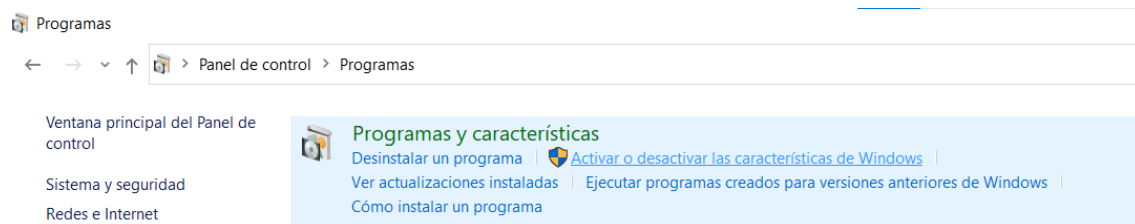


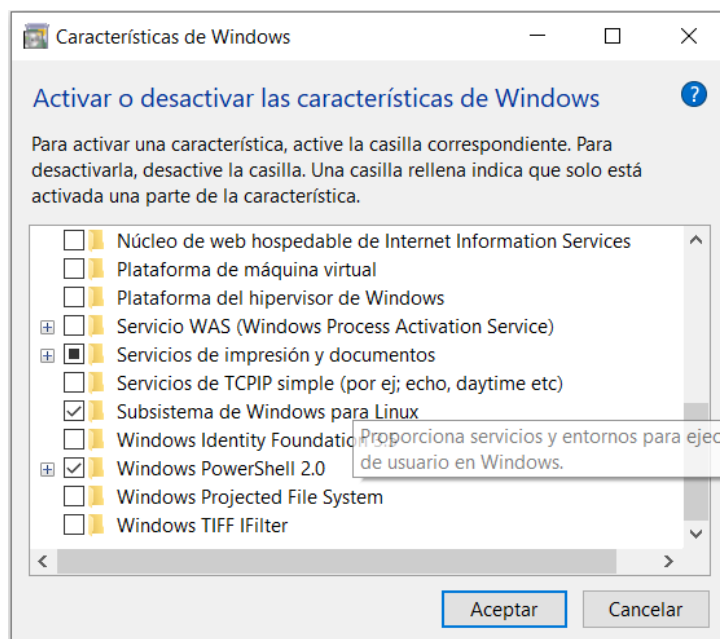
Instructions to install Linux on Windows 10 as well as the required programs for the Nuclear Reactions course

Windows 10 provides a Linux environment with the base installation, although it must be activated. In order to do so one must go to

Control Panel/Programs/Activate or deactivate Windows features

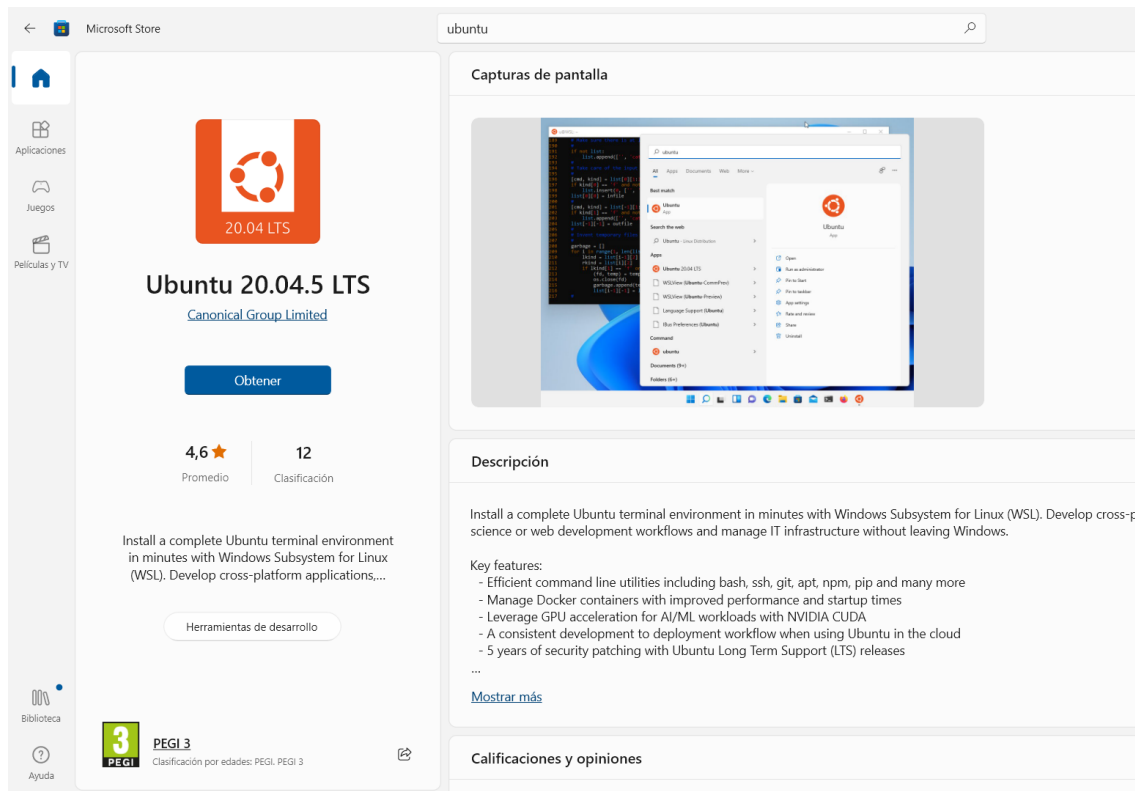


In the opened window the option *Windows Subsystem for Linux* must be activated



Afterwards the computer must be rebooted for the changes to take place.

After reboot, an image for the Linux distribution must be downloaded. They can be easily accessed through the Microsoft Store, just search for “Ubuntu”. We will choose the Ubuntu 20.04 distribution.



After installation, we can run the new Ubuntu program. It will open a terminal where we will have to introduce the username and password that will be used within Ubuntu. This will be the root account, the only one able to install programs within Ubuntu, so this password must not be lost.

```
mario@LAPTOP-0EIOCDUM: ~
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 4.4.0-19041-Microsoft x86_64)

* Documentation:  https://help.ubuntu.com
* Management:    https://landscape.canonical.com
* Support:        https://ubuntu.com/advantage

This message is shown once a day. To disable it please create the
/home/mario/.hushlogin file.
mario@LAPTOP-0EIOCDUM:~$
```

After login, we will need various programs to be installed: gfortran, zip, make, python, pip. This can be installed as root user through the following commands:

`sudo apt-get install gfortran`

```
sudo apt-get install make
```

```
sudo apt-get install zip
```

```
sudo apt-get install python3
```

```
sudo apt-get install python3-pip
```

A terminal window titled 'mario@LAPTOP-0EIOCDUM: ~' with standard window controls. The terminal shows the command 'mario@LAPTOP-0EIOCDUM:~\$ sudo apt-get install zip' and the subsequent prompt '[sudo] password for mario: ' with a cursor.

Press Enter after a command to run it. The sudo command allows the user to input commands reserved for the root user, but the first time it is used it will require to input the root password.

We will also need to install some python libraries, namely matplotlib and numpy, with the following commands

```
python3 -m pip install matplotlib
```

```
python3 -m pip install numpy
```

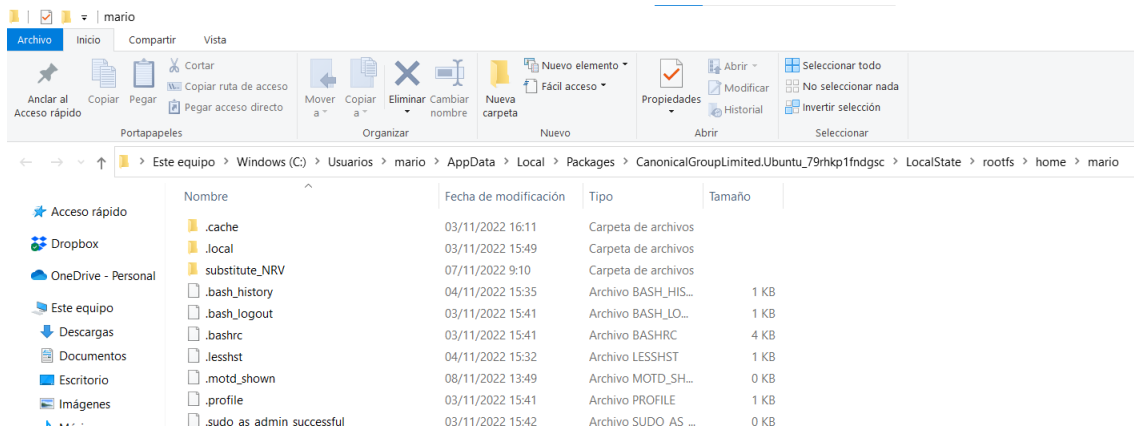
The python scripts are meant to produce graphs of the results of the calculations. In case strong difficulties are found when installing them, it is possible to skip them and look for another way of plotting the results.

The files generated in the home folder in this Ubuntu application can be found in the following folder in Windows:

```
C:\Users\USER\AppData\Local\Packages\CanonicalGroupLimited.Ubuntu_79rhkp1fndgsc\LocalState\rootfs\home\USER_UBUNTU
```

Where USER is the name of the Windows user while USER_UBUNTU is the name of the user we created in Ubuntu. The name CanonicalGroupLimited.Ubuntu_79rhkp1fndgsc may change with the Ubuntu distribution, although it should not be too different. To access this folder from Windows Explorer, the visualization of hidden files may have to be habilitated.

In recent updates of Windows, it is possible to access the Linux files directly from Windows Explorer, through the icon of a penguin which is visible on the left scrollable location list.

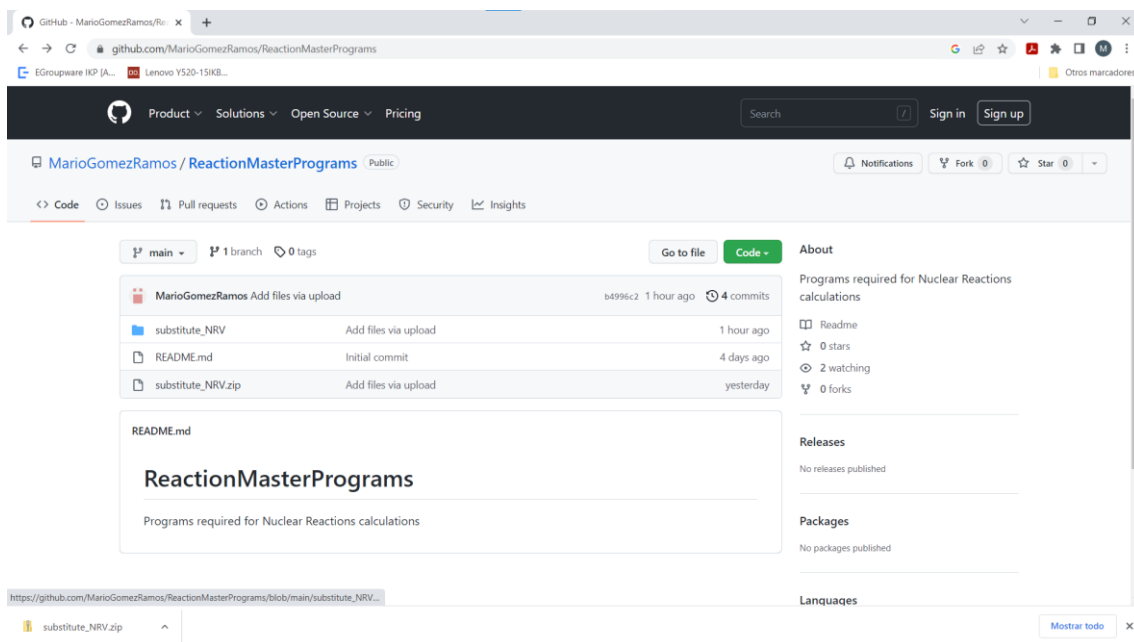


It may be useful to generate a direct access to this folder in the desktop for ease of access. We will now close the Ubuntu application by typing

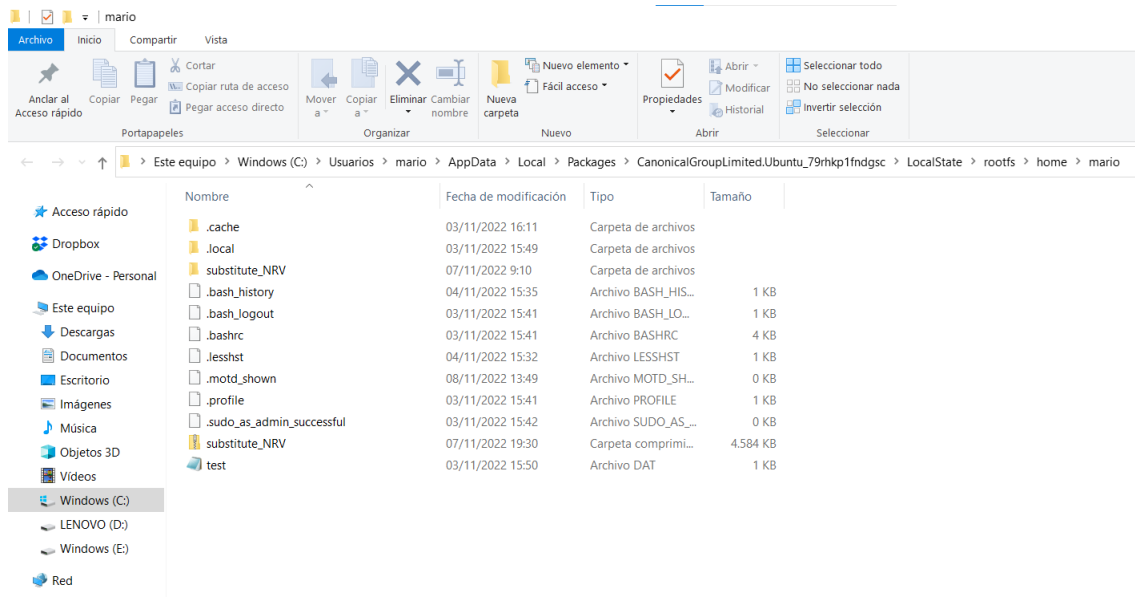
exit

and download (in Windows) the file with the programs required for this course from the website

<https://github.com/MarioGomezRamos/ReactionMasterPrograms>



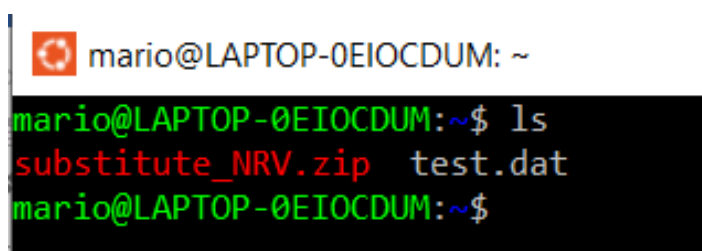
After download we will move the substitute_NRV.zip file to the Ubuntu home folder indicated before



After moving the file to this folder run again the Ubuntu program. The program only reads this folder at its start. Therefore, any files added from Windows while the Ubuntu program is running will not be detected.

After start, the Ubuntu application loads its home folder. In order to see its contents we run the command

Ls



We should see the substitute_NRV.zip file. In order to extract its contents first we have to change the permissions on this file by running

```
chmod 777 substitute_NRV.zip
```

A helpful tip when typing: When filling a name, we can press the Tab key and the terminal will autofill the name of the file. Now we can unzip by running

```
unzip substitute_NRV.zip
```

After a series of messages, we can run

Ls

again and we will see a new blue element substitute_NRV.

mario@LAPTOP-0EIOCDUM: ~

```
mario@LAPTOP-0EIOCDUM:~$ ls
substitute_NRV substitute_NRV.zip test.dat
mario@LAPTOP-0EIOCDUM:~$
```

This is a folder. We can go inside the folder with the cd command:

cd substitute_NRV

By using ls again we see it has some other files and folders inside

mario@LAPTOP-0EIOCDUM: ~/substitute_NRV

```
mario@LAPTOP-0EIOCDUM:~$ ls
substitute_NRV substitute_NRV.zip test.dat
mario@LAPTOP-0EIOCDUM:~$ cd substitute_NRV/
mario@LAPTOP-0EIOCDUM:~/substitute_NRV$ ls
elastic_inelastic fres initialize transfer uninstall
mario@LAPTOP-0EIOCDUM:~/substitute_NRV$
```

Now we must run the initialize program. In order to run a program we must type its name with ./ in front of it

./initialize

After some time and several messages the installation is complete. In order to check it we can move to the fres/source folder

cd fres/source

ls

```
mario@LAPTOP-0EIOCDUM: ~/substitute_NRV/fres/source
2775 | 70 if(x(i+1)-z) 100,60,50
      | 1
Warning: Array reference at (1) out of bounds (34 > 33) in loop beginning at (2)
gfortran -o brush13 brush13.o
gfortran -c -O2 -Wtabs grwf.f
f951: Warning: Nonconforming tab character in column 1 of line 30 [-Wtabs]
f951: Warning: Nonconforming tab character in column 1 of line 44 [-Wtabs]
grwf.f:33:72:
      33 | 15      rms = rms + de * r*r
          | 1
Warning: Fortran 2018 deleted feature: DO termination statement which is not END DO or CONTINUE with label 15 at (1)
gfortran -o grwf grwf.o
mario@LAPTOP-0EIOCDUM:~/substitute_NRV$ ls
elastic_inelastic fres initialize transfer uninstall
mario@LAPTOP-0EIOCDUM:~/substitute_NRV$ cd fres/source/
mario@LAPTOP-0EIOCDUM:~/substitute_NRV/fres/source$ ls
aliases      cpu_time.o    frxx0.f       frxx12.o     frxx3.o       frxx8.f       kcom2.mod     sfresco.f
arrays.mod    drier.mod     frxx0.f~      frxx13.f     frxx4.f       frxx8.o       makefile      sfresco.o
bpmfus.f      etime.f       frxx0.o       frxx13.o     frxx4.o       frxx9.f       makefilegfort  sfresco_g95.f
brush13       factorials.mod frxx1.f       frxx16.f     frxx5.f       frxx9.o       makefilegfort~  sfresco_std.f
brush13.f     flush.f       frxx1.f.orig  frxx16.o     frxx5.f~      gails.mod     makefileifort   system_clock.f
brush13.o     fort.3        frxx1.f.patch frxx17.f     frxx5.o       globx7.f     minuit-cern.f   trace.mod
cdc.f         fresco        frxx1.o       frxx17.o     frxx6.f       globx7.o     minuit-cern.o   usescatwf.f
cdc.o         fresco.f      frxx10.f      frxx18.f     frxx6.o       grwf          mk              veffpot.f
cdc4fMGR      fresco.o      frxx10.o      frxx18.o     frxx7a.f      grwf.f        parameters.mod
cdc4fMGR.f    fresco1.mod   frxx11.f      frxx2.f      frxx7a.o      grwf.o        searchdata.mod
cdc4fMGR.o    fresco_g95.f frxx11.o      frxx2.o      frxx7b.f      io.mod        searchpar.mod
cpu_time.f    fresco_std.f  frxx12.f      frxx3.f      frxx7b.o      kcom.mod      sfresco
mario@LAPTOP-0EIOCDUM:~/substitute_NRV/fres/source$
```

If we see the file fresco in it the installation has been successful. We can go back to the substitute_NRV folder by using the command

```
cd ..
```

which goes to the parent folder. Using it twice or typing `cd ../../` we will return to the substitute_NRV folder, as can be seen by the input prompt

```
mario@LAPTOP-0EIOCDUM: ~/substitute_NRV
mario@LAPTOP-0EIOCDUM:~/substitute_NRV/fres/source$ cd ../../
mario@LAPTOP-0EIOCDUM:~/substitute_NRV$ ls
elastic_inelastic  fres  initialize  transfer  uninstall
mario@LAPTOP-0EIOCDUM:~/substitute_NRV$
```

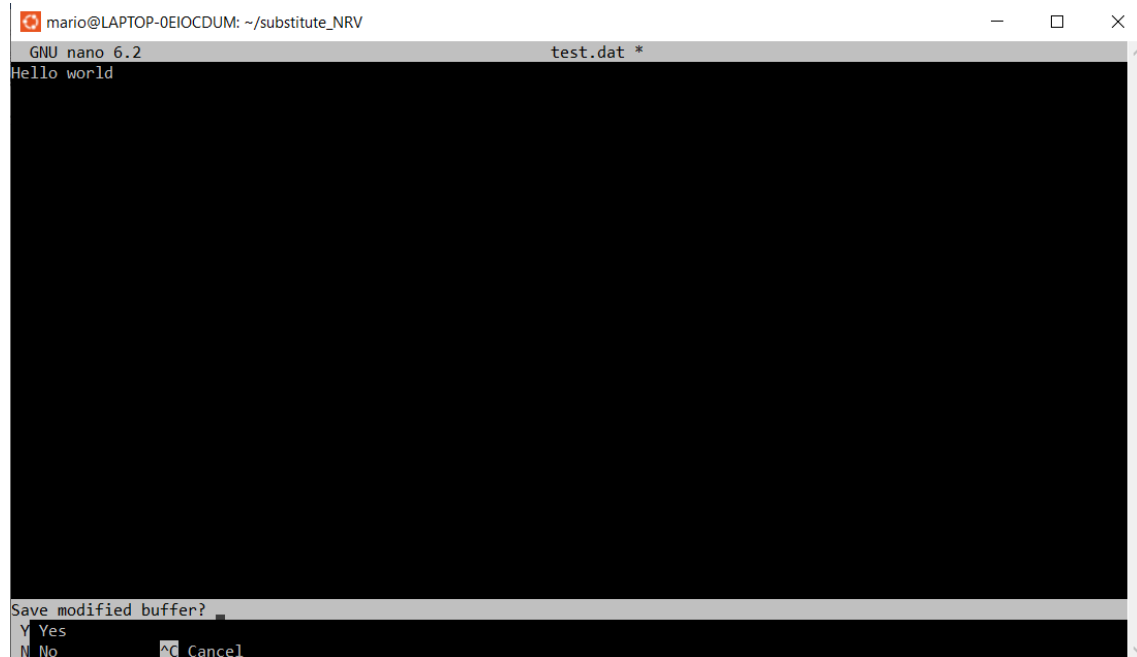
Finally we will see how to create and modify data files and how to open them with Windows. The program nano is a moderately sophisticated text editor program included in Linux distributions. We will create a test file with it by typing

```
nano test.dat
```

This will open a nano window where we can type some message, like “Hello world”

```
mario@LAPTOP-0EIOCDUM: ~/substitute_NRV
GNU nano 6.2 test.dat *
Hello world_
[ New File ]
^G Help      ^O Write Out ^W Where Is  ^K Cut       ^T Execute   ^C Location  M-U Undo     M-A Set Mark
^X Exit      ^R Read File ^\ Replace  ^U Paste     ^J Justify   ^_ Go To Line M-E Redo     M-G Copy
```

Then we will close nano with Ctrl+X



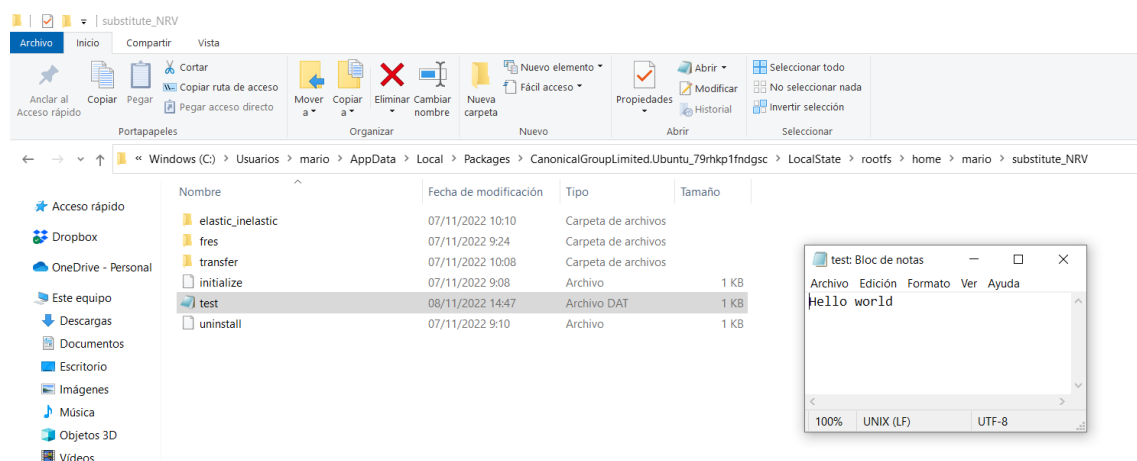
It will ask us if we want to save the file. We confirm by typing Y. We can modify the name of the file now, but we will leave it as by pressing the Enter key.

We can use

`nano test.dat`

again to see our written text which has now been saved.

If back in Windows we look at the Ubuntu home folder we can go to the `substitute_NRV` folder to find our test file. If we open it with the notepad (we may have to tell windows to use the notepad) we will be able to see our text.



In this way we can access the files generated in the Ubuntu SO to treat them with Windows programs. The files can be copied to a Windows folder that is more convenient to use. Remember that the changes performed in Windows may not be well transferred to Ubuntu so it is better to modify the input files through the Ubuntu terminal.

Now, we will remove the test file by typing

```
rm test.dat
```

Be careful when removing files, as they cannot be recovered and you can lose files essential for the course, although they can be downloaded back from the website.