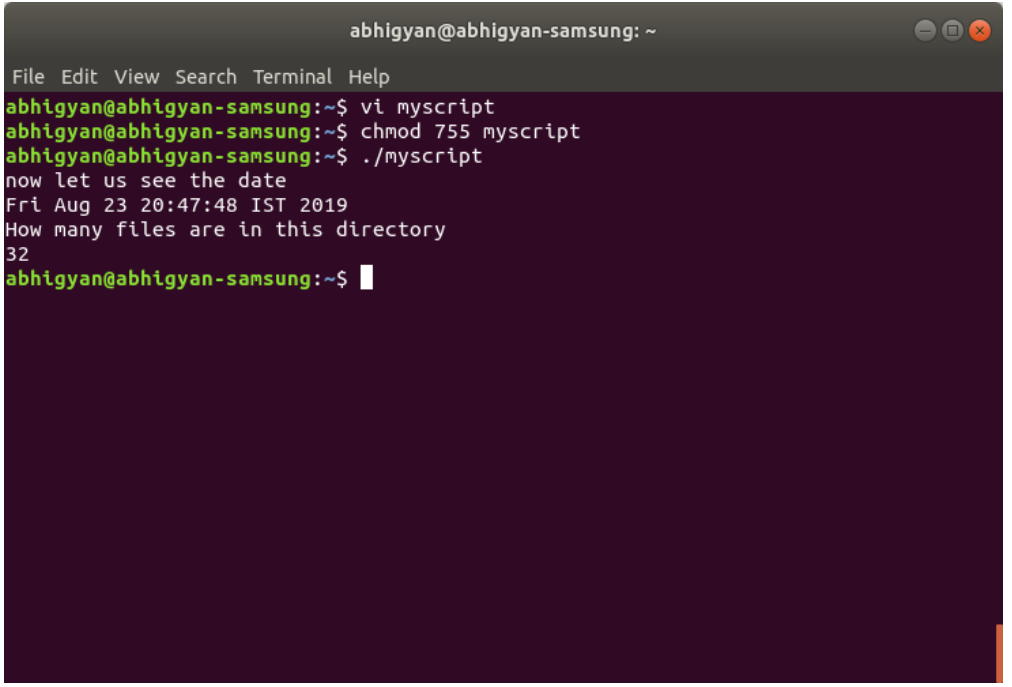
2.3.4. Create an alias that displays the hard discs currently mounted in the system.



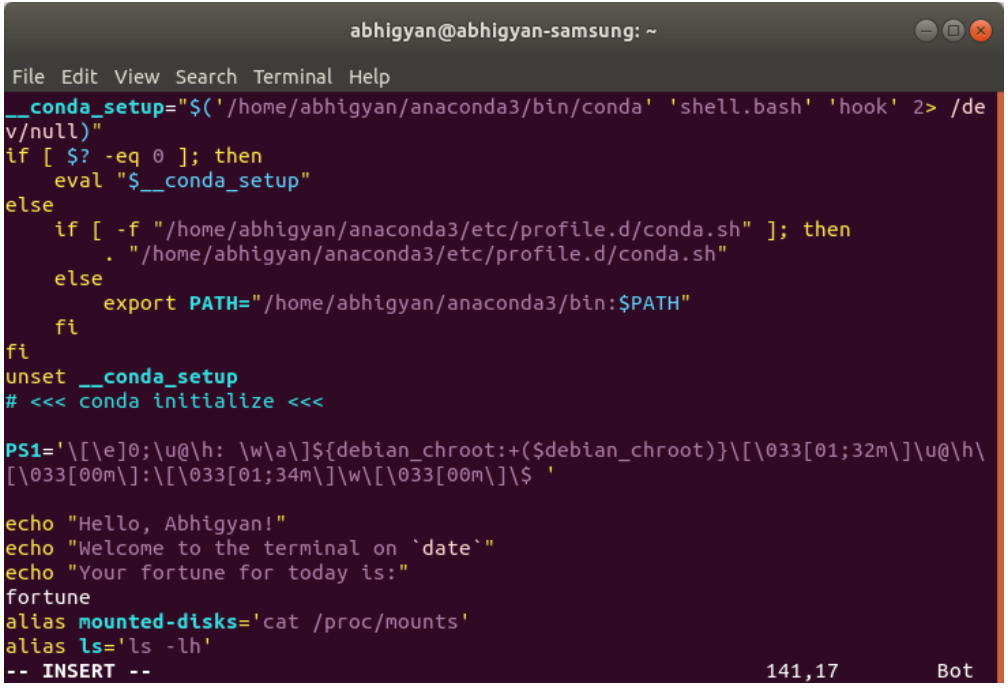


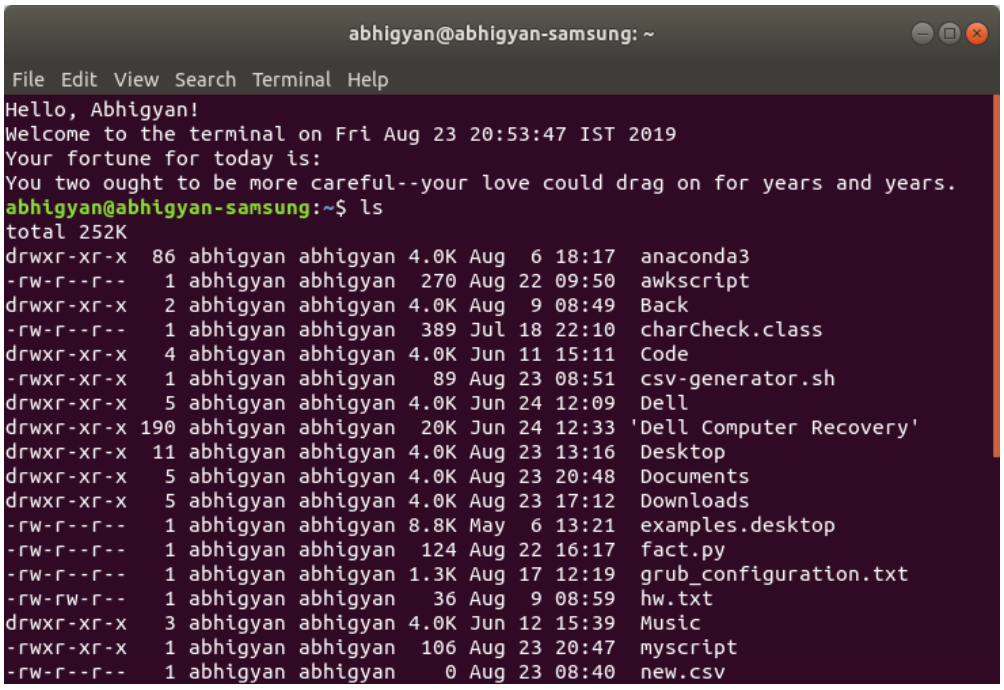
2.4.1. Create a file with a command inside it, change its permission to executable and see if you are able to create a new command for yourself.



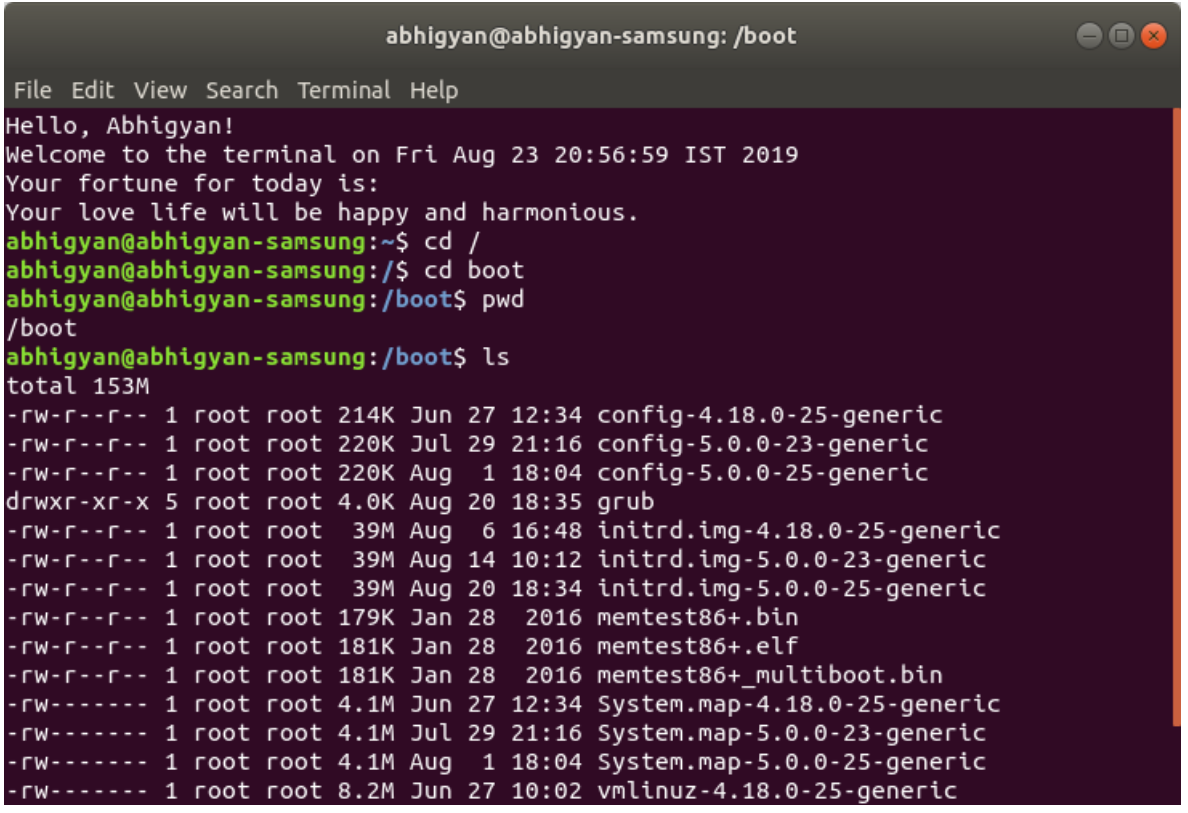


2.4.2. Create an alias for a command your favorite options so that the output is what you desire. Eg: the directory listing with file size in human readable form.



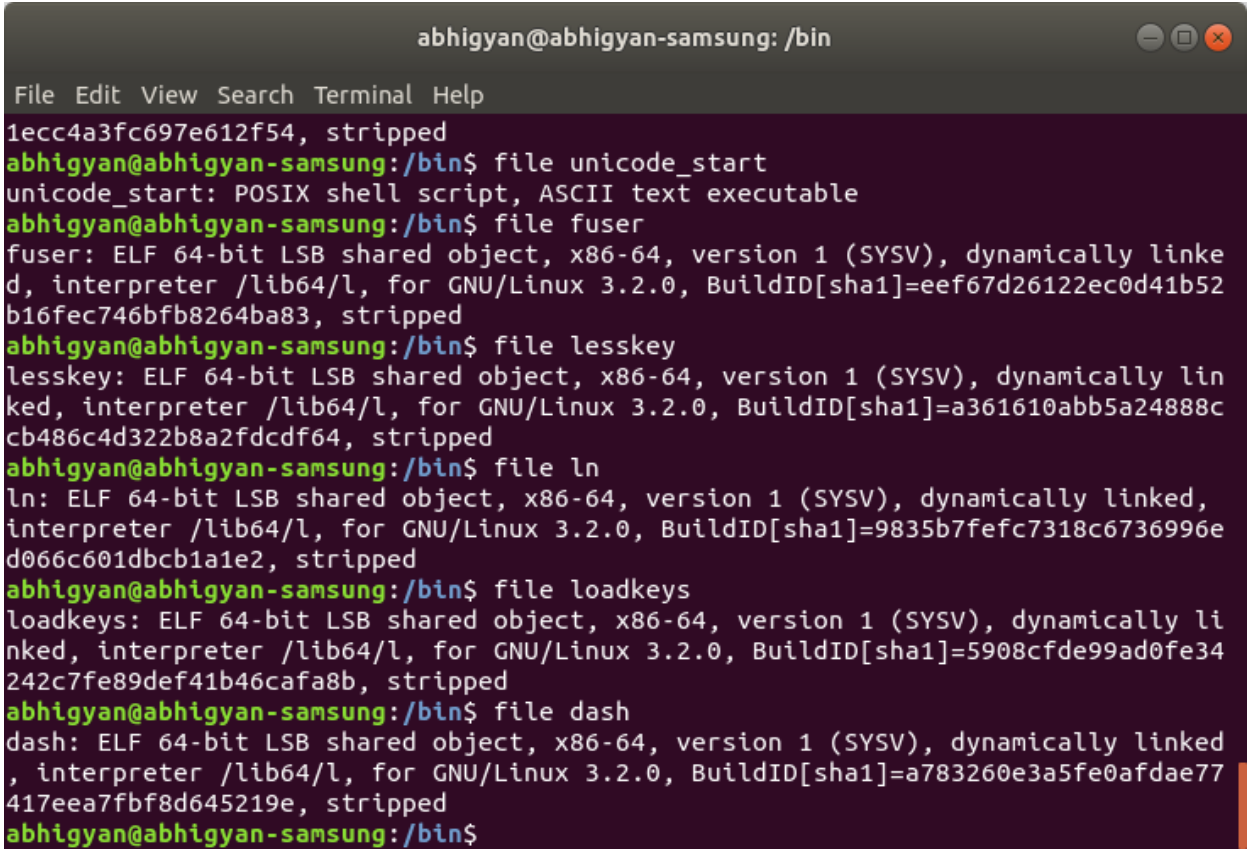


2.4.3. Use the commands “cd” and “pwd” to navigate around the file system and locate configuration files for your system eg., for graphics, network, file systems to be mounted during booting and system service programs that run automatically when the machine is booted up.

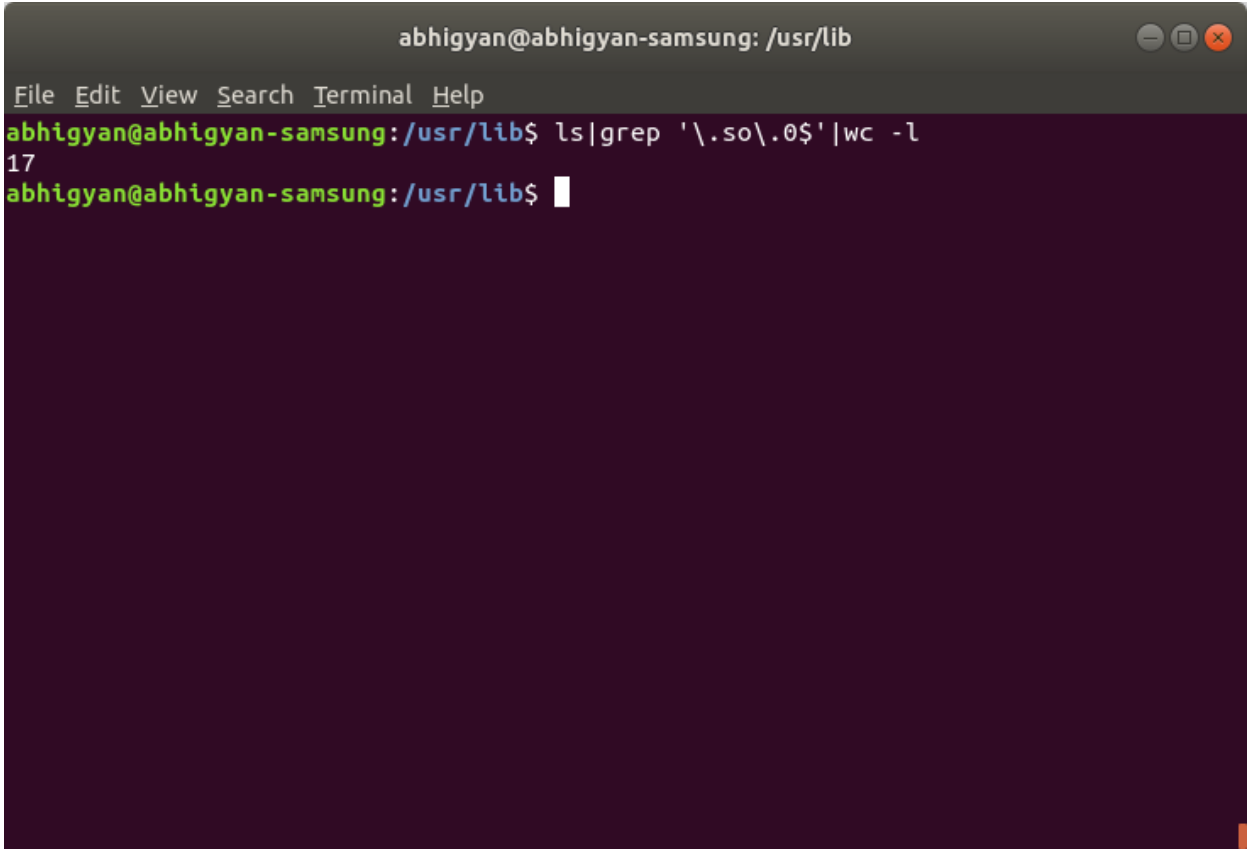


Homework – Session 3

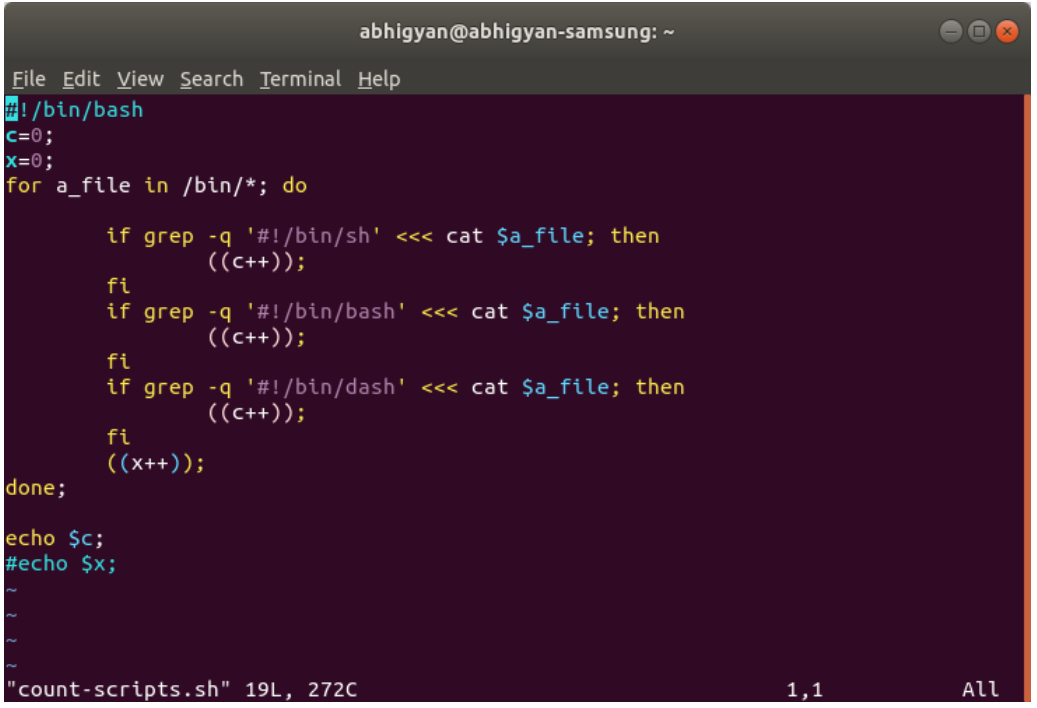
3.1.1. Use “file” command in the /bin directory and see what type of executables are out there.

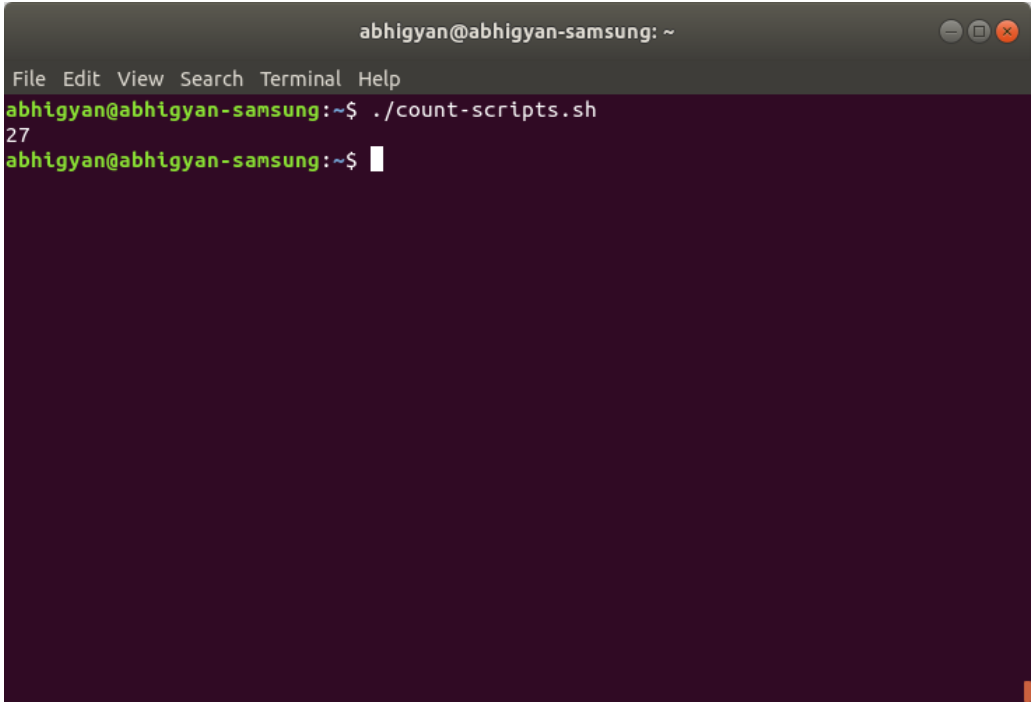


3.1.2. Count the number of library files that have their names ending with “.so.0” in /usr/lib directory.

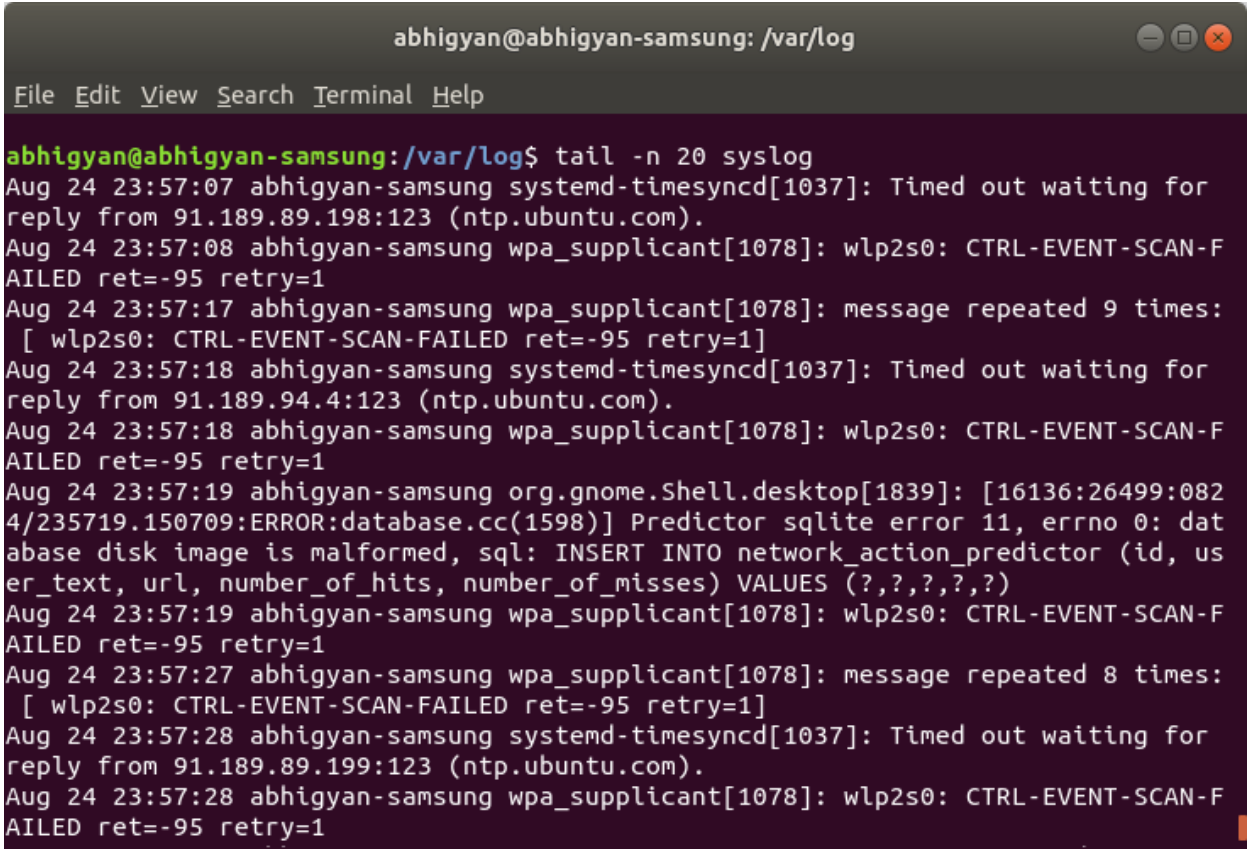


3.1.3. Count the number of shell scripts in /bin directory

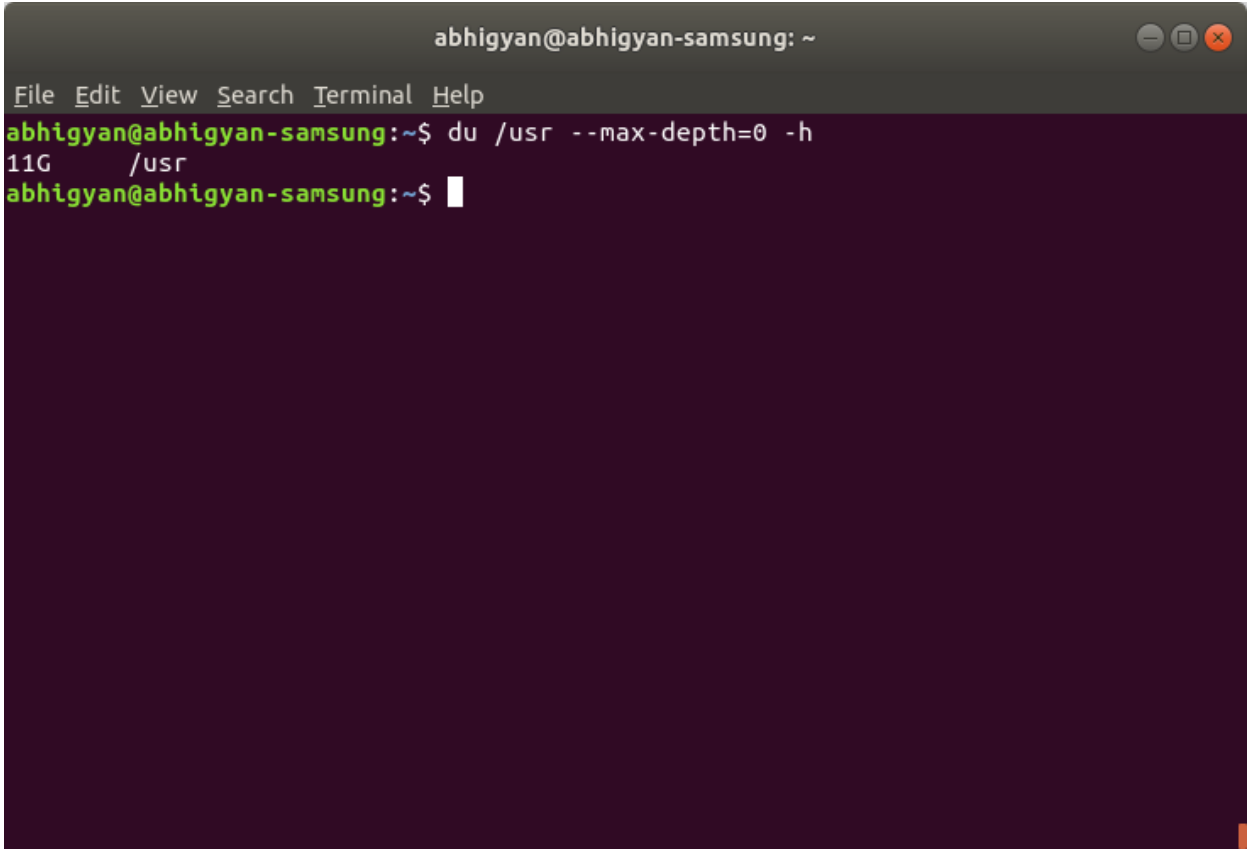




3.1.4. Explore /var/log folder and see which file is for what purpose. Look at the latest 20 lines of “syslog” and write down what details of system activity is being logged.



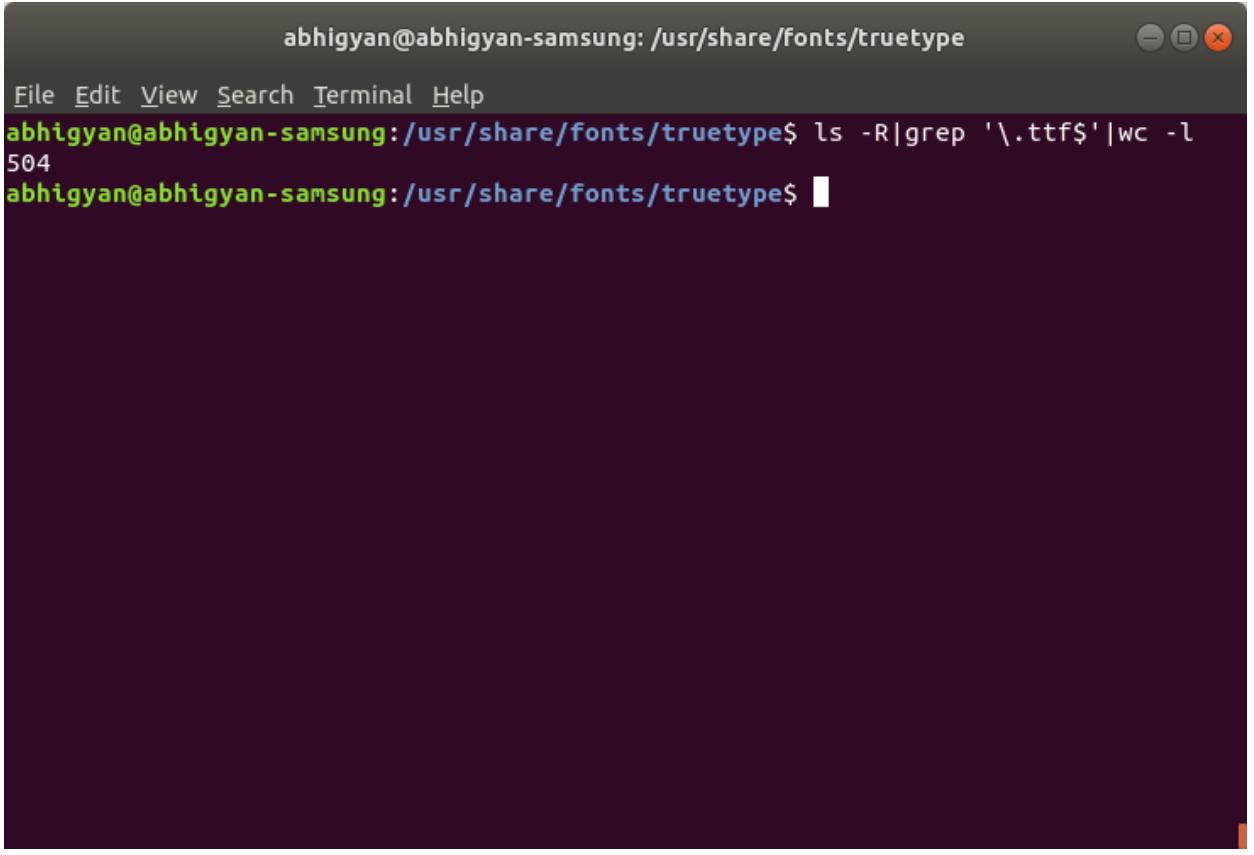
3.1.5. Estimate how much storage is occupied by your /usr directory using a command



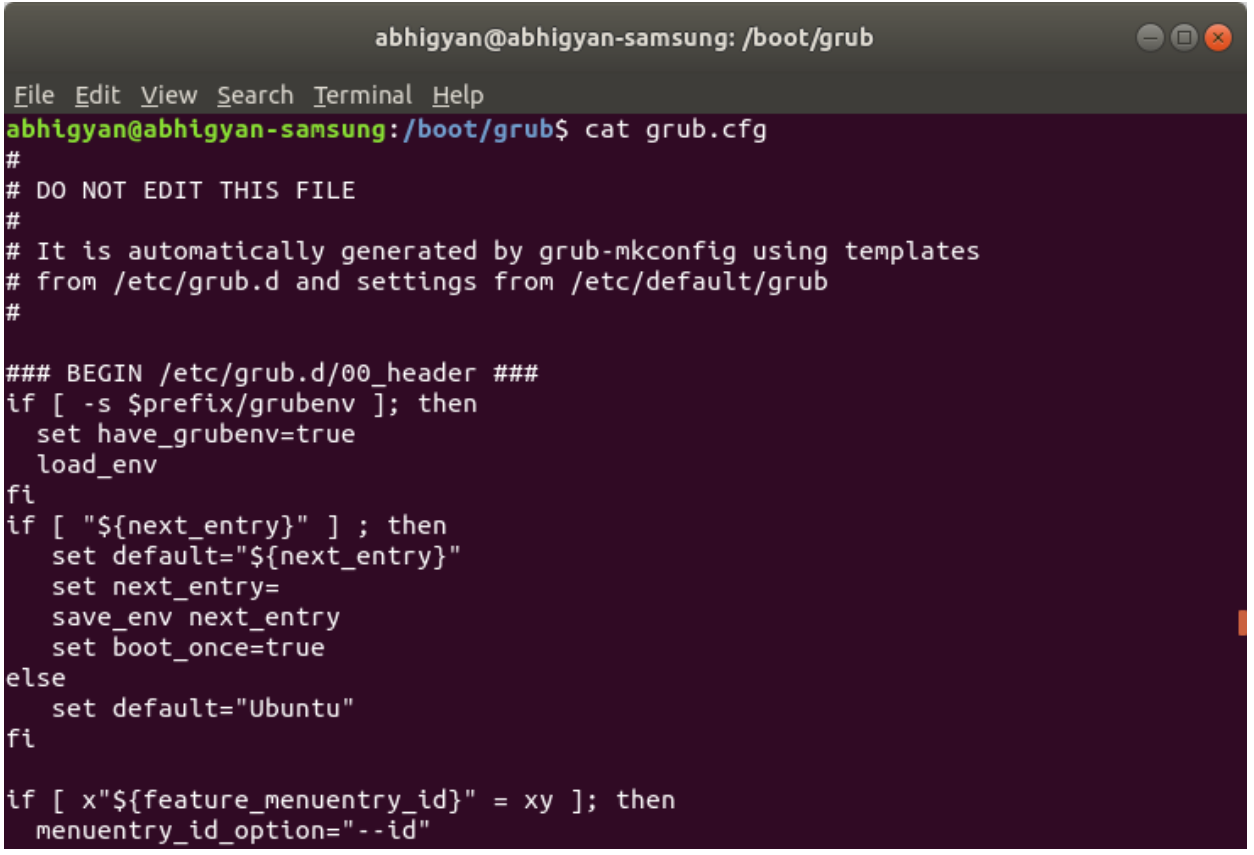
--max-depth=0 prevents recursive searching into sub-directories

-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.



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.



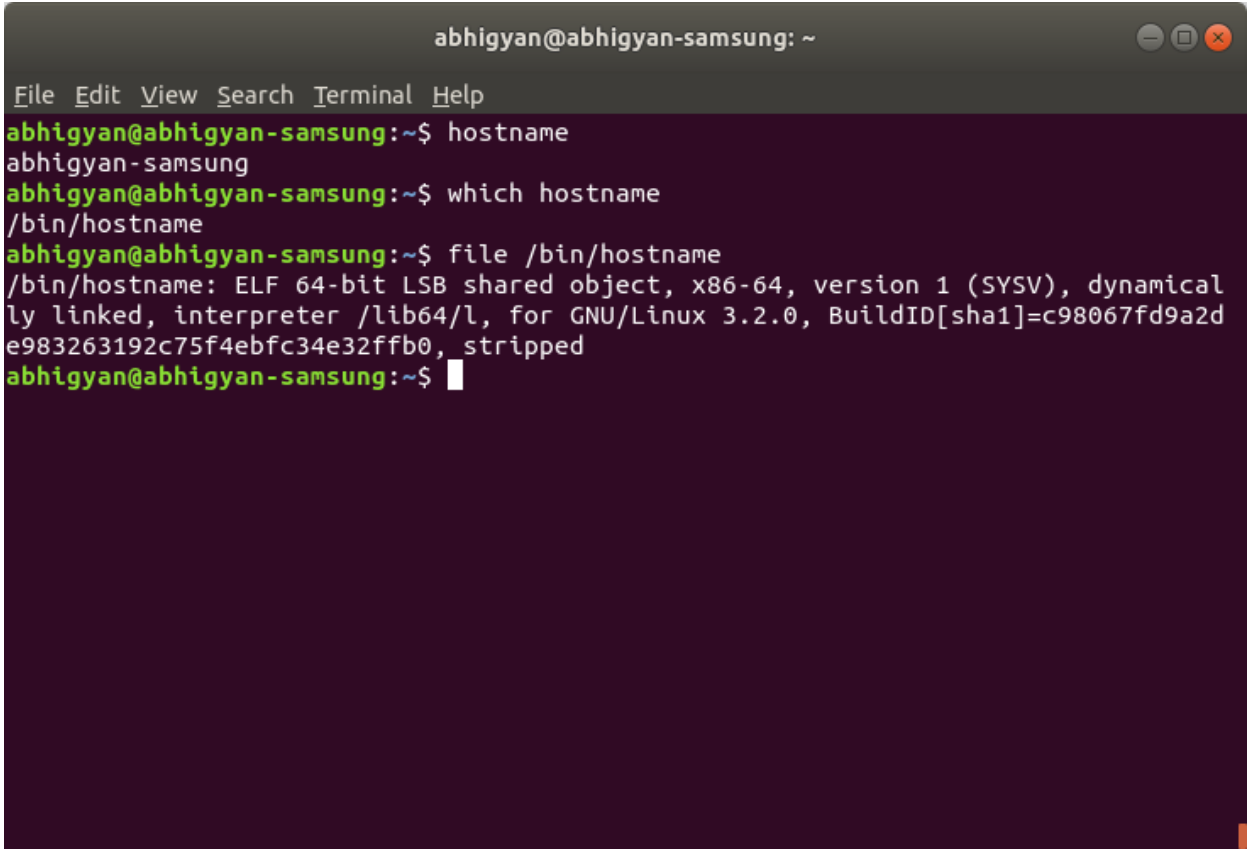
The file:

/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?



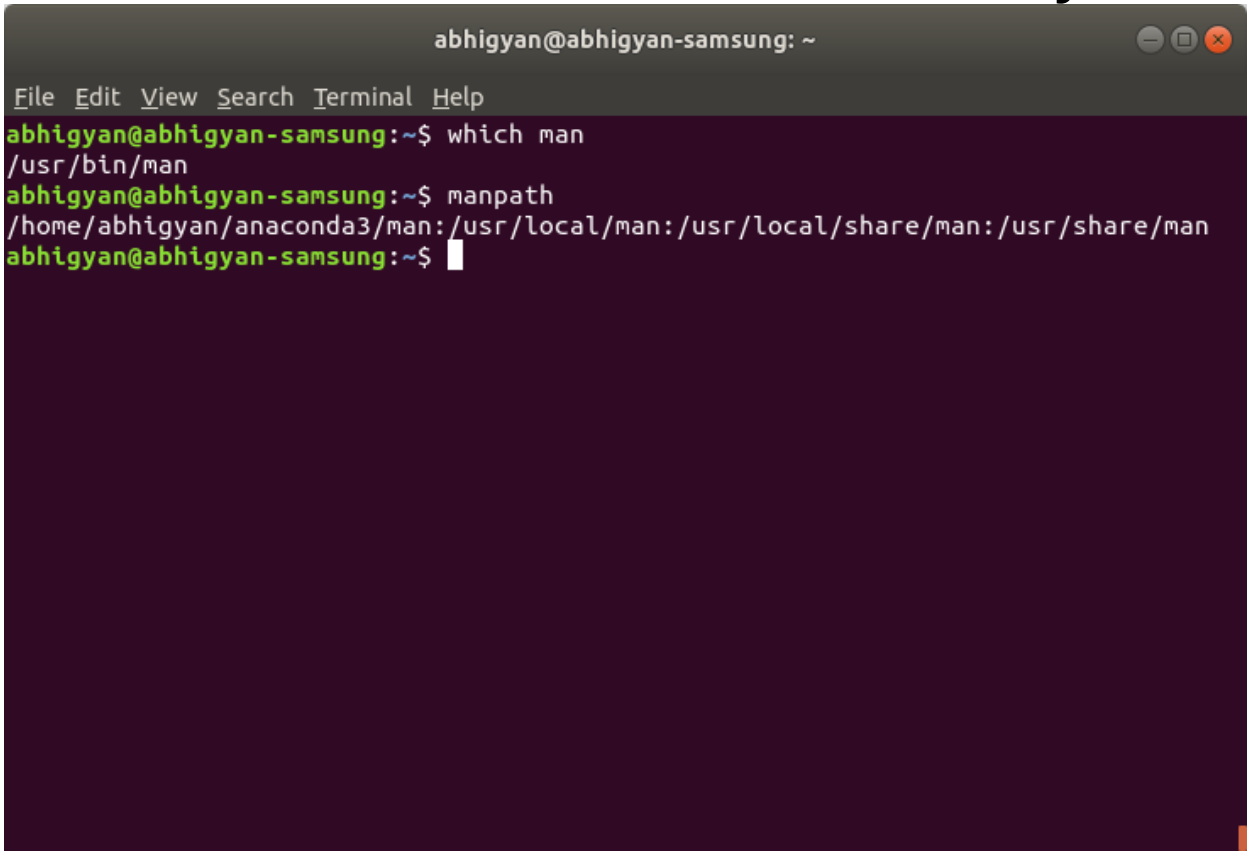
The file:

/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?



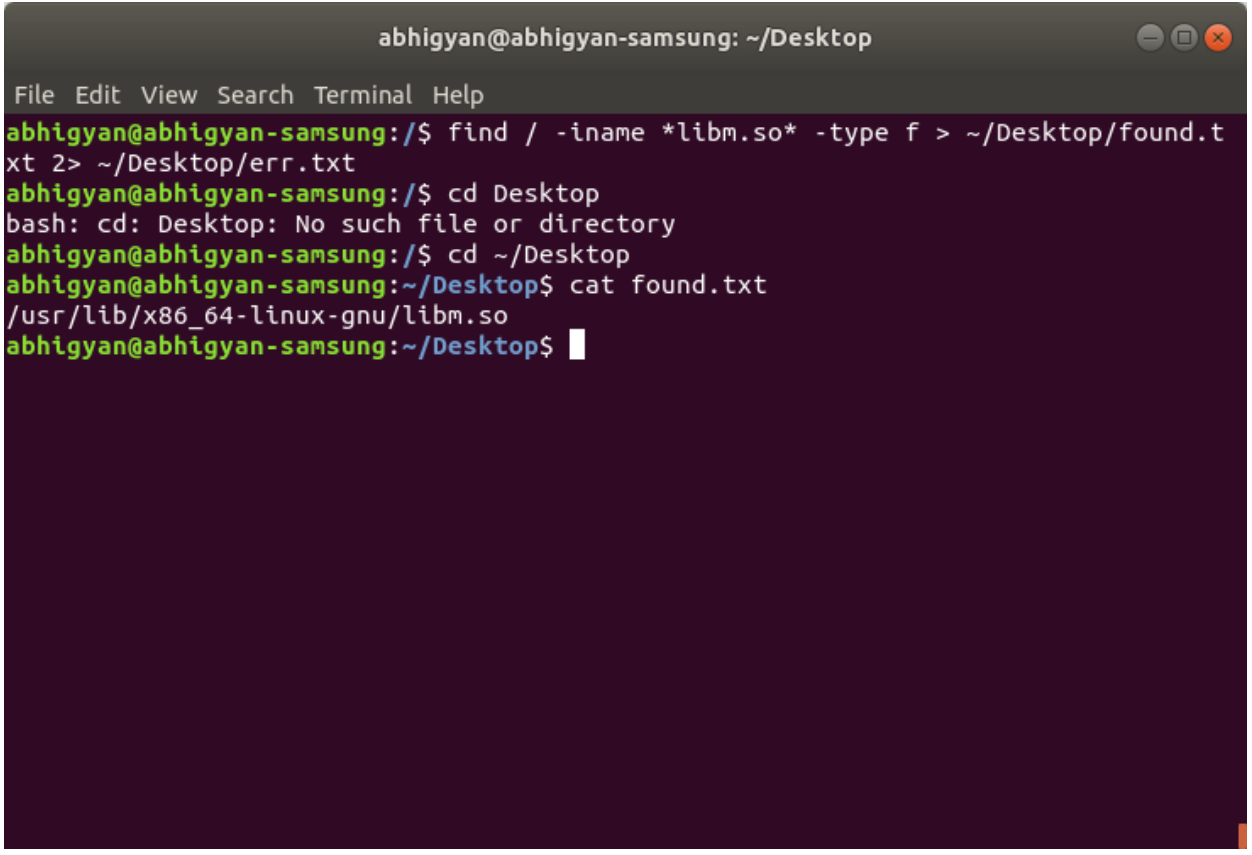
The file:

/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
```

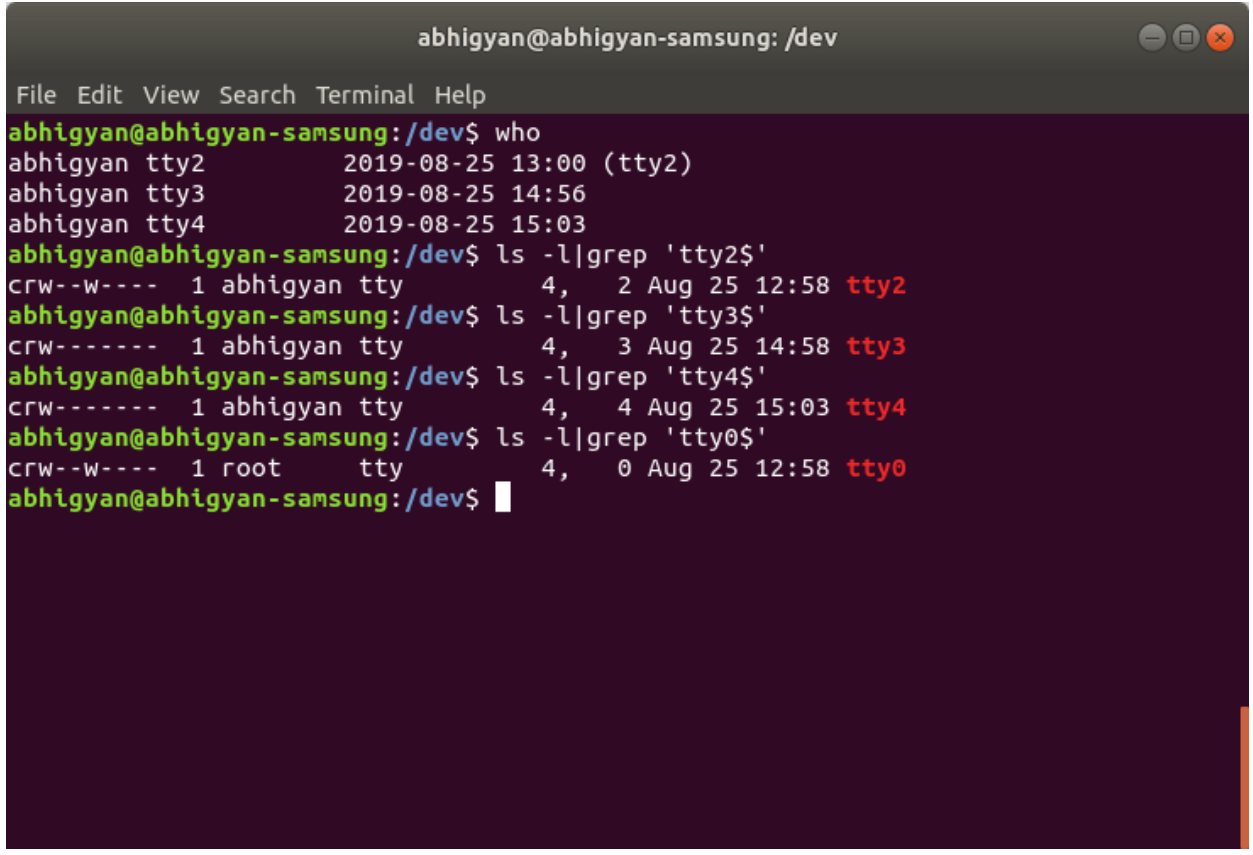
3.2.4. When you compile a c program, you often use “-lm” to link the math library. This library file is typically named “libm.so.X” where X is a number. Where is this file located in your system?



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?



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.