1INF06 Data Structures and Methodical Programming

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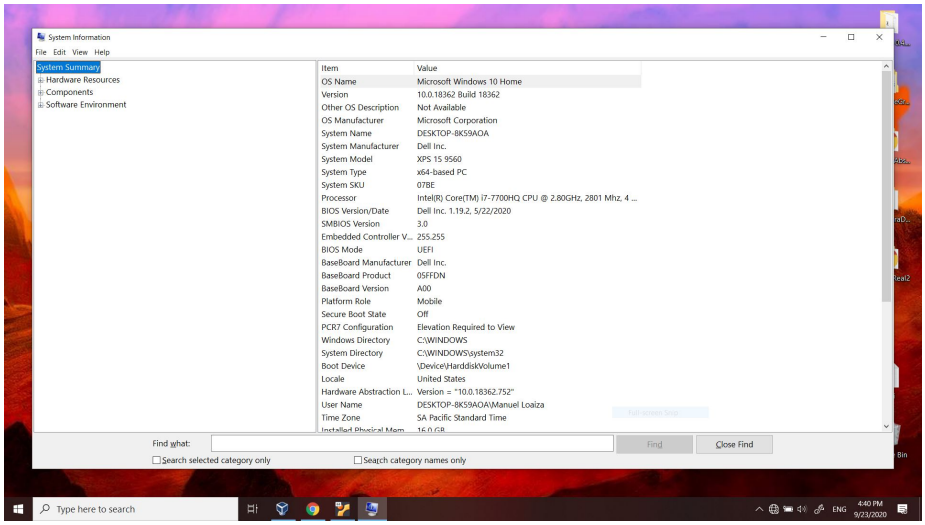
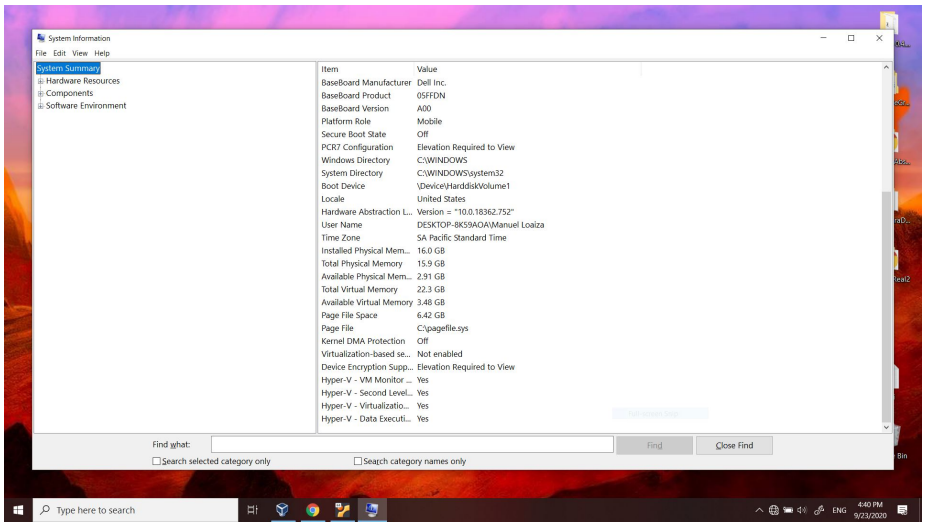
Second report of the course Data Structures and Methodical Programming taught at the Faculty of Science and Engineering at Pontificia Universidad Católica del Perú (PUCP) by Viktor Khlebnikov in the semester 2020-2.

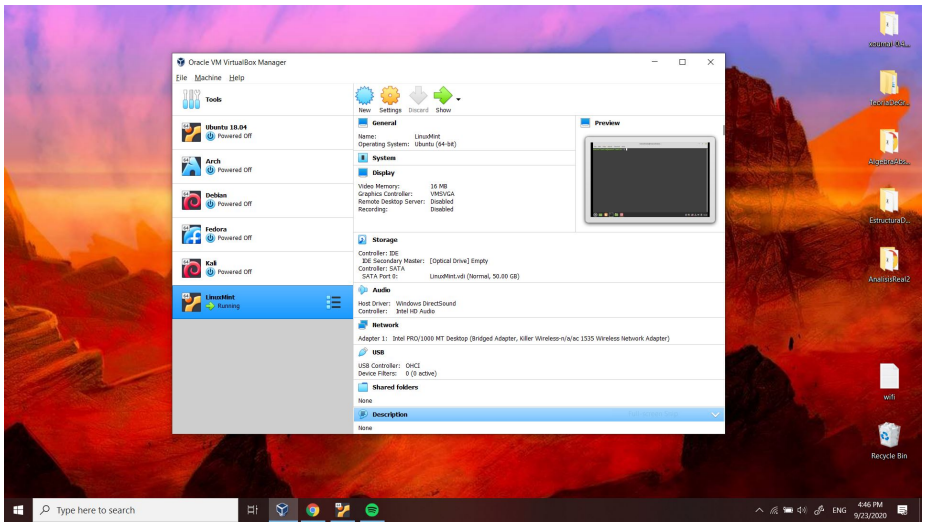
Contents

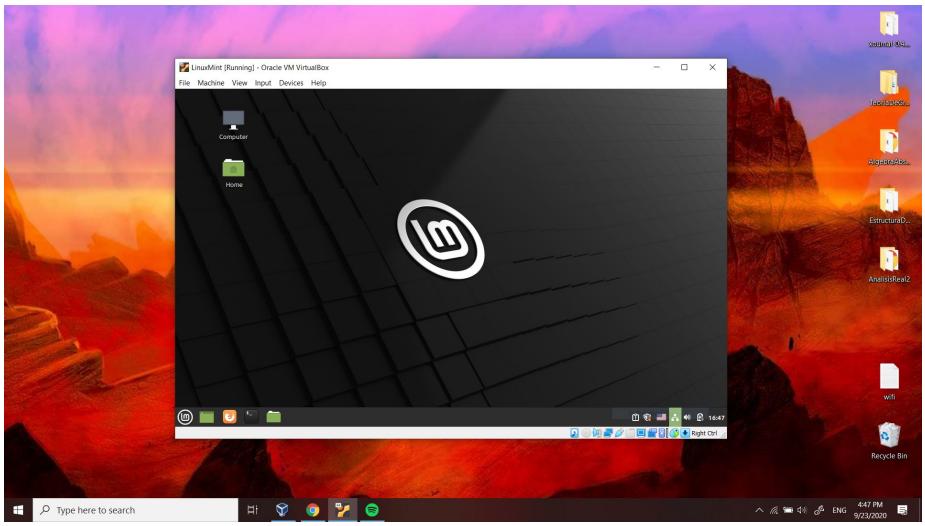
1 Loaiza Vasquez, Manuel Alejandro

1.1 Resources and Oracle VM VirtualBox parameters



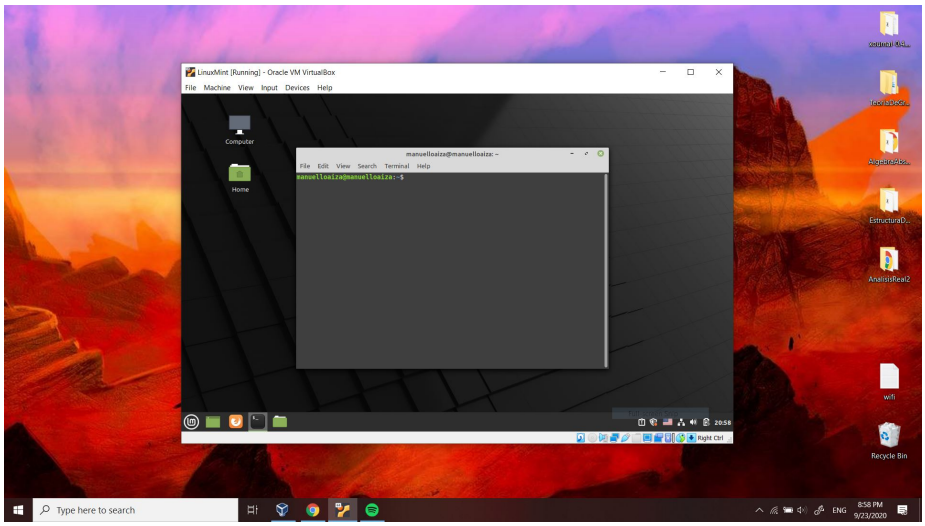




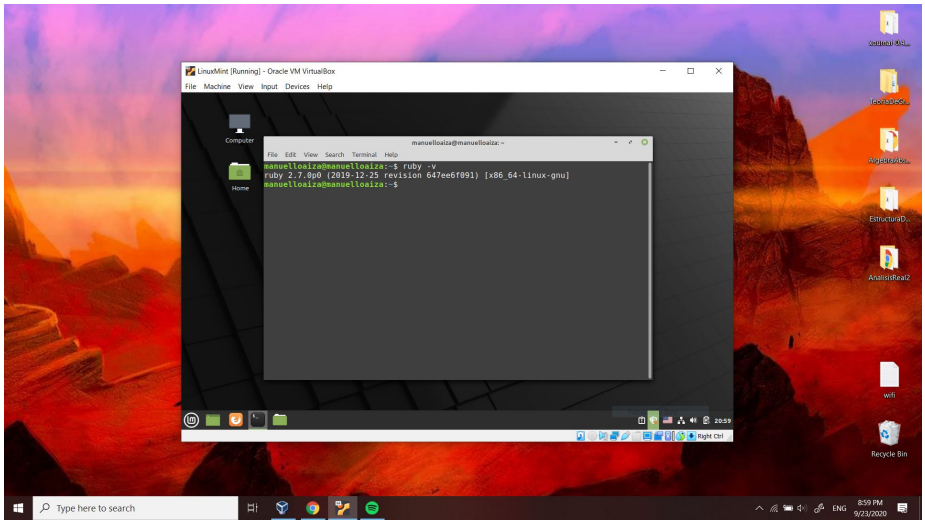


1.2 Ruby and Vim installation

Let's open the terminal using `Ctrl + Alt + t`.

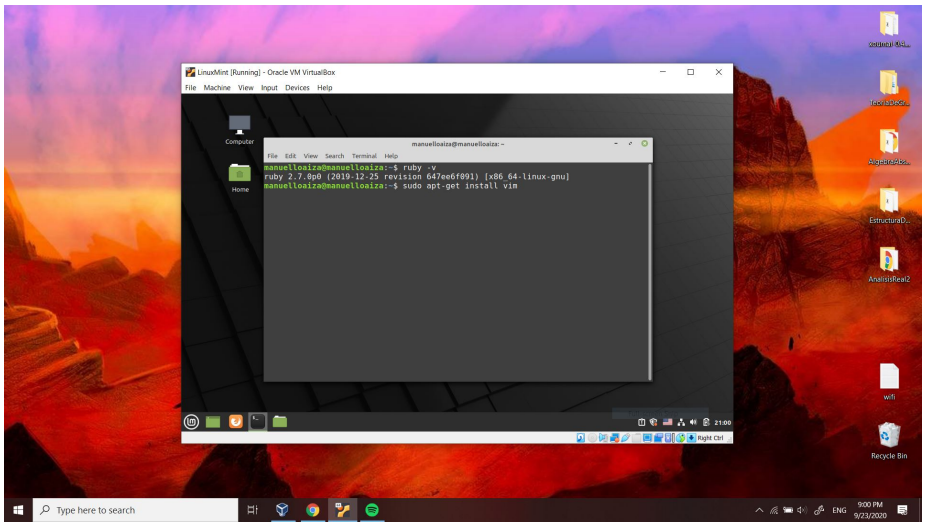


To check if we have Ruby already installed, we type `ruby -v`.

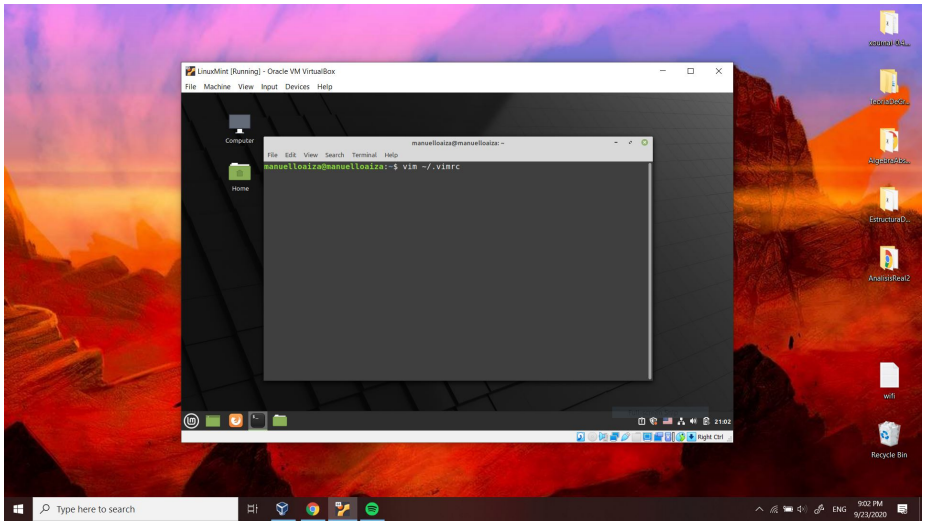


I have already installed Ruby on Linux Mint, so I'm not going to download anything.

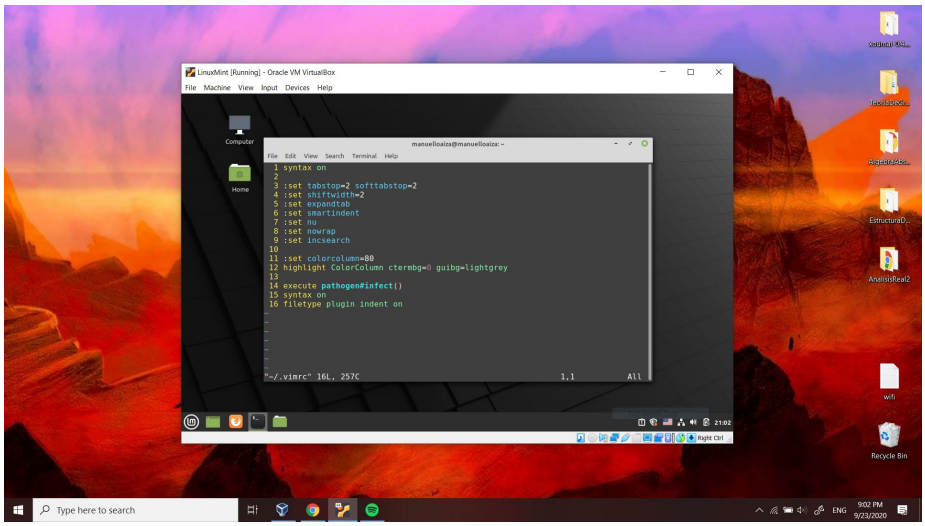
I have been using Vim since 2018 due to Competitive Programming. Vim became my favorite IDE because it is light, extremely fast and simple to use, easy to customize making changes in the vimrc file and there is also a well known story that says that hardcore programmers use Vim instead of more sofisticated IDEs. To install it, we type `sudo apt-get install vim` in the command line.



To customize it, we type `vim ~/.vimrc` in the command line and put there our environment settings.

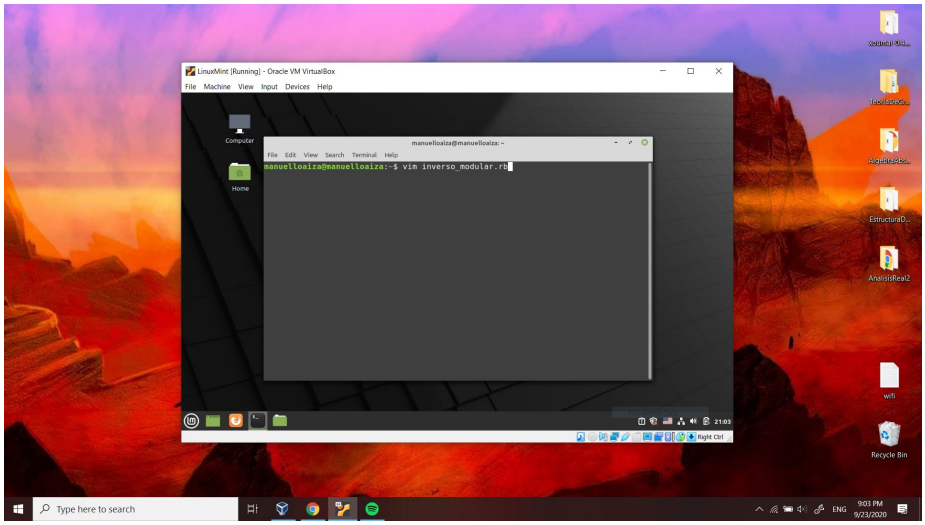


The most important features that I use are the following: `tabstop` and `softtabstop` for having more compact code, I reduce the length of the tab to 2 spaces. Also, I use `expandtab` to convert the tab into 2 blankspace characters, which is very useful when I want to open my code in other editor or computer and preserve the identation I have used before. I set a light grey column after 80 characters to be aware of having very long lines to make code more readable. The last three lines are plugins for using LaTeX in Vim.



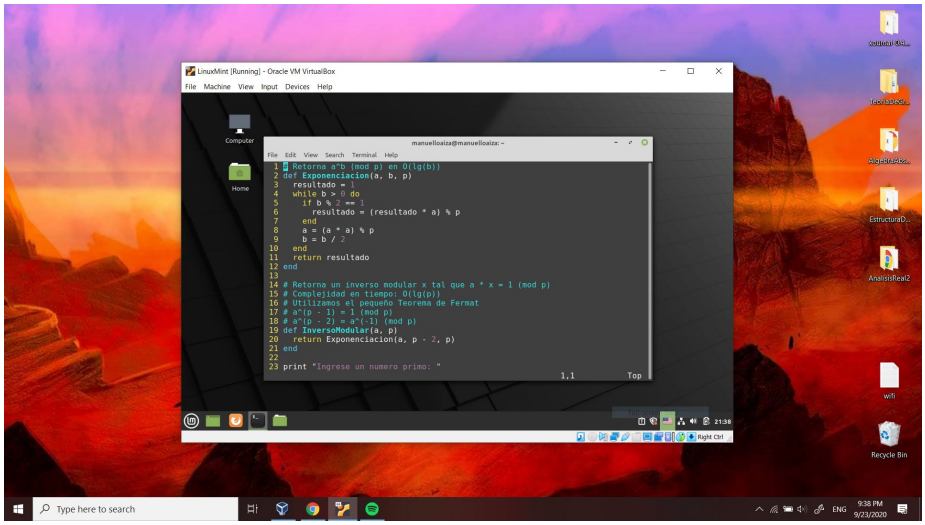
1.3 Ruby example program

I want to make a program that calculates the modular inverse of a number n modulo p, with p prime, in $O(\log_2 p)$. First, we create and open a file in Vim typing `vim inverso_modular.rb`.

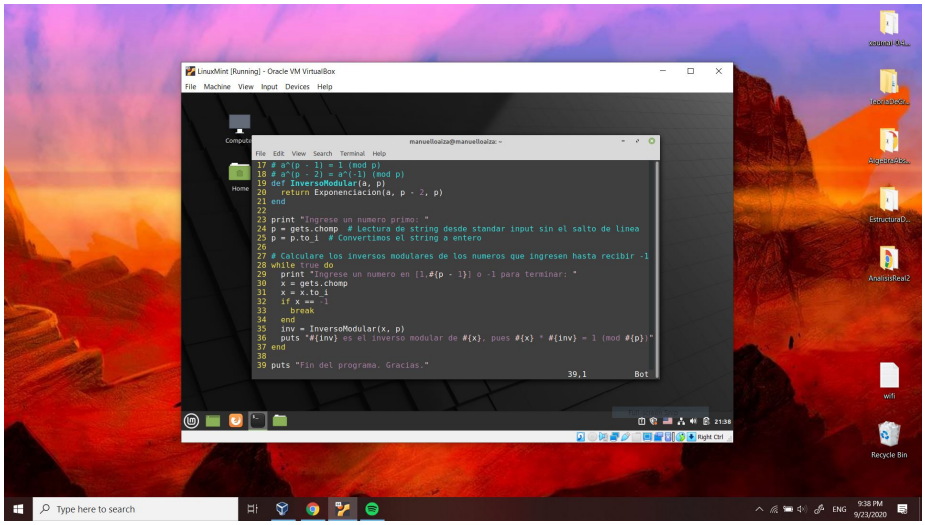


The function `Exponenciacion` returns the value of $a^b \pmod p$ in $O(\log_2 p)$ with an iterative binary exponentation. Then, using Fermat's Little Theorem, we solve $ax \equiv 1 \pmod p$, where x is called the modular inverse of a, calling the function `InversoModular`.

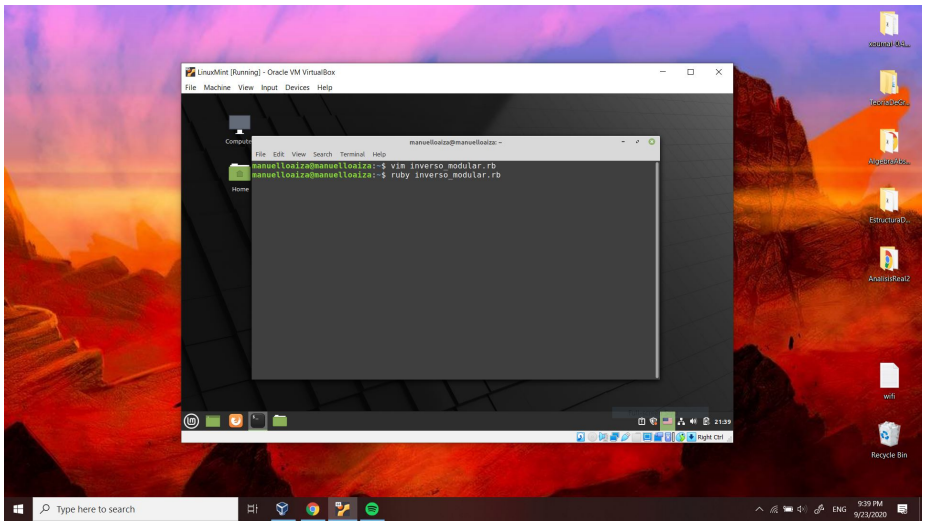
$$a^{\phi(p)} \equiv 1 \pmod{p}$$
$$a^{p-1} \equiv 1 \pmod{p}$$
$$a^{p-2} \equiv a^{-1} \pmod{p}.$$

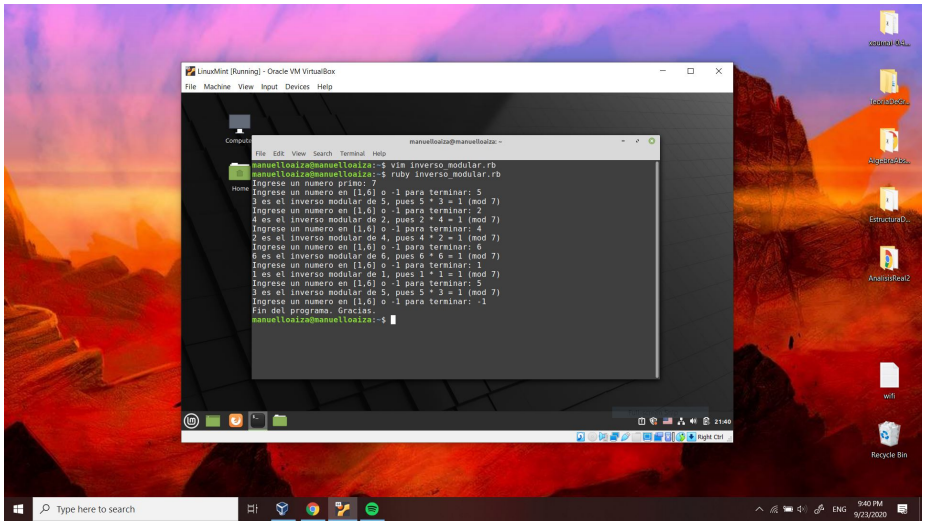


Our main program is going to receive a prime number p from the standard input using `gets.chomp`, which is going to read a string without the final end of line. However, because we are going to use p as an integer, we need to use `.to_i` to convert a string into an integer. Finally, we find the modular inverse of many numbers using `while ... do ... end`.



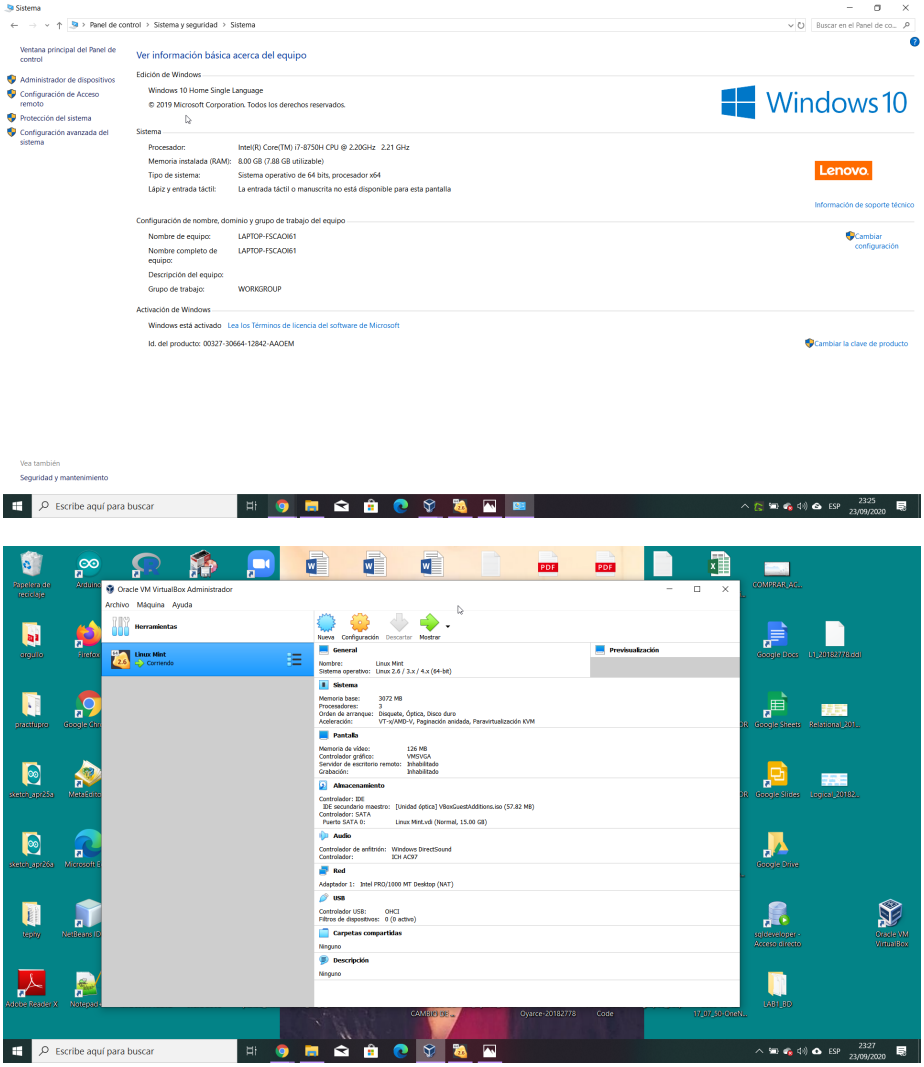
To save and exit the file we have coded in Vim, we press `Esc` and then type `:wq`. In the command line, we type `ruby inverso_modular.rb` to execute the program. Ruby is an interpreted language, so we don't need to compile it every time we make a change.

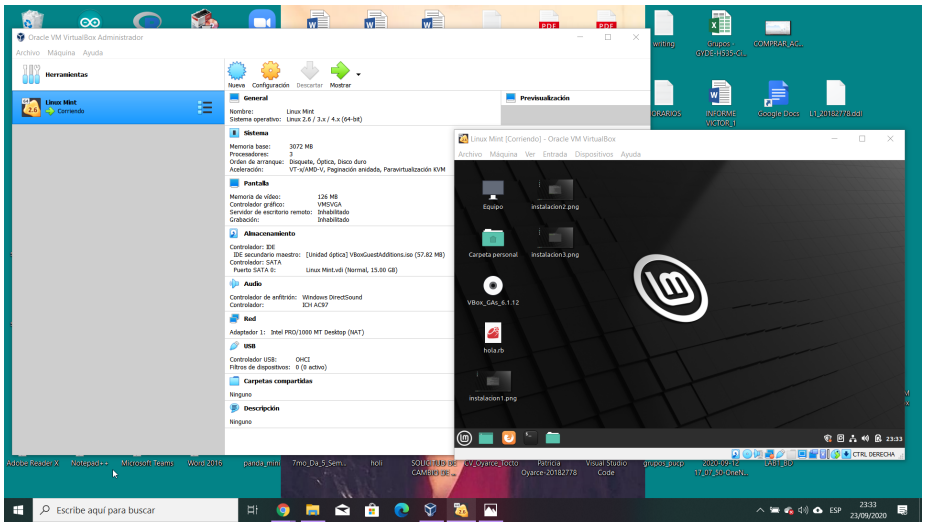




2 Oyarce Tocto, Elizabeth Patricia

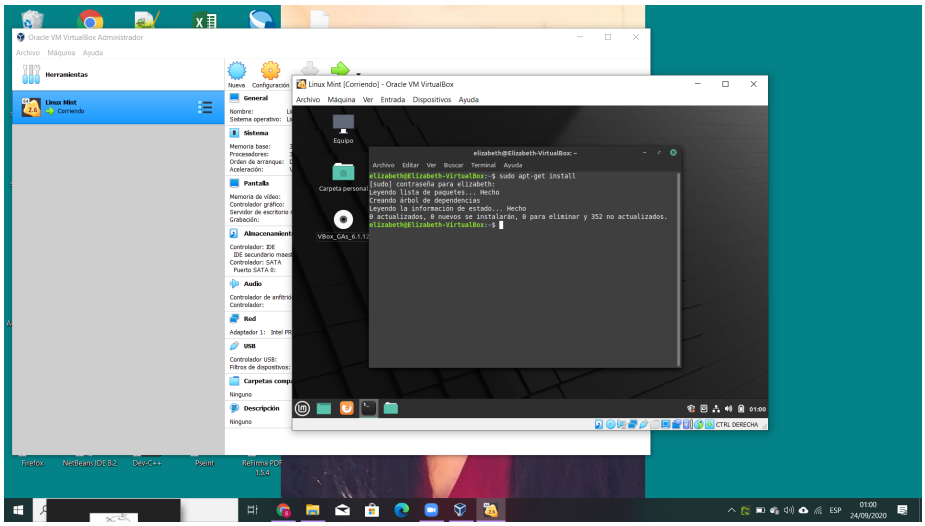
2.1 Resources and Oracle VM VirtualBox parameters



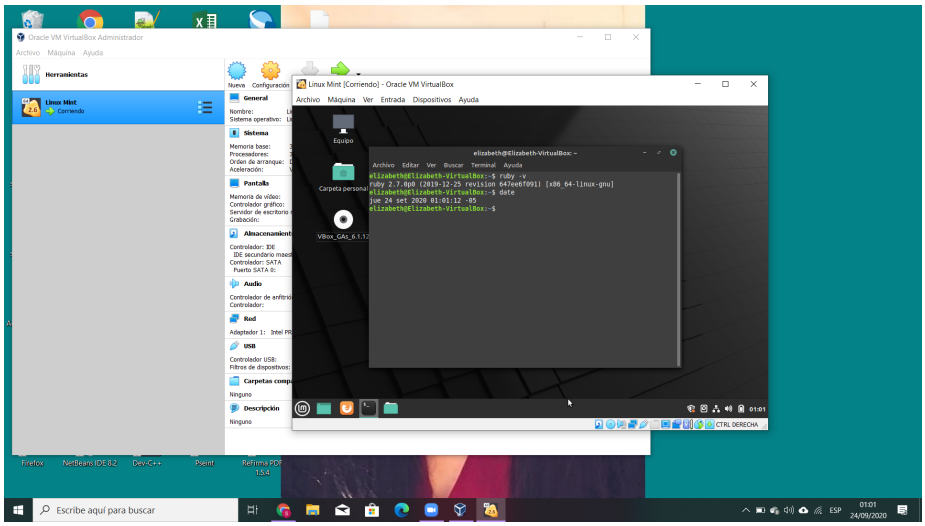


2.2 Ruby installation

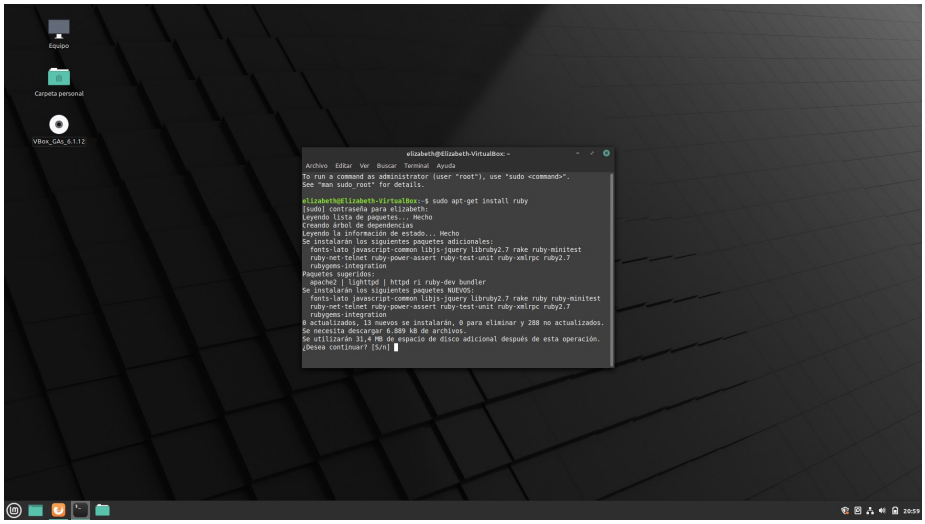
First, let's open the terminal using `Ctrl + Alt + t`. To install the Ruby language, we use the command `sudo apt-get install ruby` and press the Enter key. As we can see in the picture, I have already installed Ruby on Linux Mint, so I'm not going to download it again.

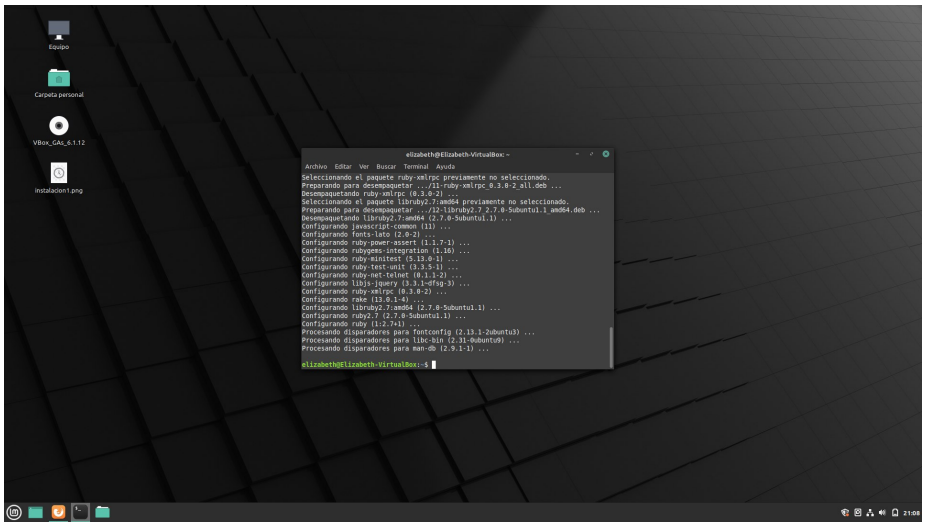


To check if we have Ruby installed, we type `ruby -v` to check which version of Ruby we have.



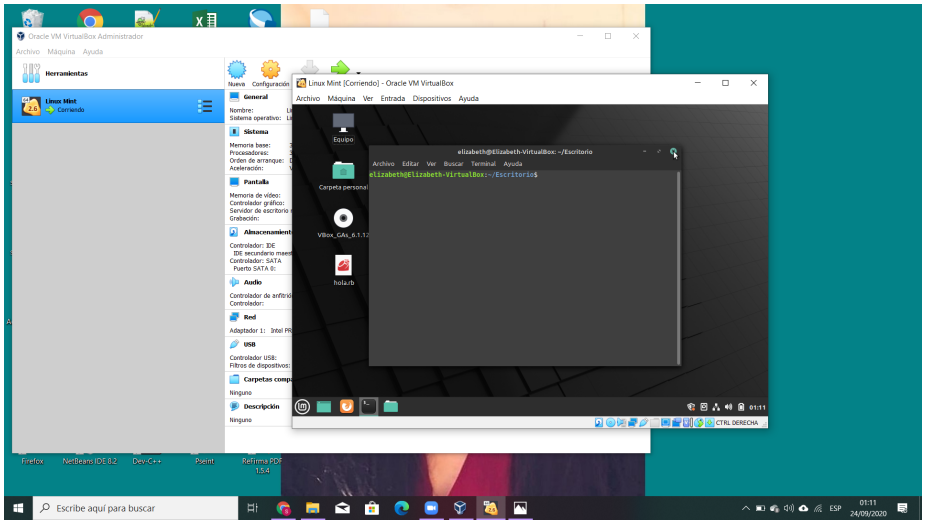
The following pictures have been taken from my Ruby installation process.



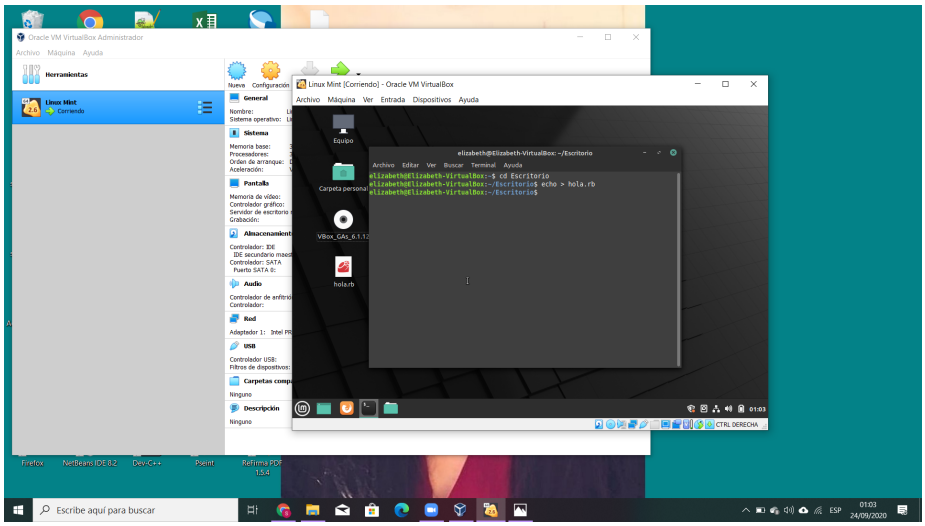


2.3 Ruby example program

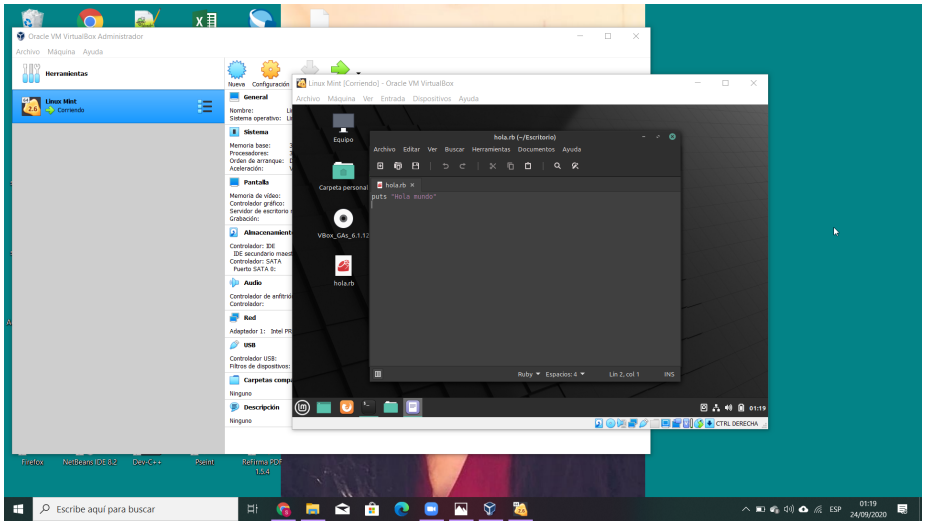
Let's open the terminal using `Ctrl + Alt + t`.



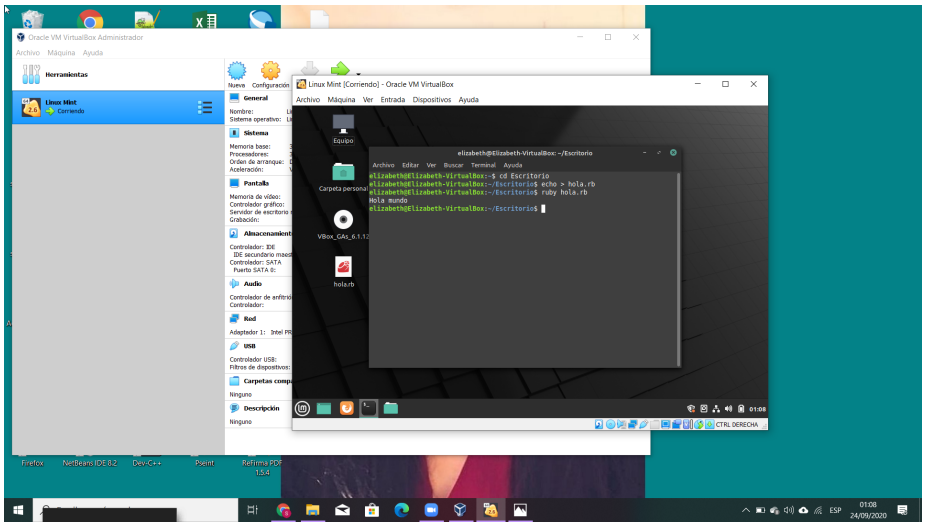
As our first step, we will change our current directory to the desktop using the command `cd` and there, we will create the file .rb with the command `echo > hola.rb`.



Then, we write our program in the file using the text editor. In this case, the code was `puts "Hola mundo"`.

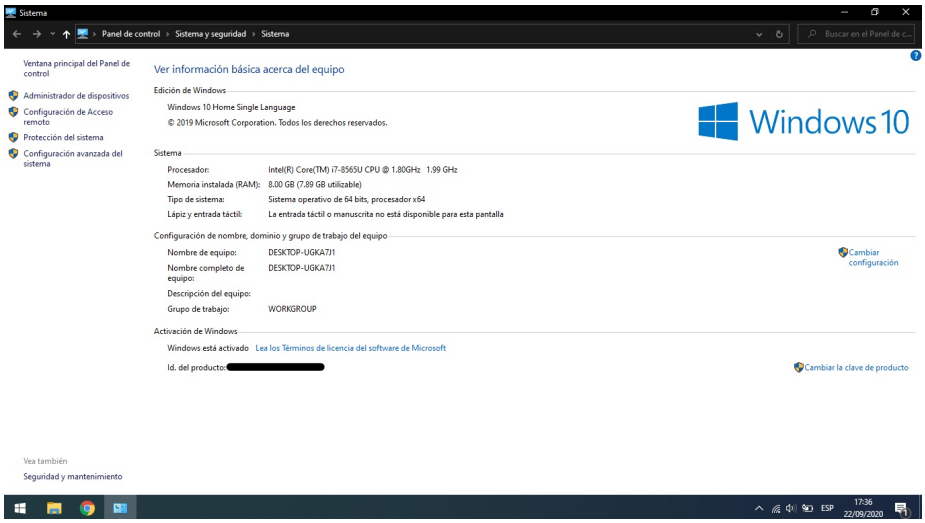


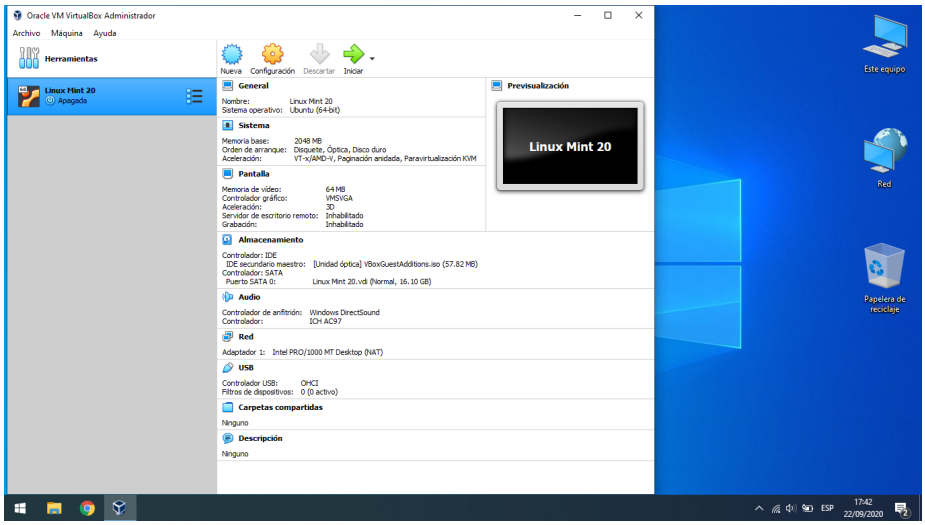
Finally, we run the program from the terminal: we type the command `ruby hola.rb` to execute it and press the `Enter` key.

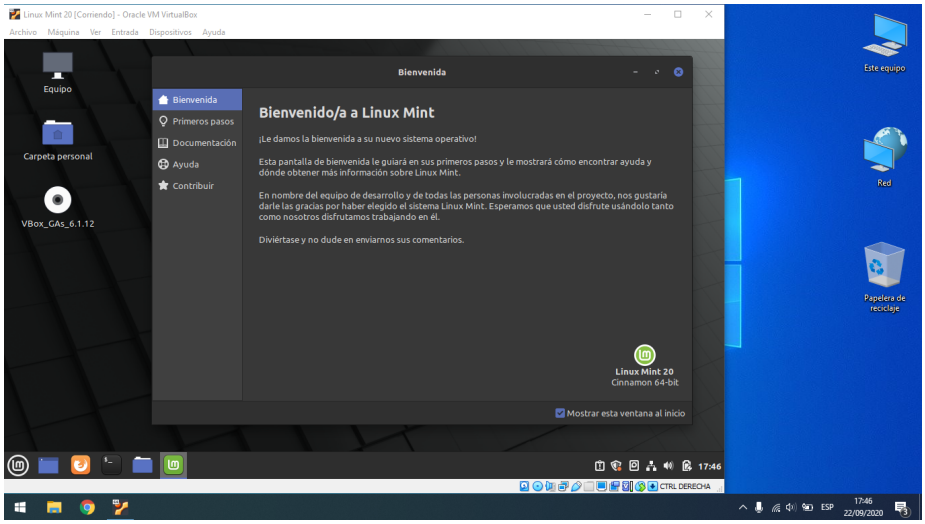


3 Saras Rivera, André Edgardo

3.1 Resources and Oracle VM VirtualBox parameters

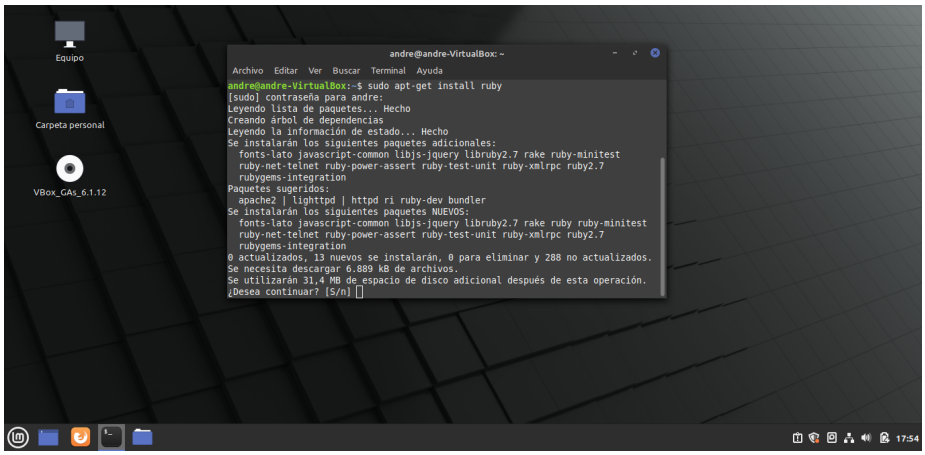


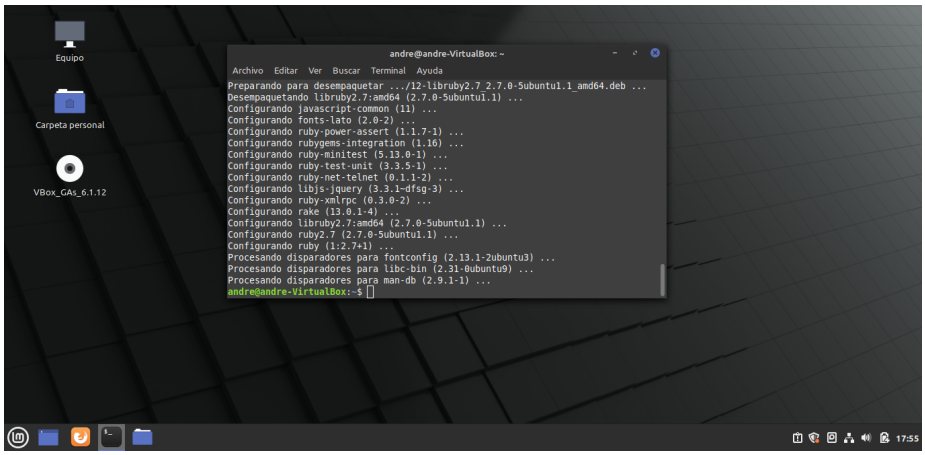


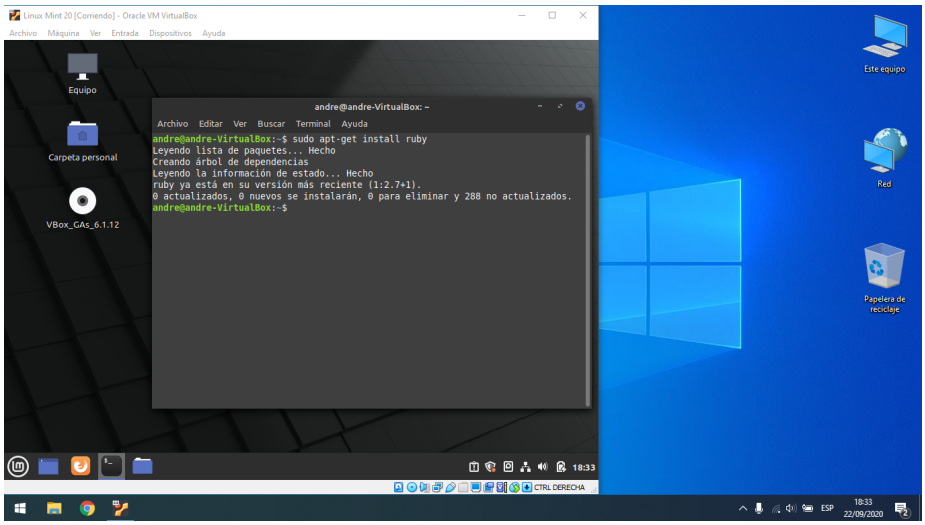


3.2 Ruby installation

Let's open the terminal using `Ctrl + Alt + t`.


Equipo
Carpeta personal
VBox_GAs_6.1.12
andre@andre-VirtualBox: ~
Archivo Editar Ver Buscar Terminal Ayuda
andre@andre-VirtualBox:~$ sudo apt-get install ruby
[sudo] contraseña para andre:
Leyendo lista de paquetes... Hecho
Creando árbol de dependencias
Leyendo la información de estado... Hecho
Se instalarán los siguientes paquetes adicionales:
fonts-lato javascript-common libjs-jquery libruby2.7 rake ruby-minitest
ruby-net-telnet ruby-power-assert ruby-test-unit ruby-xmlrpc ruby2.7
rubygems-integration
Paquetes sugeridos:
apache2 | lighttpd | httpd ri ruby-dev bundler
Se instalarán los siguientes paquetes NUEVOS:
fonts-lato javascript-common libjs-jquery libruby2.7 rake ruby ruby-minitest
ruby-net-telnet ruby-power-assert ruby-test-unit ruby-xmlrpc ruby2.7
rubygems-integration
0 actualizados, 13 nuevos se instalarán, 0 para eliminar y 288 no actualizados.
Se necesita descargar 6.889 kB de archivos.
Se utilizarán 31,4 MB de espacio de disco adicional después de esta operación.
¿Desea continuar? [S/n]
17:54

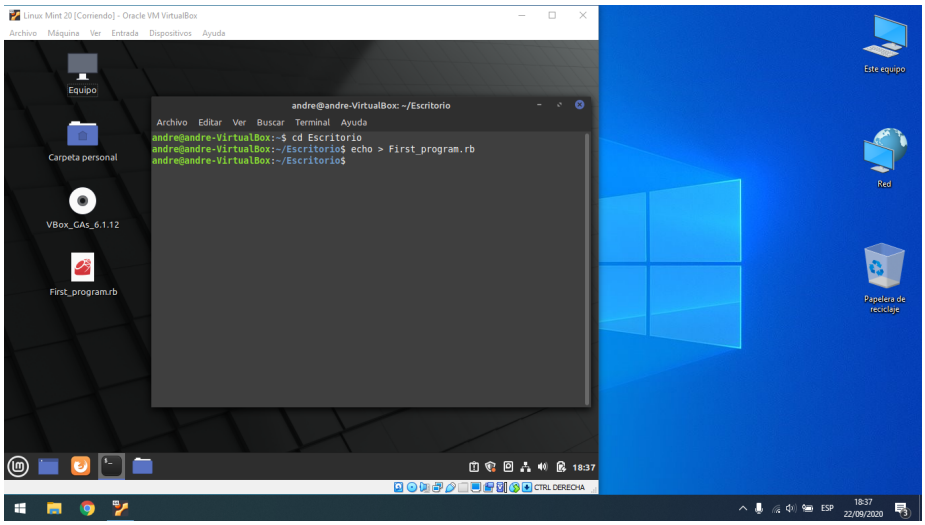

Equipo
Carpeta personal
VBox_GAs_6.1.12
andre@andre-VirtualBox: ~
Archivo Editar Ver Buscar Terminal Ayuda
Preparando para desempaquetar .../12-libruby2.7_2.7.0-5ubuntu1.1_amd64.deb ...
Desempaquetando libruby2.7:amd64 (2.7.0-5ubuntu1.1) ...
Configurando javascript-common (11) ...
Configurando fonts-lato (2.0-2) ...
Configurando ruby-power-assert (1.1.7-1) ...
Configurando rubygems-integration (1.16) ...
Configurando ruby-minitest (5.13.0-1) ...
Configurando ruby-test-unit (3.3.5-1) ...
Configurando ruby-net-telnet (0.1.1-2) ...
Configurando libjs-jquery (3.3.1-dfsg-3) ...
Configurando ruby-xmlrpc (0.3.0-2) ...
Configurando rake (13.0.1-4) ...
Configurando libruby2.7:amd64 (2.7.0-5ubuntu1.1) ...
Configurando ruby2.7 (2.7.0-5ubuntu1.1) ...
Configurando ruby (1:2.7+1) ...
Procesando disparadores para fontconfig (2.13.1-2ubuntu3) ...
Procesando disparadores para libc-bin (2.31-0ubuntu9) ...
Procesando disparadores para man-db (2.9.1-1) ...
andre@andre-VirtualBox:~$
17:55

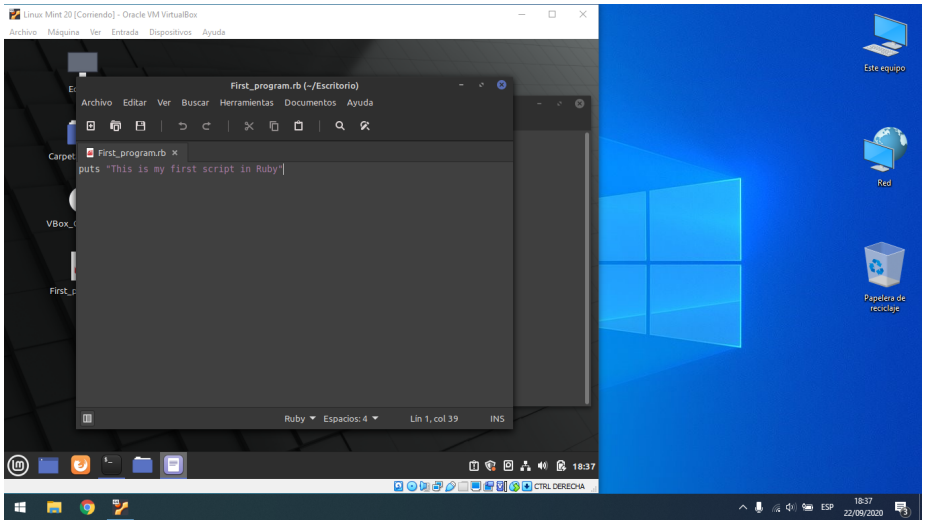

Linux Mint 20 [Corriendo] - Oracle VM VirtualBox
Archivo Máquina Ver Entrada Dispositivos Ayuda
Equipo
Carpeta personal
VBox_GAs_6.1.12
andre@andre-VirtualBox: ~
Archivo Editar Ver Buscar Terminal Ayuda
andre@andre-VirtualBox:~$ sudo apt-get install ruby
Leyendo lista de paquetes... Hecho
Creando árbol de dependencias
Leyendo la información de estado... Hecho
ruby ya está en su versión más reciente (1:2.7+1).
0 actualizados, 0 nuevos se instalarán, 0 para eliminar y 288 no actualizados.
andre@andre-VirtualBox:~$
18:33
CTRL DERECHA
Este equipo
Red
Papelera de reciclaje
ESP
18:33
22/09/2020

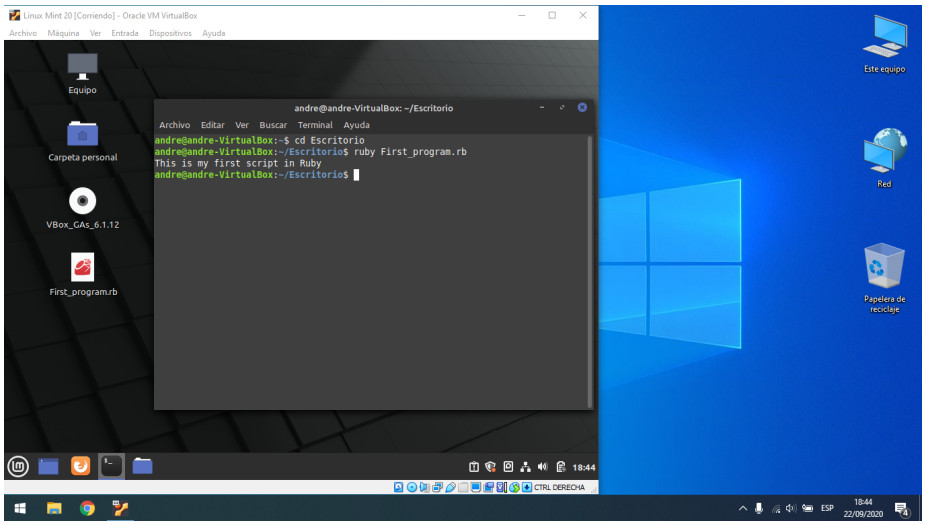
First; we open the terminal, put the command `sudo apt-get install ruby` and press the Enter key. Secondly; we accept the installation by pressing the letter `S` and wait for it to finish. Finally; we put the command `sudo apt-get install ruby` again to verify that the installation was correct and you have the most recent version of Ruby.

3.3 Ruby example program

Let's open the terminal again using `Ctrl + Alt + t`.







As is customary, as it is the first program created in the programming language that we plan to learn, the famous `Hello World` program will be created. Before everything; We will create the file .rb in which we will work for this use the command `echo > name file.rb`. Then; we write our program in the file, in this case, use the function: puts "insert text". Finally; we run the program from the terminal following the following steps:

1. With the command `cd` we are located on the desktop.
2. When we are there, we open the script we created in Ruby with the command: `ruby name program.rb`.
3. We press Enter to run the program.