1. At first, update package repositories. Then check the available commands for apt using command help. What commands are used to perform the following tasks with apt:

- **Upgrading installed packages in the system**

```
user@AC4892-Ubuntu:~$ sudo apt update
[sudo] password for user:
Hit:1 http://fi.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://fi.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:3 http://fi.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Get:4 http://fi.archive.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:5 http://fi.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [2225 kB]
Get:6 http://fi.archive.ubuntu.com/ubuntu focal-updates/main amd64 c-n-f Metadata [16.0 kB]
Get:7 http://fi.archive.ubuntu.com/ubuntu focal-updates/universe amd64 Packages [997 kB]
Get:8 http://fi.archive.ubuntu.com/ubuntu focal-updates/universe Translation-en [231 kB]
Get:9 http://fi.archive.ubuntu.com/ubuntu focal-updates/universe amd64 c-n-f Metadata [23.0 kB]
Get:10 http://fi.archive.ubuntu.com/ubuntu focal-security/main amd64 Packages [1850 kB]
Get:11 http://fi.archive.ubuntu.com/ubuntu focal-security/main Translation-en [305 kB]
Get:12 http://fi.archive.ubuntu.com/ubuntu focal-security/main amd64 c-n-f Metadata [11.2 kB]
Get:13 http://fi.archive.ubuntu.com/ubuntu focal-security/universe amd64 Packages [770 kB]
Get:14 http://fi.archive.ubuntu.com/ubuntu focal-security/universe Translation-en [148 kB]
Get:15 http://fi.archive.ubuntu.com/ubuntu focal-security/universe amd64 c-n-f Metadata [16.7 kB]
Fetched 6929 kB in 1s (5504 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
24 packages can be upgraded. Run 'apt list --upgradable' to see them.
user@AC4892-Ubuntu:~$ apt list --upgradable
```

- **Removing unused packages from the system**

```
user@AC4892-Ubuntu:~$ sudo apt autoremove
Reading package lists... Done
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages will be REMOVED:
  libfwupdplugin1
0 upgraded, 0 newly installed, 1 to remove and 24 not upgraded.
After this operation, 459 kB disk space will be freed.
```

2. Check the information for the package called figlet and answer the following questions:

- **What is the size of the package?**

```
user@AC4892-Ubuntu:~$ sudo apt show figlet
Package: figlet
Installed-Size: 752 kB
```

- **What is the newest version available for the package?**

```
user@AC4892-Ubuntu:~$ apt-cache policy figlet
figlet:
figlet:
  Installed: (none)
  Candidate: 2.2.5-3
  Version table:
     2.2.5-3 500
```

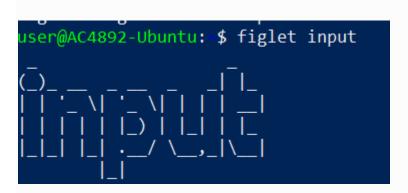- **Check the package description → What does the program do?**

```
user@AC4892-Ubuntu:~$ sudo apt show figlet
Package: figlet
```

```
Description: Make large character ASCII banners out of ordinary text
 FIGlet (Frank, Ian & Glenn's Letters) is a program that creates large
 characters out of ordinary screen characters.
 .
 It can create characters in many different styles and can
 kern and "smush" these characters together in various ways.  FIGlet
 output is generally reminiscent of the sort of "signatures" many people
 like to put at the end of e-mail, Usenet and MOTD messages.
```

3. **Install the figlet package and verify it works.**

```
user@AC4892-Ubuntu:~$ sudo apt install figlet
Reading package lists... Done
```

```
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  figlet
0 upgraded, 1 newly installed, 0 to remove and 24 not upgraded.
Need to get 133 kB of archives.
After this operation, 752 kB of additional disk space will be used.
Get:1 http://fi.archive.ubuntu.com/ubuntu focal/universe amd64 figlet am
Fetched 133 kB in 0s (2685 kB/s)
Selecting previously unselected package figlet.
(Reading database ... 108534 files and directories currently installed.)
Preparing to unpack .../figlet_2.2.5-3_amd64.deb ...
Unpacking figlet (2.2.5-3) ...
Setting up figlet (2.2.5-3) ...
```

```
user@AC4892-Ubuntu:~$ figlet input
  _                           _
 (_)_ __  _ __  _   _ _| |_
 | | '_ \| '_ \| | | | | __|
 | | | | | |_) | |_| | | |_
 |_|_| |_| .__/ \__,_|\__|
         |_|
```

4. Remove figlet from the system with all configuration files. Check that program cannot be run after the removal.

```
user@AC4892-Ubuntu:~$ sudo apt remove figlet

Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages will be REMOVED:
  figlet
0 upgraded, 0 newly installed, 1 to remove and 24 not upgraded
After this operation, 752 kB disk space will be freed.
Do you want to continue? [Y/n]
(Reading database ... 108613 files and directories currently i
Removing figlet (2.2.5-3) ...
Processing triggers for man-db (2.9.1-1) ...
```

```
user@AC4892-Ubuntu:~$ figlet input
-bash: /usr/bin/figlet: No such file or directory
user@AC4892-Ubuntu:~$
```

5. In this task you must install Python3 by compiling it from the source code. Download the package from the url http://student.labranet.jamk.fi/~hantt/os/Python-3.7.4.tgz.

- Before the compilation process, install the following packages with apt:

  - libffi-dev

    ```
    user@AC4892-Ubuntu:~$ sudo apt install libffi-dev
    ```

```
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  libffi-dev
0 upgraded, 1 newly installed, 0 to remove and 24 not upgraded.
Need to get 57.0 kB of archives.
After this operation, 312 kB of additional disk space will be used.
Get:1 http://fi.archive.ubuntu.com/ubuntu focal/main amd64 libffi-dev amd64
Fetched 57.0 kB in 0s (1418 kB/s)
Selecting previously unselected package libffi-dev:amd64.
(Reading database ... 108537 files and directories currently installed.)
Preparing to unpack .../libffi-dev_3.3-4_amd64.deb ...
Unpacking libffi-dev:amd64 (3.3-4) ...
Setting up libffi-dev:amd64 (3.3-4) ...
Processing triggers for install-info (6.7.0.dfsg.2-5) ...
Processing triggers for man-db (2.9.1-1) ...
```

- **zlib1g-dev**

```
user@AC4892-Ubuntu:~$ sudo apt install zlib1g-dev
```

```
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  libc-dev-bin libc6-dev libcrypt-dev linux-libc-dev manpages-dev
Suggested packages:
  glibc-doc
The following NEW packages will be installed:
  libc-dev-bin libc6-dev libcrypt-dev linux-libc-dev manpages-dev zl:
0 upgraded, 6 newly installed, 0 to remove and 24 not upgraded.
Need to get 6236 kB of archives.
After this operation, 31.2 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```

- **If you cannot start your newly installed Python3 fix the symbolic link to point for the *python3.7* executable.**

```
user@AC4892-Ubuntu:~$ wget http://student.labranet.jamk.fi/~hantt/os/Python-3.7.4.tgz
```

```
--2022-11-16 22:12:45--  http://student.labranet.jamk.fi/~hantt/os/Python-3.7.4.tgz
Resolving student.labranet.jamk.fi (student.labranet.jamk.fi)... 192.168.20.20
Connecting to student.labranet.jamk.fi (student.labranet.jamk.fi)|192.168.20.20|:80...
HTTP request sent, awaiting response... 302 Found
Location: https://student.labranet.jamk.fi/~hantt/os/Python-3.7.4.tgz [following]
--2022-11-16 22:12:45--  https://student.labranet.jamk.fi/~hantt/os/Python-3.7.4.tgz
Connecting to student.labranet.jamk.fi (student.labranet.jamk.fi)|192.168.20.20|:443...
HTTP request sent, awaiting response... 200 OK
Length: 23017663 (22M) [application/x-gzip]
Saving to: 'Python-3.7.4.tgz'

Python-3.7.4.tgz            100%[===================================================>]

2022-11-16 22:12:45 (245 MB/s) - 'Python-3.7.4.tgz' saved [23017663/23017663]
```

Then extract it

```
user@AC4892-Ubuntu:~$ tar xvf Python-3.7.4.tgz
```

```
user@AC4892-Ubuntu:~$ sudo apt install python3
```

- **Verify the operation of Python3 by starting the shell with command python3. You should now see the version 3.7.4 at the start of your Python shell.**

```
user@AC4892-Ubuntu:~$ python3
Python 3.8.10 (default, Jun 22 2022, 20:18:18)
[GCC 9.4.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
```