AOS ASSIGNMENT 2

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ROLL: 2022202007

Setup

Oracle VirtualBox is used for installing Virtual Machine.
While installing, 4 CPU cores and a minimum of 40GB hard disk space are allotted to the VM.

Installing kernel linux 4.19.210

```
wget https://cdn.kernel.org/pub/linux/kernel/v4.x/linux-4.19.210.tar.xz
```

Extracting Kernel

```
sudo tar -xvf linux-4.19.210.tar.xz -C/usr/src/
```

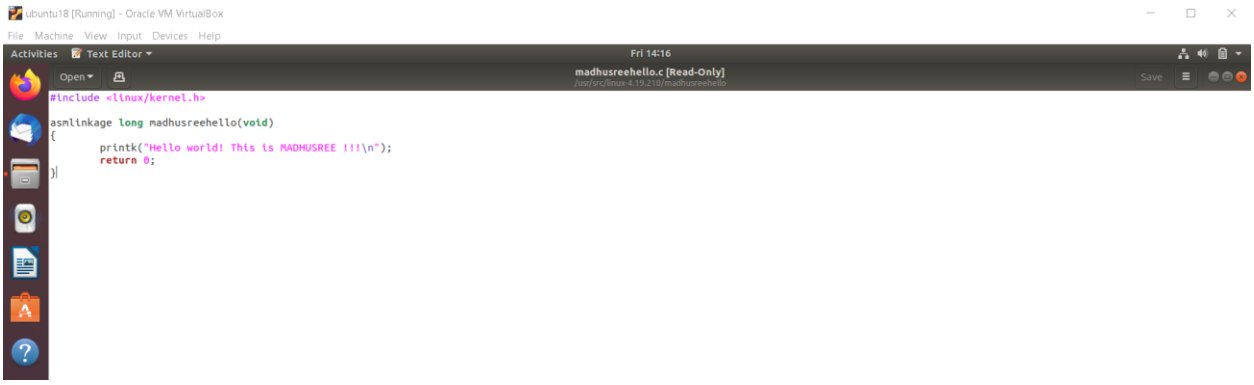
Now all the files are extracted in /usr/src/linux-4.19.210

Question 1

1. Create directory madhusreehello, inside it madhusreehello.c

   ```
   mkdir madhusreehello
   cd madhusreehello
   gedit madhusreehello.c
   ```

2. Code



3. Create Makefile

   ```
   gedit Makefile
   ```

   obj-y := madhusreehello.o

   This is to ensure that the madhusreehello.c file is compiled and included in the kernel source code.

4. Go to parent and edit the makefile

   ```
   cd ..
   gedit Makefile
   ```

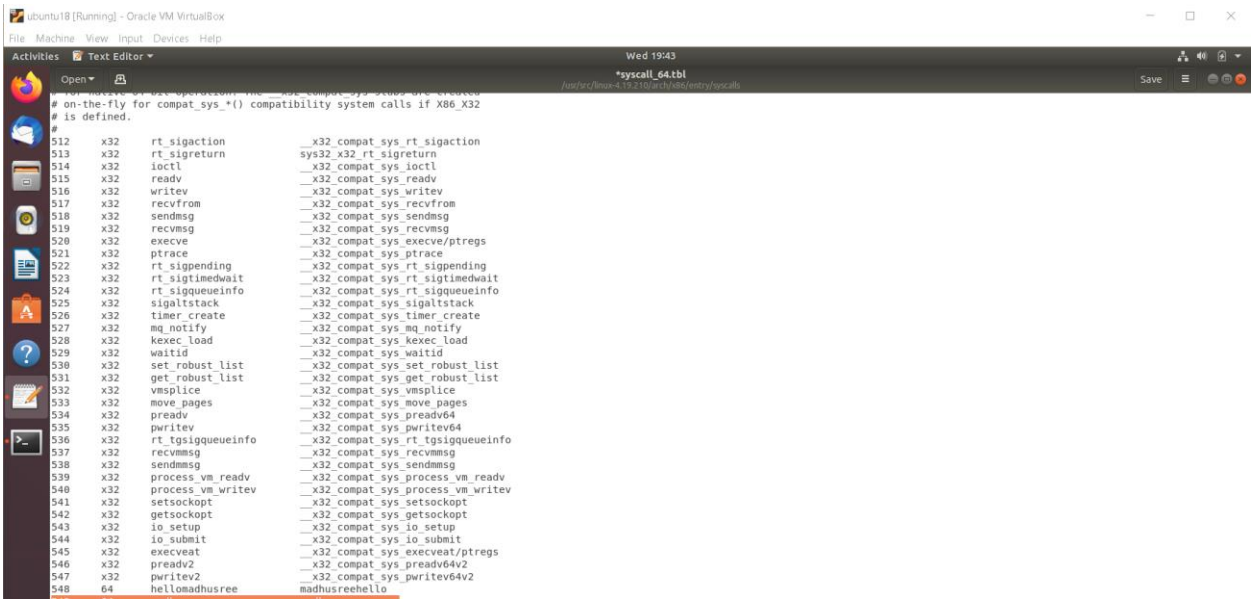
   Change the line and add madhusreehello/ at the end

   core-y += kernel/ mm/ fs/ ipc/ security/ crypto/ block/ **madhusreehello/**

This is to tell the compiler that the source files of our new system call (madhusreehello()) are present in the madhusreehello directory.

5. Add the new system call to the table of system calls

```
cd arch/x86/entry/syscalls/
gedit syscall_64.tbl
```



The Syscall number is 548.

6. Add the syscall to the system call header file

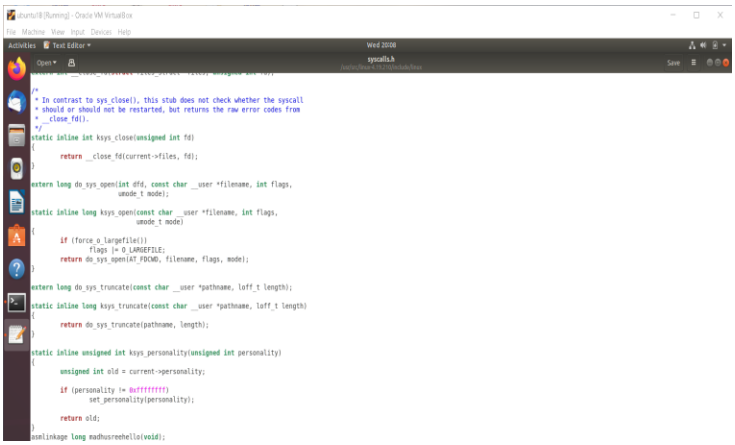
From linux-4.19.210 directory

```
cd include/linux/
gedit syscalls.h
```

Add

```
asmlinkage long madhusreehello(void);
```

Before endif in last line



7. Install essential packages

```
sudo apt-get install gcc
sudo apt-get install libncurses5-dev
sudo apt-get install bison
sudo apt-get install flex
sudo apt-get install libssl-dev
sudo apt-get install libelf-dev
sudo apt-get update
sudo apt-get upgrade
```

8. Compile the Kernel

```
sudo make -j4
```

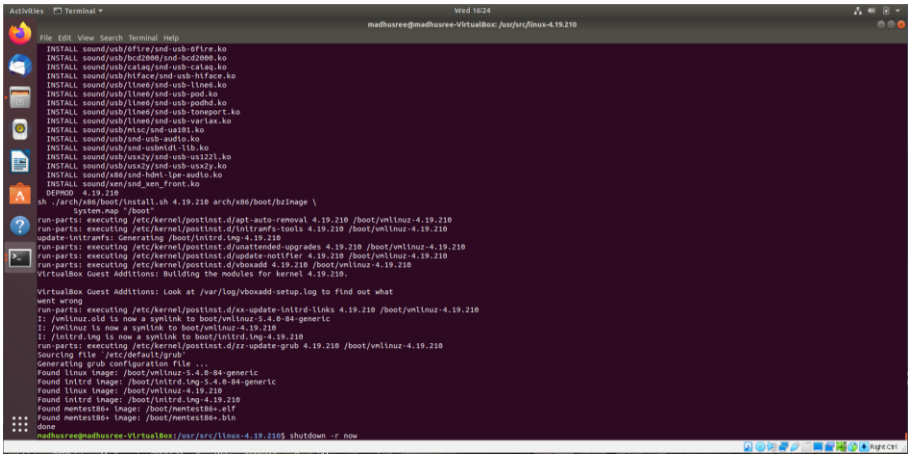
-j 4 because we have allotted 4 cores to our VM. It will make the compilation process faster

```
sudo make modules_install install
```

It will create some files under /boot/ directory and it will automatically make an entry in grub.cfg.

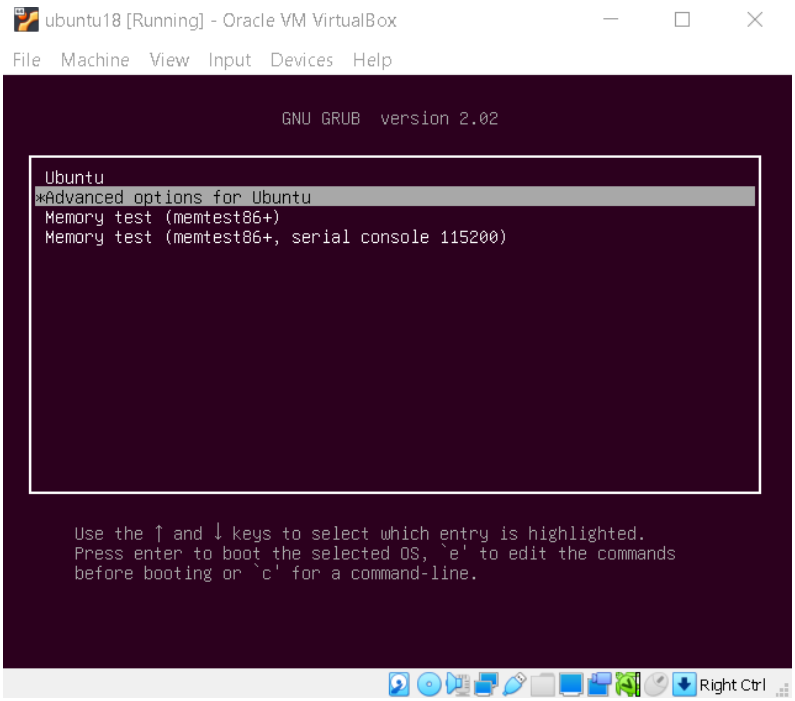
9. Reboot the system

```
shutdown -r now
```

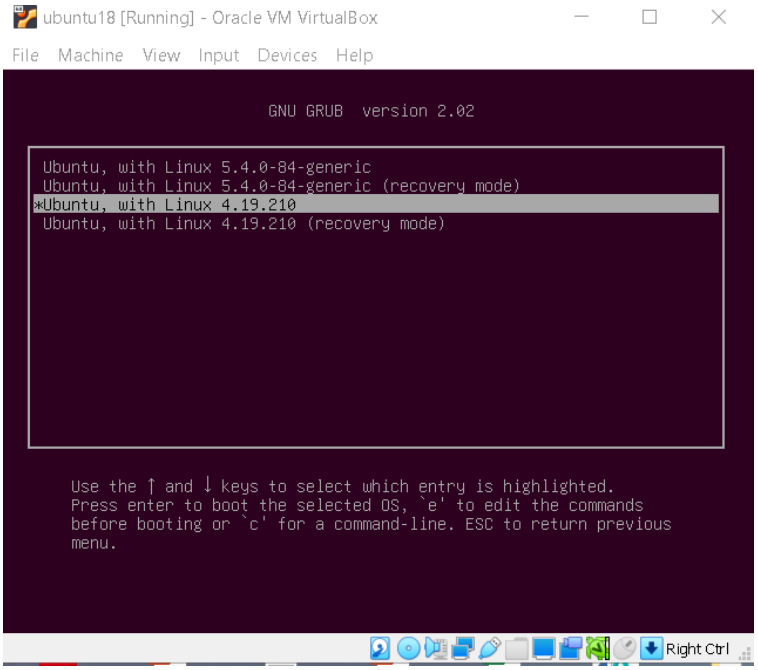


10. Boot the system using kernel linux-4.19.210

10.1. Select advanced options for Ubuntu

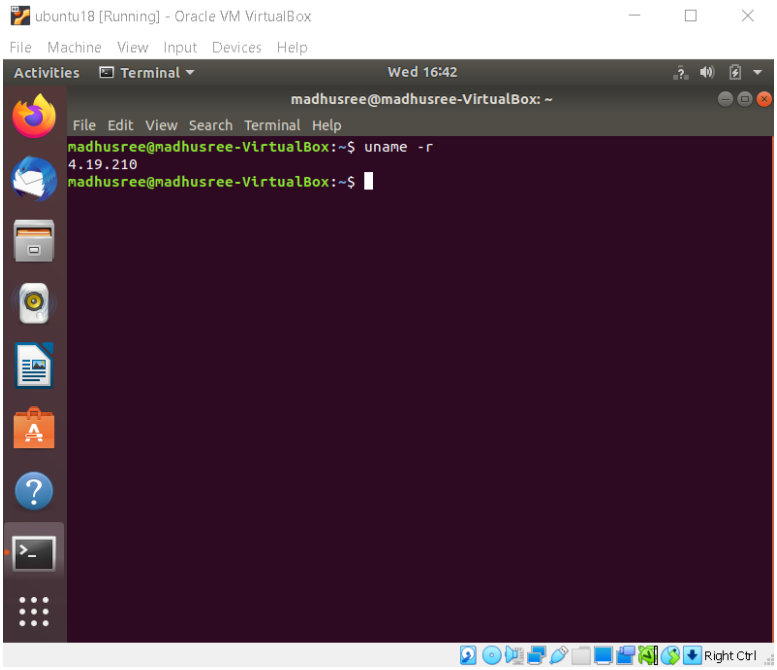


10.2 Select Ubuntu with Linux 4.19.210



11. Confirm the kernel

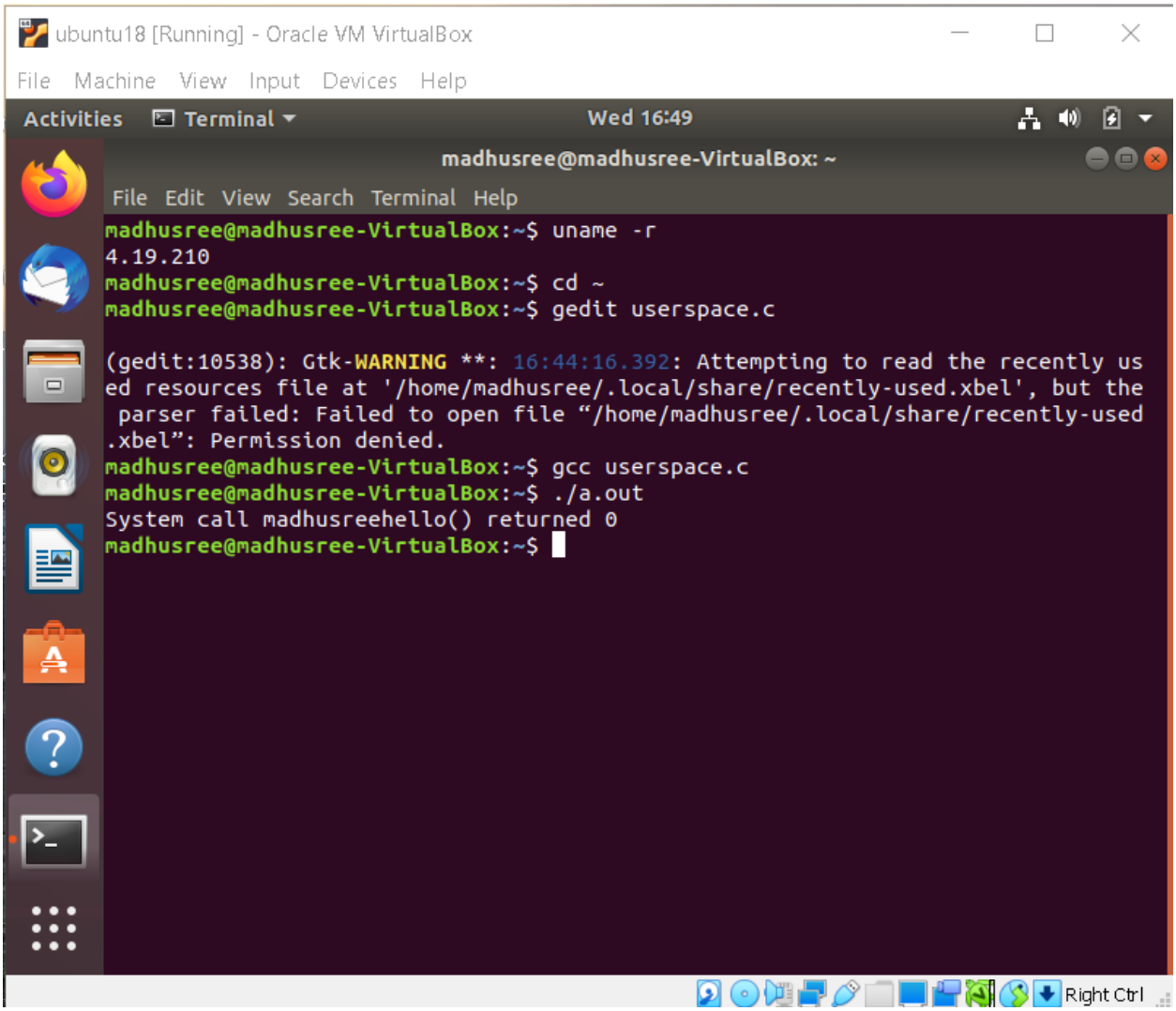
```
uname -r
```



12. Create madhusreehello.c in ~/home and add the code

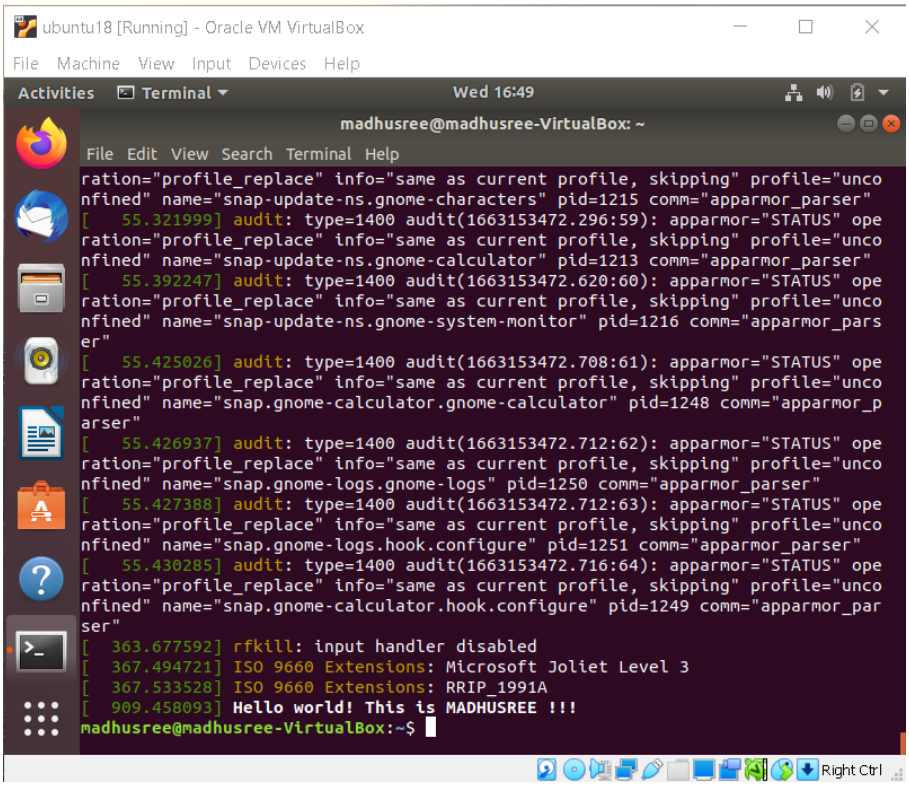
```c
#include <stdio.h>
#include<linux/kernel.h>
#include<sys/syscall.h>
#include<unistd.h>
int main(){
        long int ret_val = syscall(548);
        printf("System call madhusreehello() returned %ld\n", ret_val);
        return 0;
}
```

13. Compile and execute the code



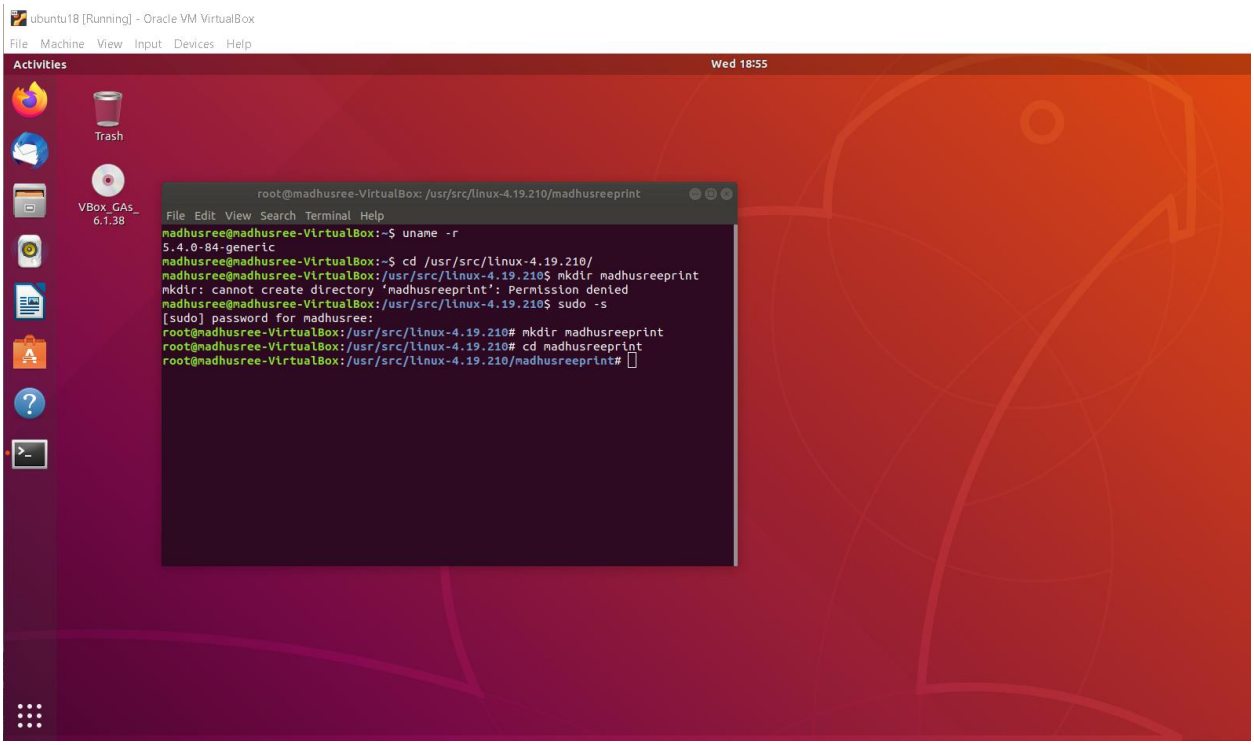
14. Check the log

dmesg



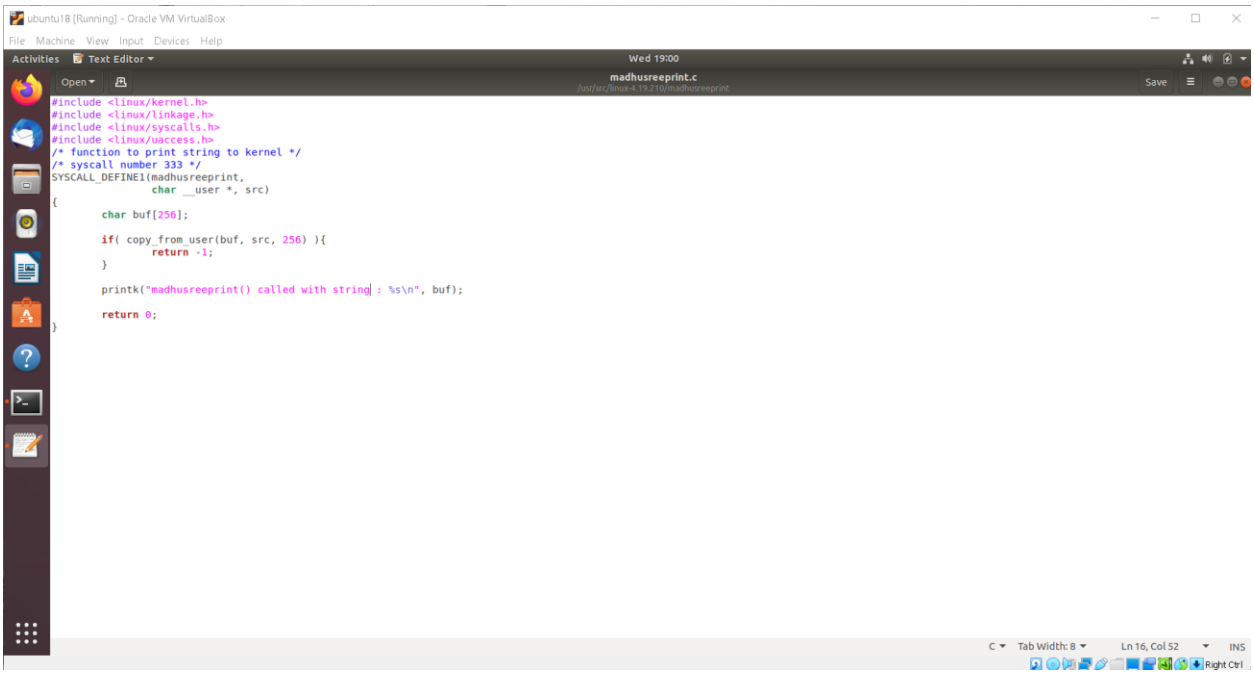
Question 2

1.Create directory madhusreeprint, inside it madhusreeprint.c



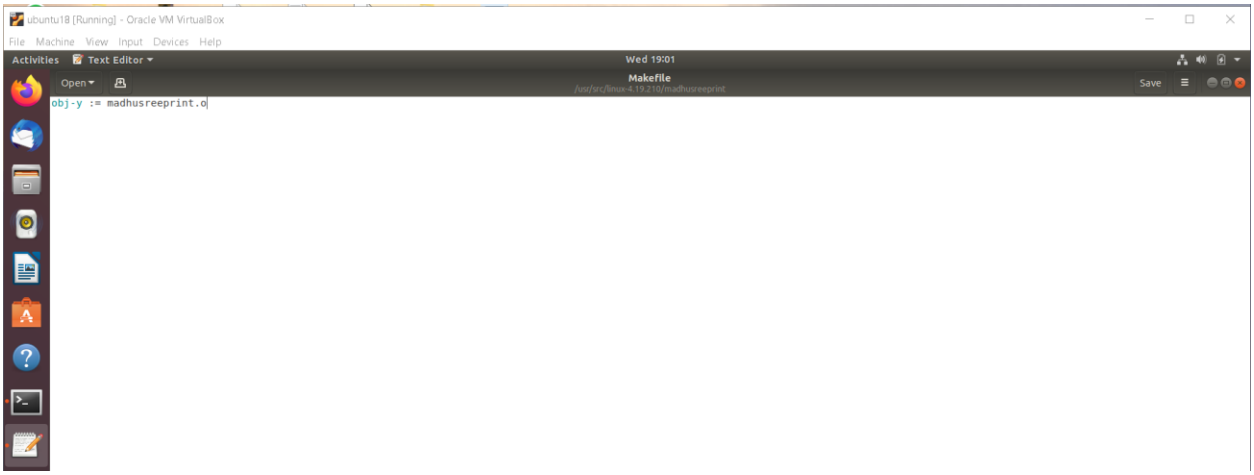
2. Code

`gedit madhusreeprint.c`



3. Create Makefile

`gedit Makefile`

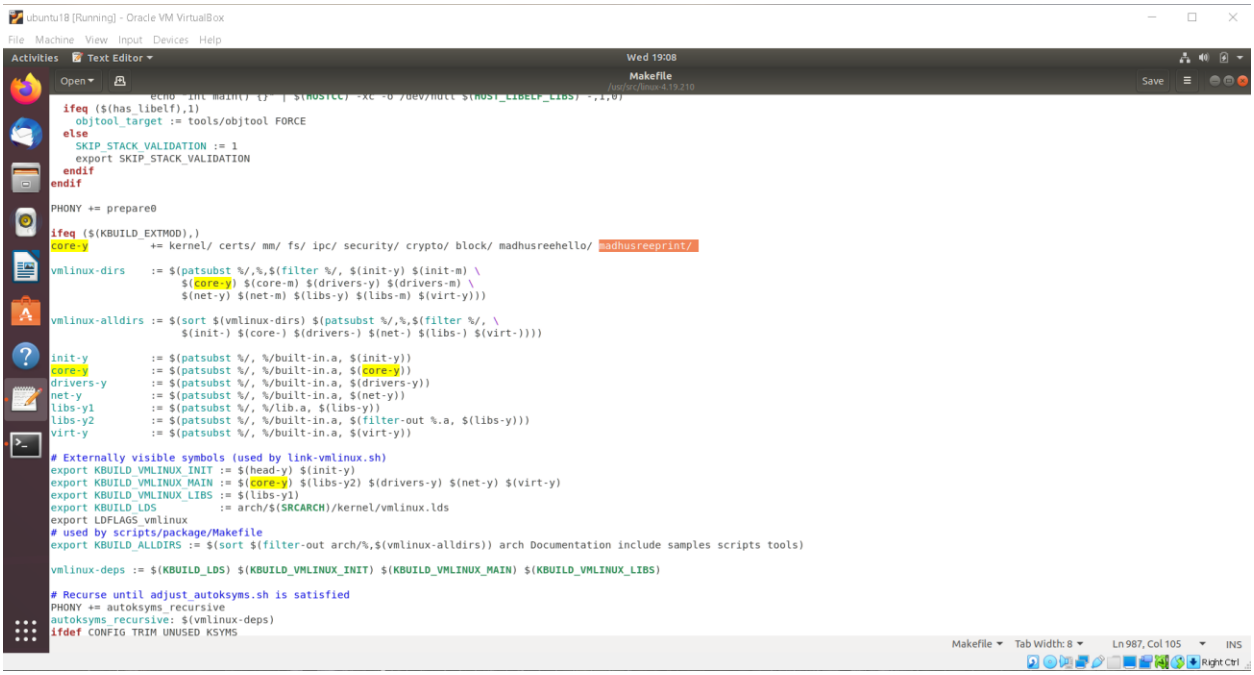


This is to ensure that the madhusreeprint.c file is compiled and included in the kernel source code.

4. Go to parent and edit the makefile

```
cd ..
gedit Makefile
```

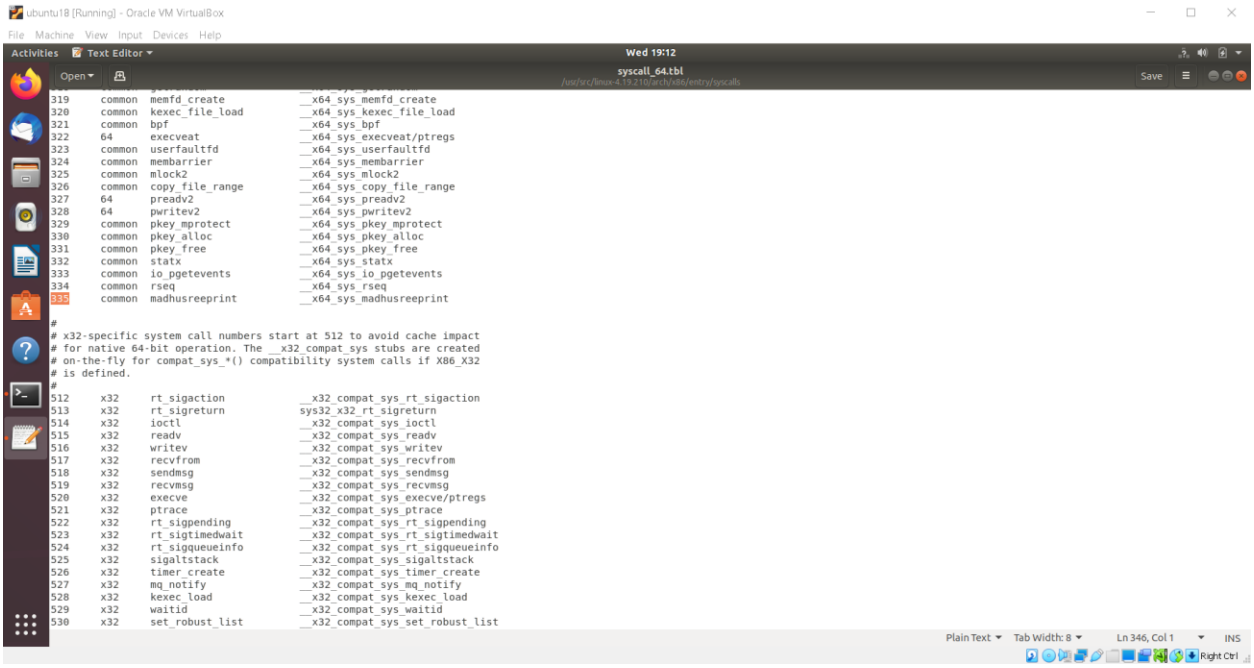
Change the line and add madhusreeprint/ at the end



This is to tell the compiler that the source files of our new system call (madhusreeprint()) are present in the madhusreeprint directory.

5. Add the new system call to the table of system calls

```
cd arch/x86/entry/syscalls/
gedit syscall_64.tbl
```



The Syscall number is 335.

6. Install essential packages

```
sudo apt-get install git fakeroot build-essential ncurses-dev xz-utils libssl-dev bc
```

7. Compile the Kernel

```
sudo make -j4
```

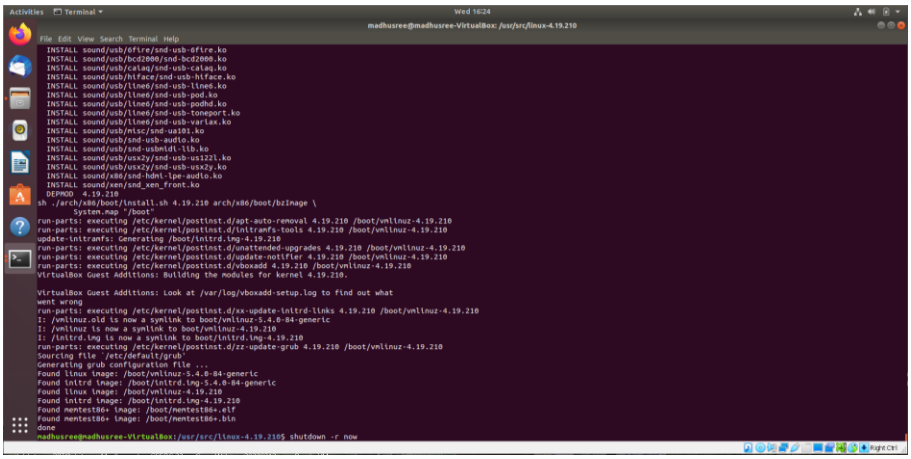
-j 4 because we have allotted 4 cores to our VM. It will make the compilation process faster

```
sudo make modules_install install
```

It will create some files under /boot/ directory and it will automatically make an entry in grub.cfg.

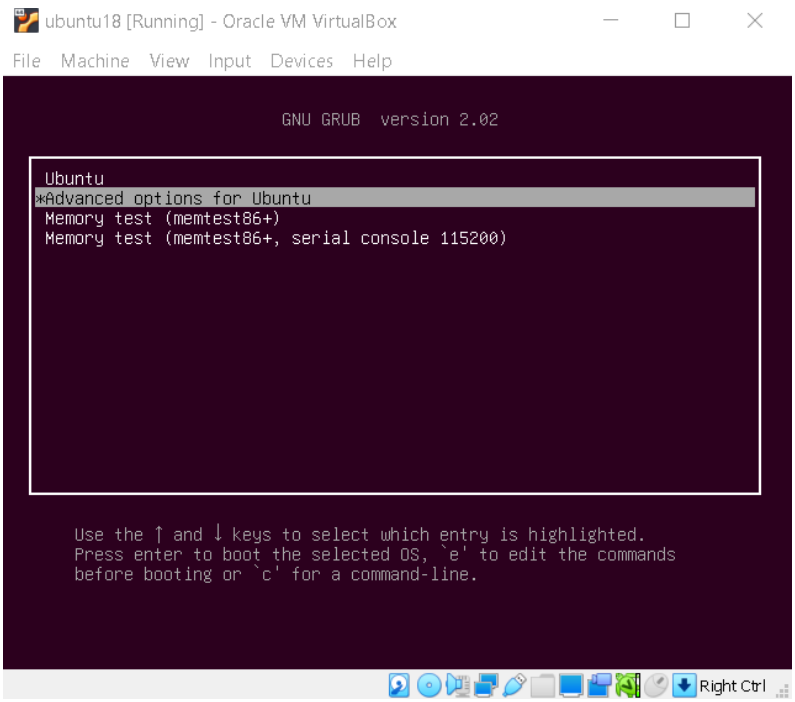
8. Reboot the system

```
shutdown -r now
```

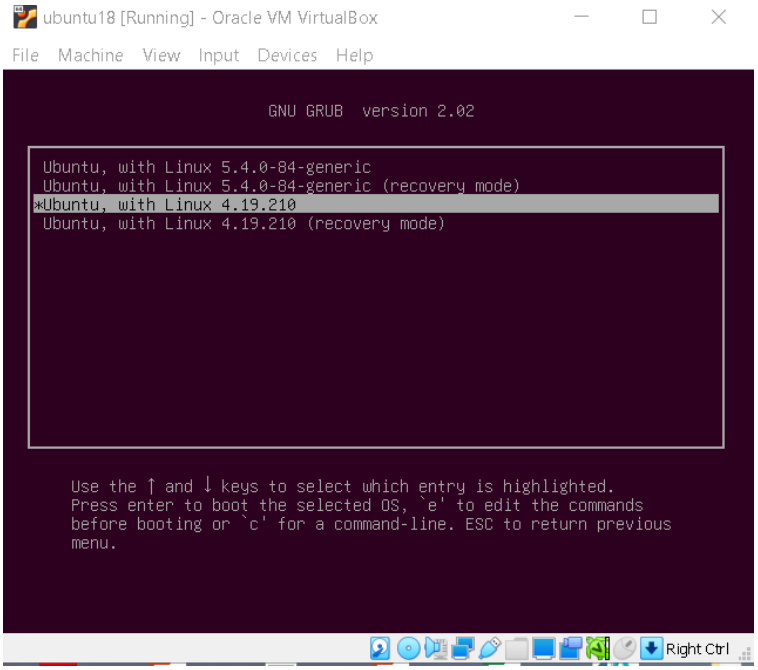


9. Boot the system using kernel linux-4.19.210

9.1. Select advanced options for Ubuntu

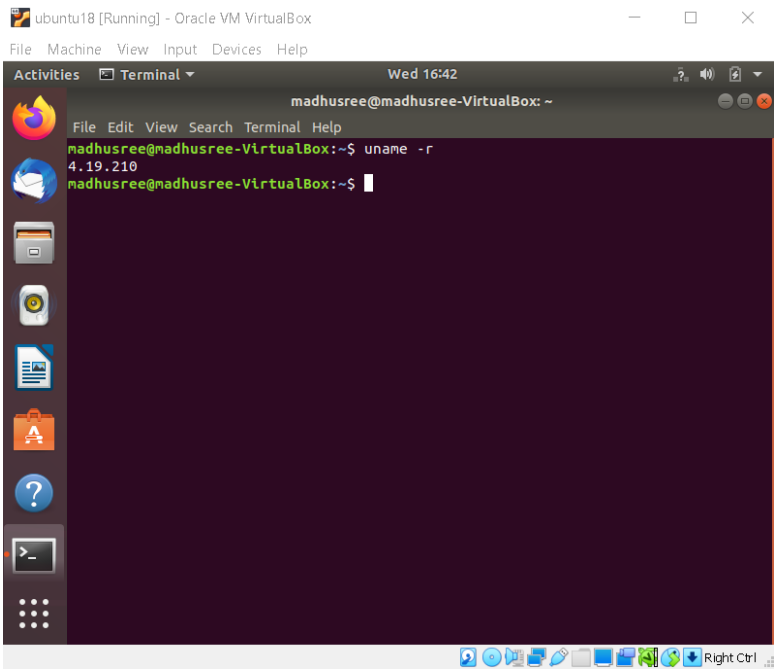


9.2 Select Ubuntu with Linux 4.19.210



10. Confirm the kernel

`uname -r`



11. Create madhusreeprint.c in ~/home and add the code

12. Compile and execute the code

```
madhusree@madhusree-VirtualBox:~$ gedit madhusreeprint.c
madhusree@madhusree-VirtualBox:~$ gcc madhusreeprint.c
madhusree@madhusree-VirtualBox:~$ ./a.out
System call madhusreeprint() returned 0
madhusree@madhusree-VirtualBox:~$
```

13. Check the log

dmesg

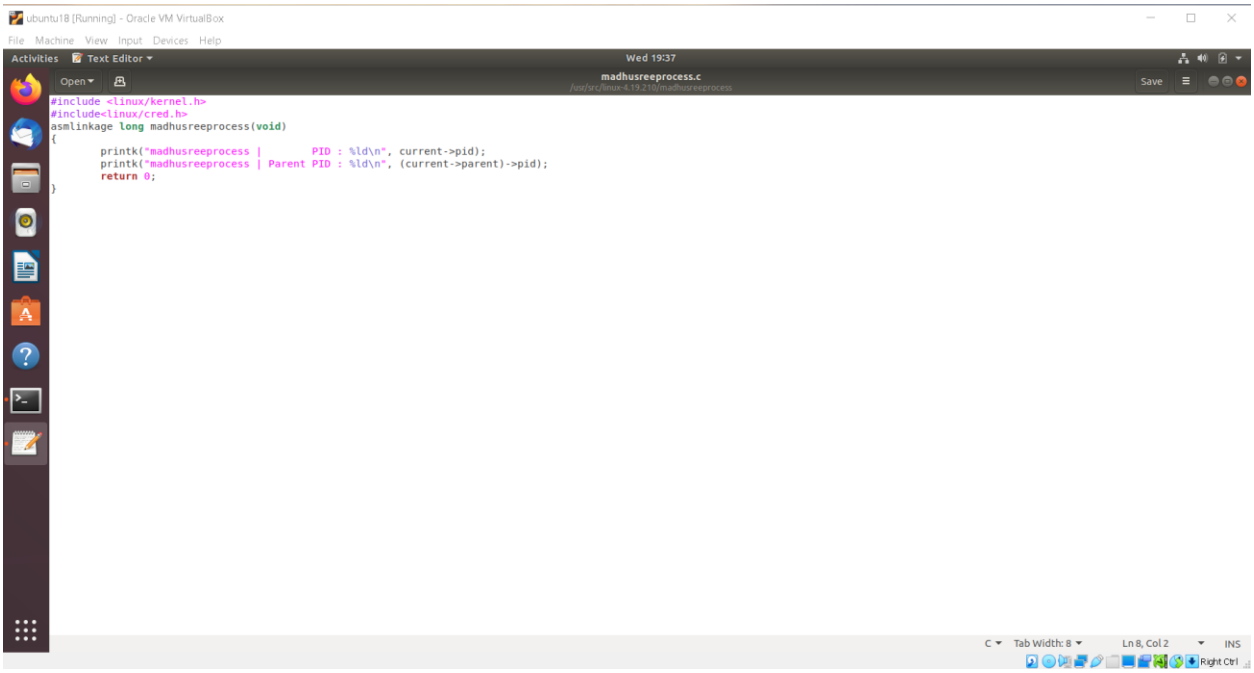
```
[  572.068406] madhusreeprint() called with string : AOS_ASSIGNMENT 2
madhusree@madhusree-VirtualBox:~$
```

Question 3

1. Create directory madhusreeprocess, inside it madhusreeprocess.c

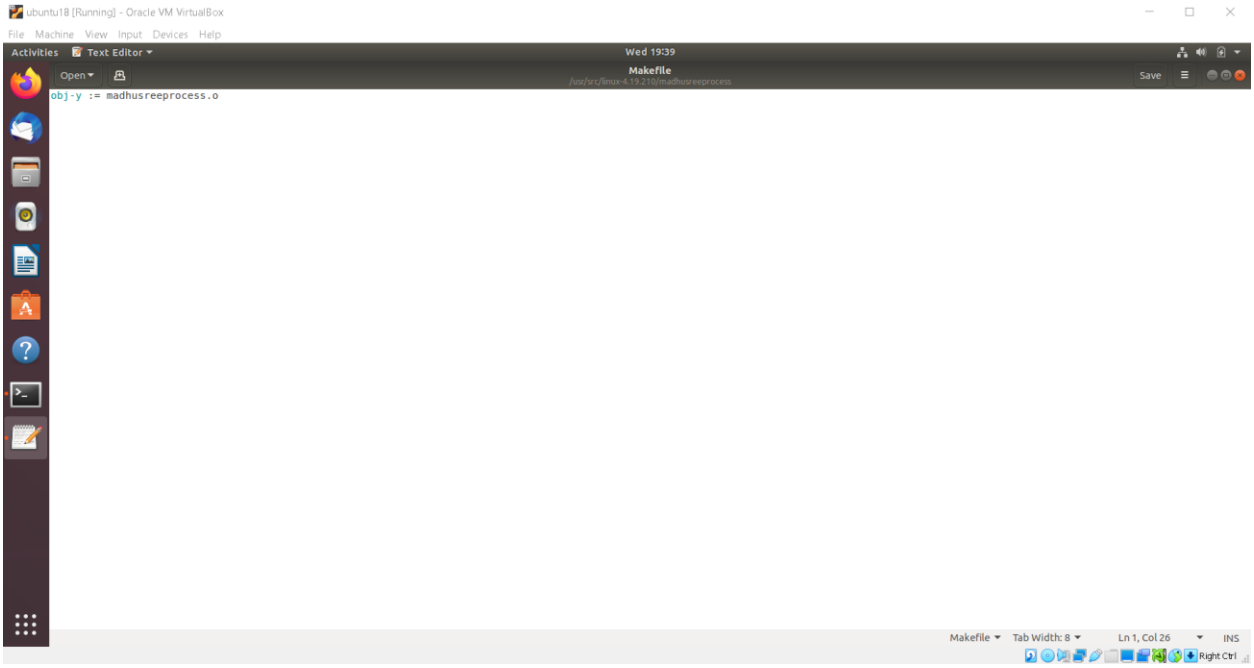
```
mkdir madhusreeprocess
cd madhusreeprocess
gedit madhusreeprocess.c
```

2.Code



3.Create Makefile

```
gedit Makefile
```

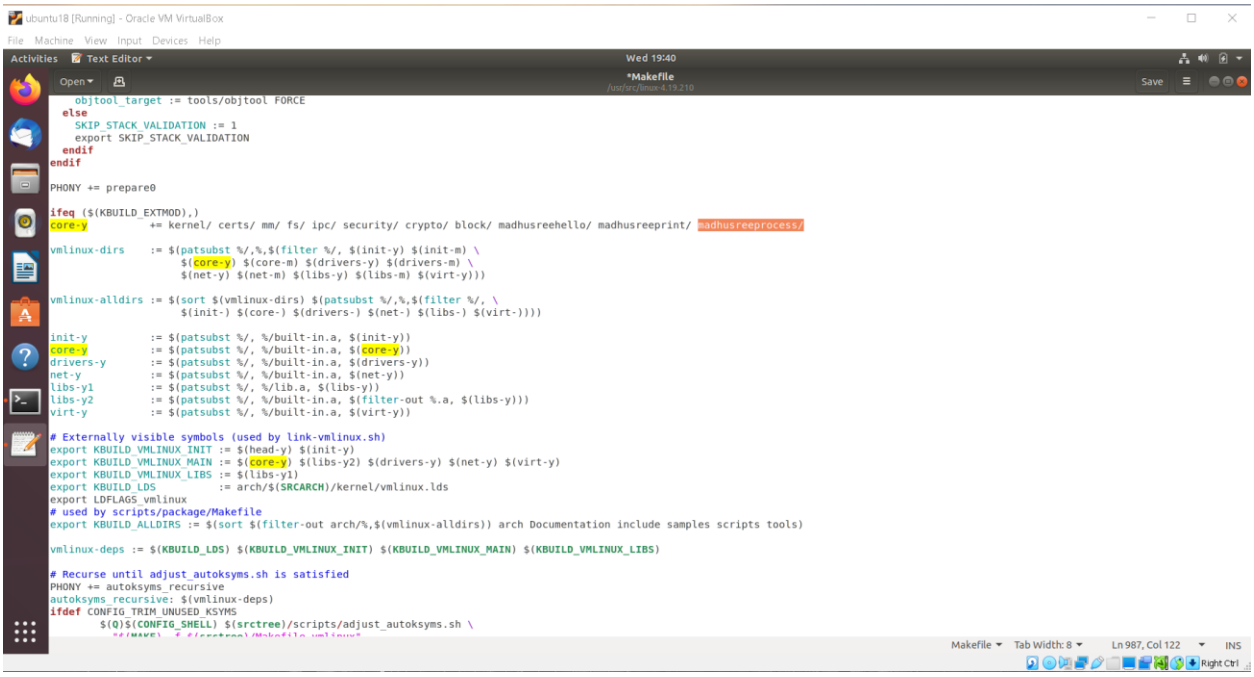


This is to ensure that the madhusreeprocess.c file is compiled and included in the kernel source code.

4.Go to parent and edit the makefile

```
cd ..
gedit Makefile
```

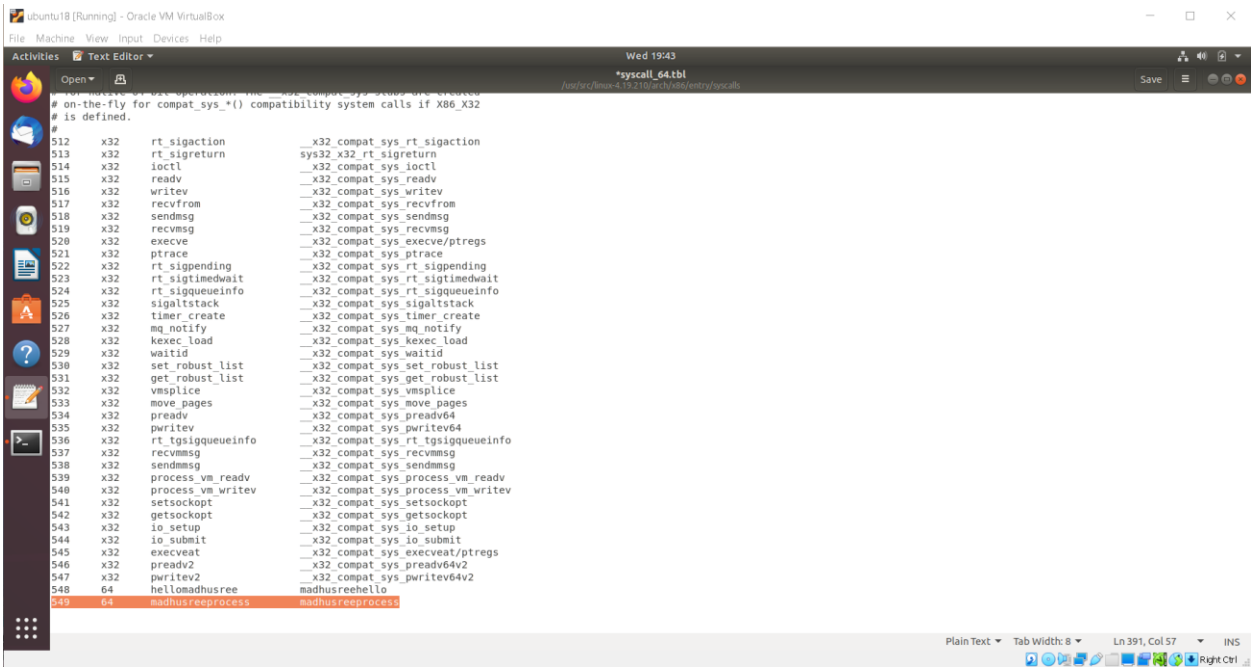
Change the line and add madhusreeprocess/ at the end



This is to tell the compiler that the source files of our new system call (madhusreeprocess()) are present in the madhusreeprocess directory.

5. Add the new system call to the table of system calls

```
cd arch/x86/entry/syscalls/
gedit syscall_64.tbl
```



The Syscall number is 549.

6. Add the syscall to the system call header file

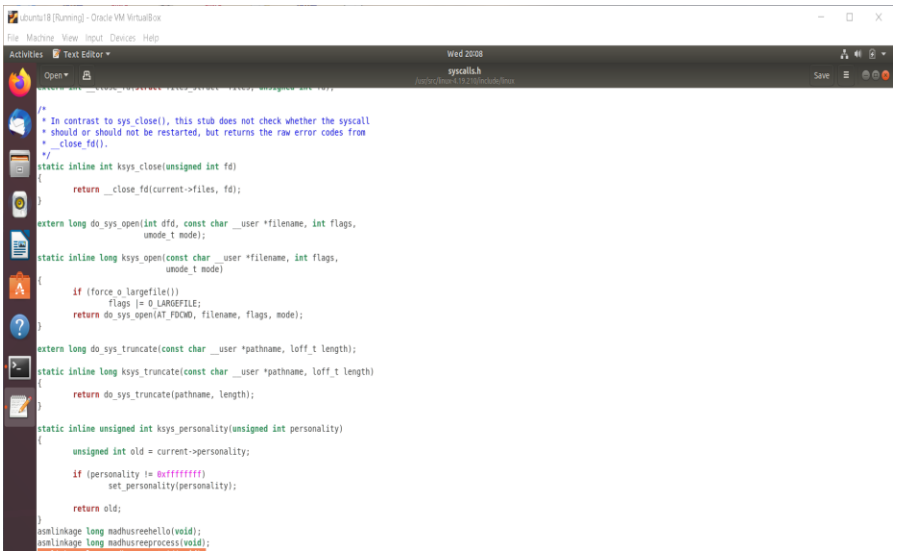
From linux-4.19.210 directory

```
cd include/linux/
gedit syscalls.h
```

Add

```
asmlinkage long madhusreeprocess(void);
```

Before endif in last line



7. Compile the Kernel

`sudo make -j4`

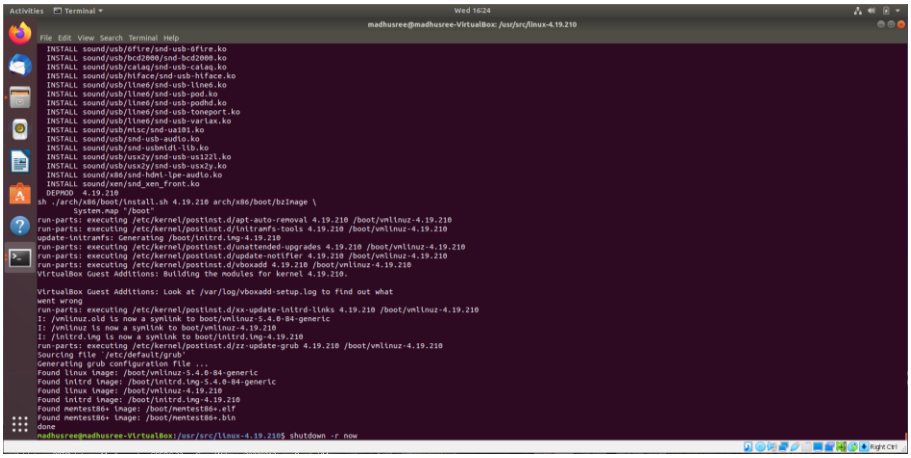
-j 4 because we have allotted 4 cores to our VM. It will make the compilation process faster

`sudo make modules_install install`

It will create some files under /boot/ directory and it will automatically make an entry in grub.cfg.

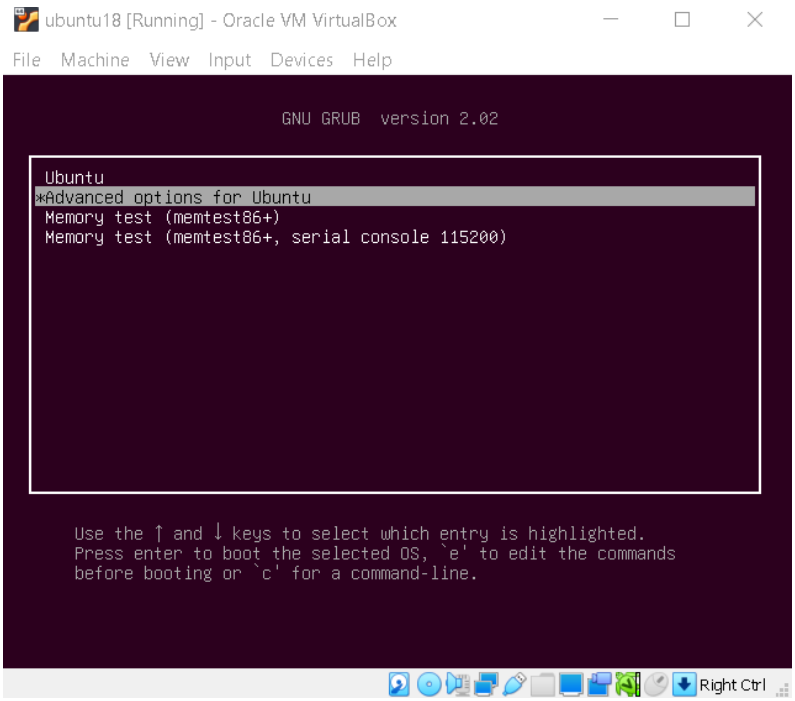
8. Reboot the system

`shutdown -r now`

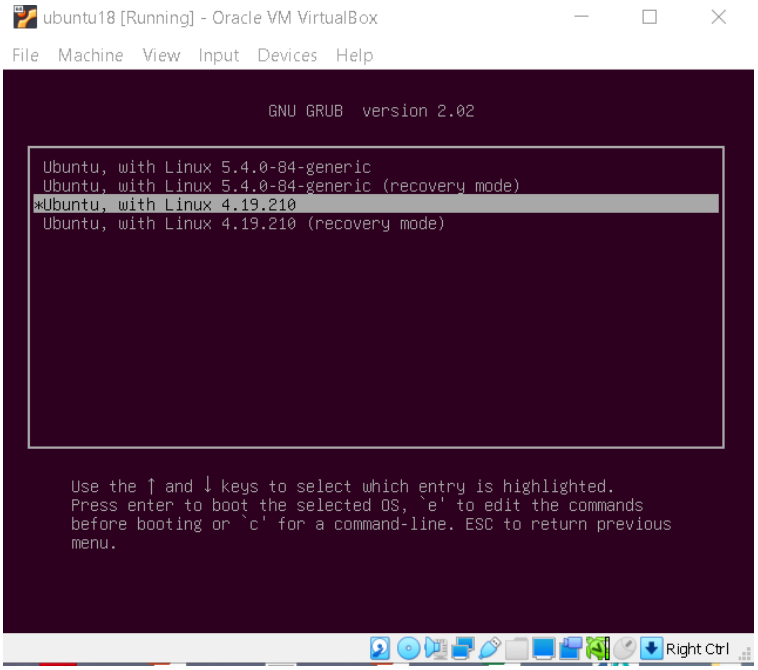


9. Boot the system using kernel linux-4.19.210

9.1. Select advanced options for Ubuntu

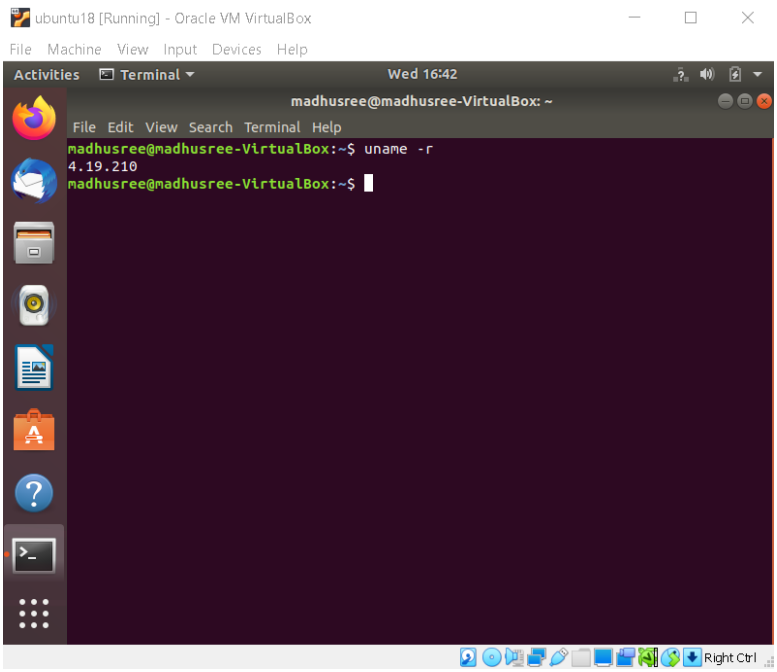


9.2 Select Ubuntu with Linux 4.19.210

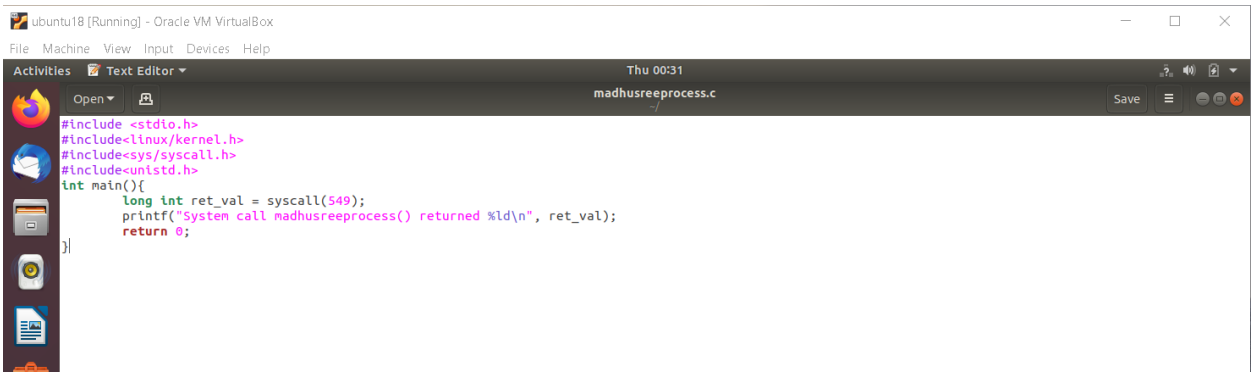


10. Confirm the kernel

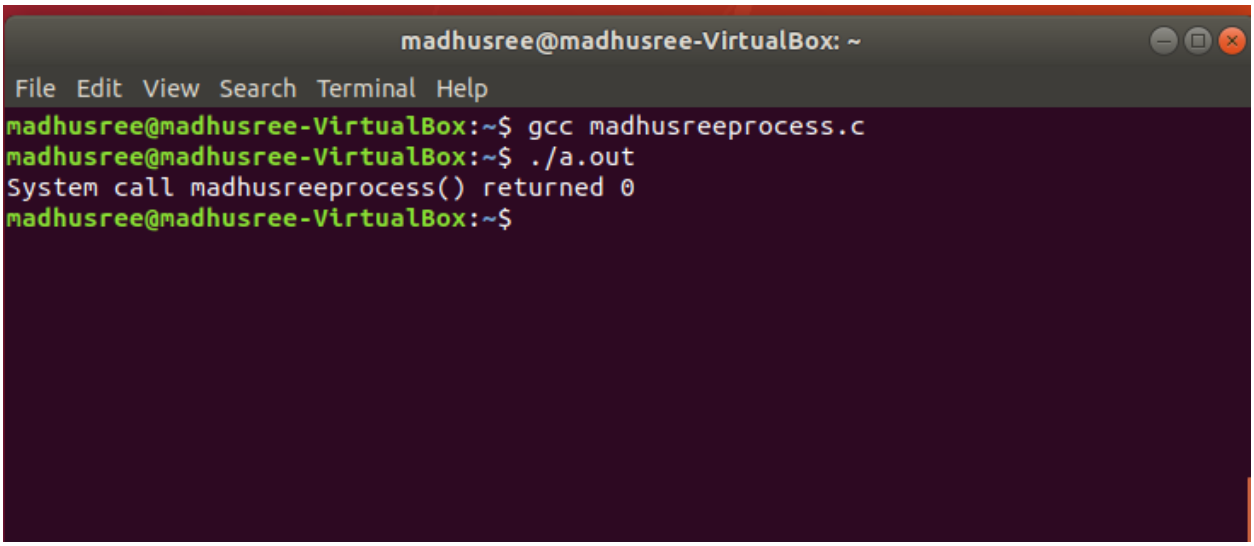
`uname -r`



11. Create madhusreeprocess.c in ~/home and add the code

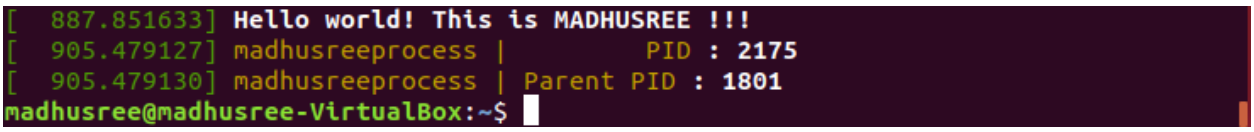


12. Compile and execute the code



13. Check the log

dmesg

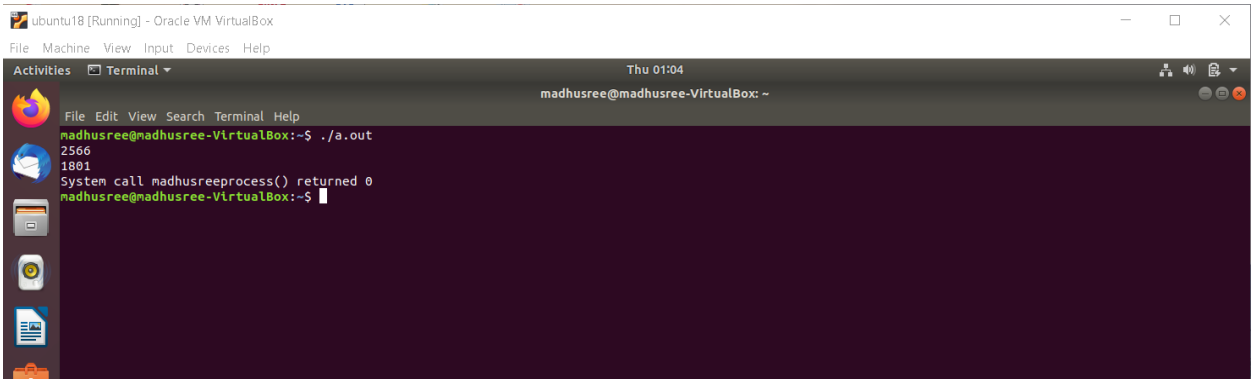


Question: Are both the process ID s same

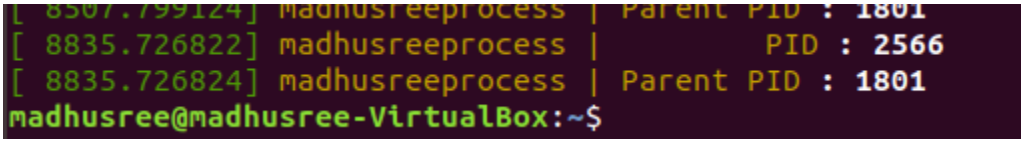
Answer:

On executing getpid() and getppid()

Output



And output from system call on dmesg



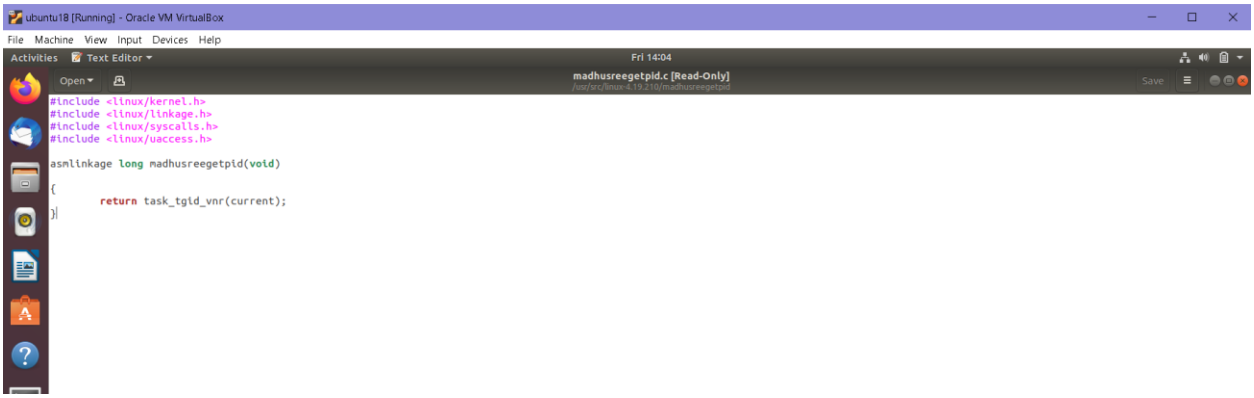
So getpid() and current->pid are the same.
getppid() and current->parent->pid are same.

Question 4

1. Create directory madhusreegetpid, inside it madhusreegetpid.c

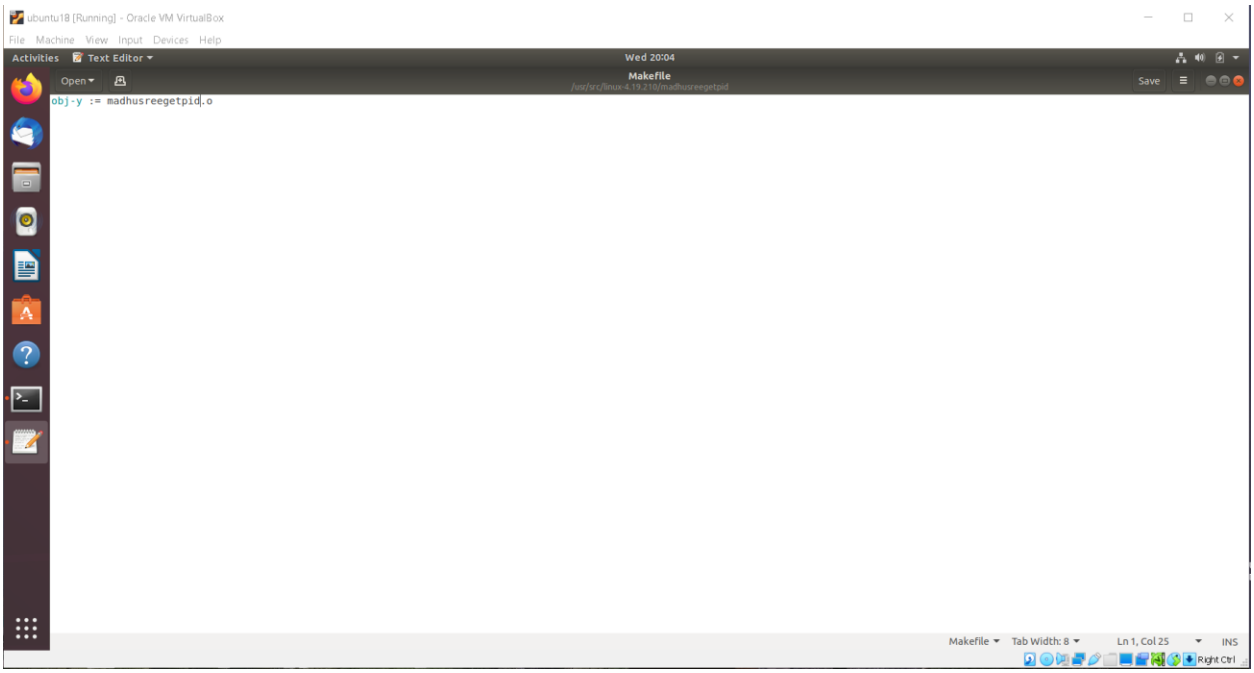
```
mkdir madhusreegetpid
cd madhusreegetpid
gedit madhusreegetpid.c
```

2. Code



3.Create Makefile

```
gedit Makefile
```

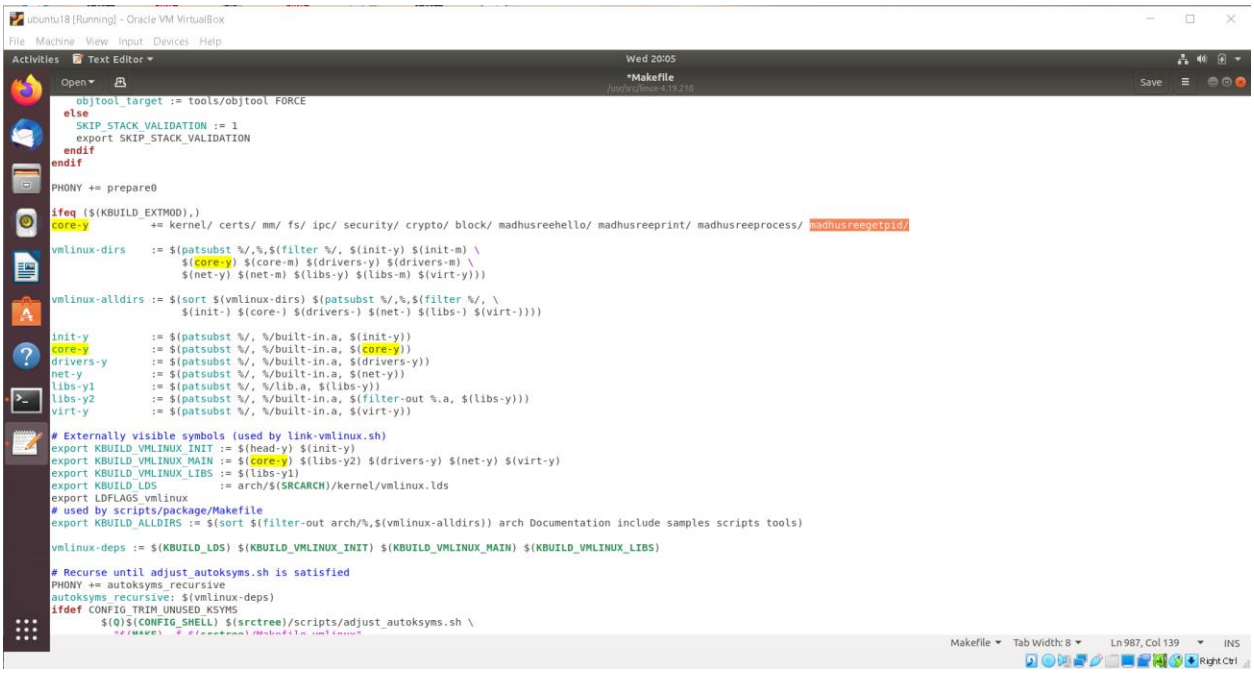


This is to ensure that the madhusreegetpid.c file is compiled and included in the kernel source code.

4.Go to parent and edit the makefile

```
cd ..
gedit Makefile
```

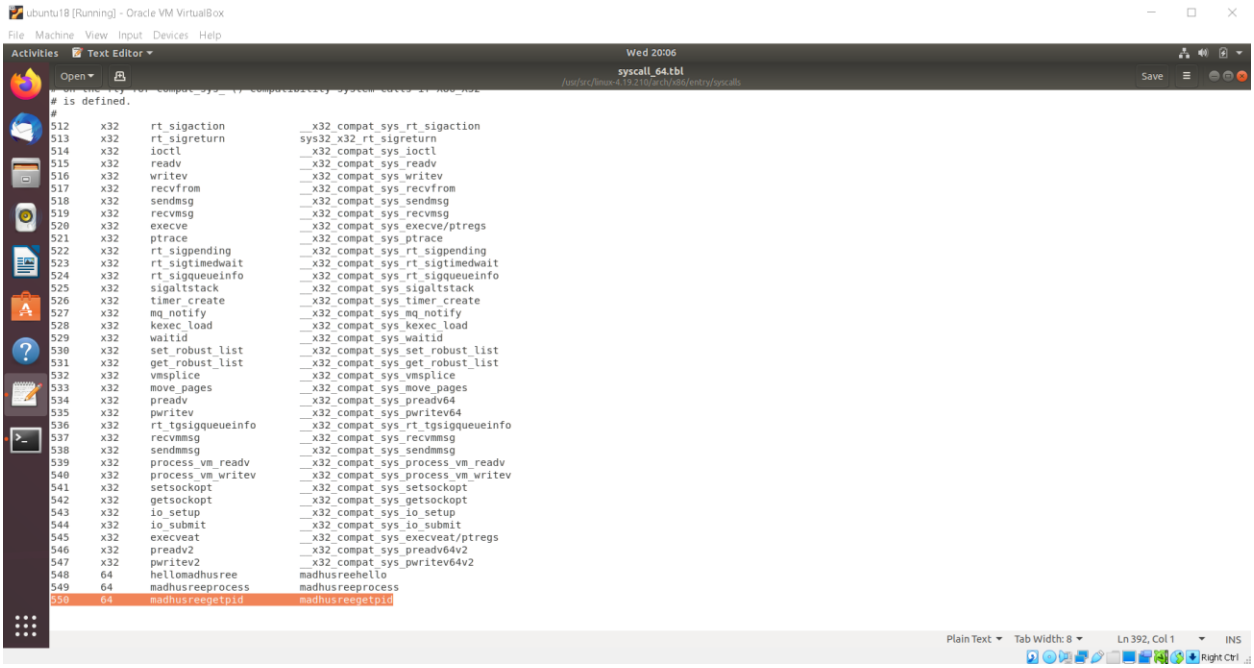
Change the line and add madhusreegetpid/ at the end



This is to tell the compiler that the source files of our new system call (madhusreegetpid()) are present in the madhusreegetpid directory.

5. Add the new system call to the table of system calls

```
cd arch/x86/entry/syscalls/
gedit syscall_64.tbl
```



The Syscall number is 550.

6. Add the syscall to the system call header file

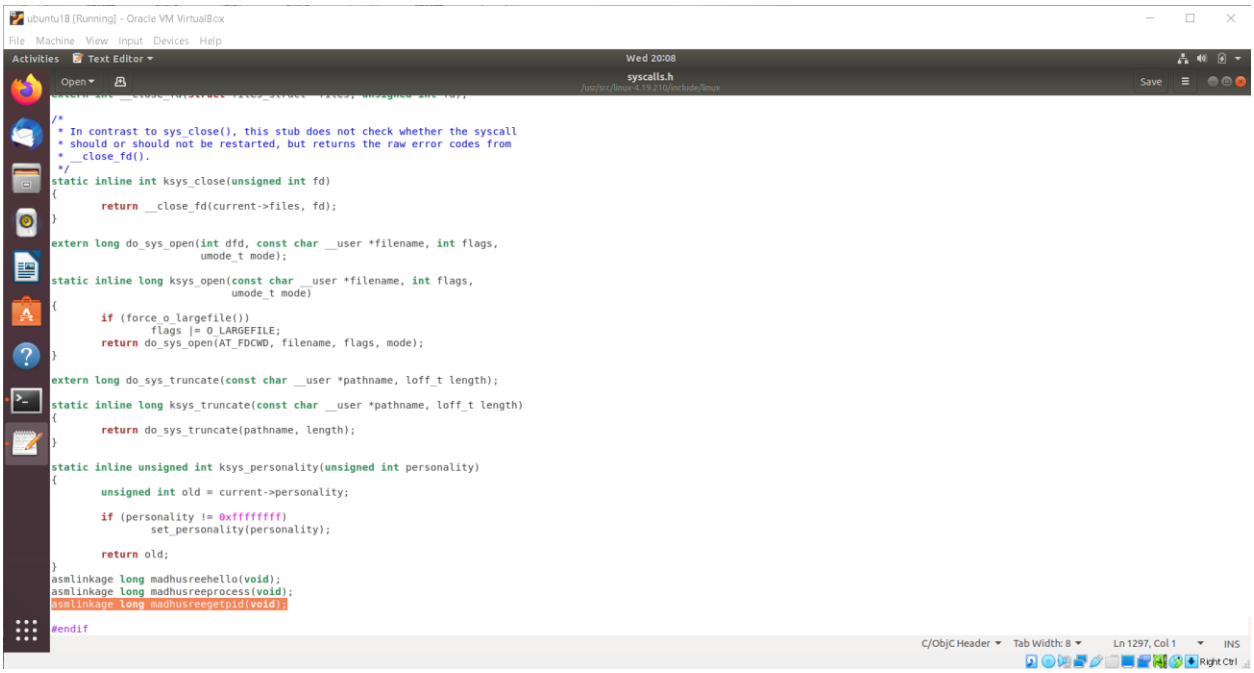
From linux-4.19.210 directory

```
cd include/linux/
gedit syscalls.h
```

Add

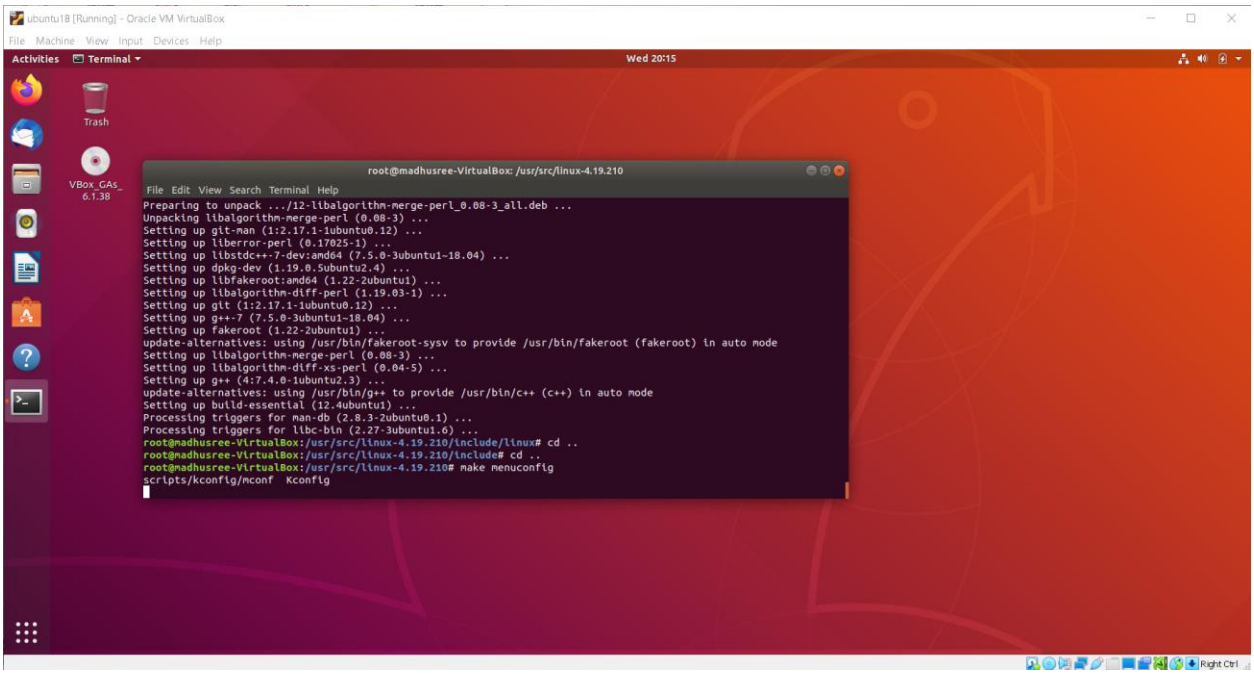
```
asmlinkage long madhusreegetpid(void);
```

Before endif in last line

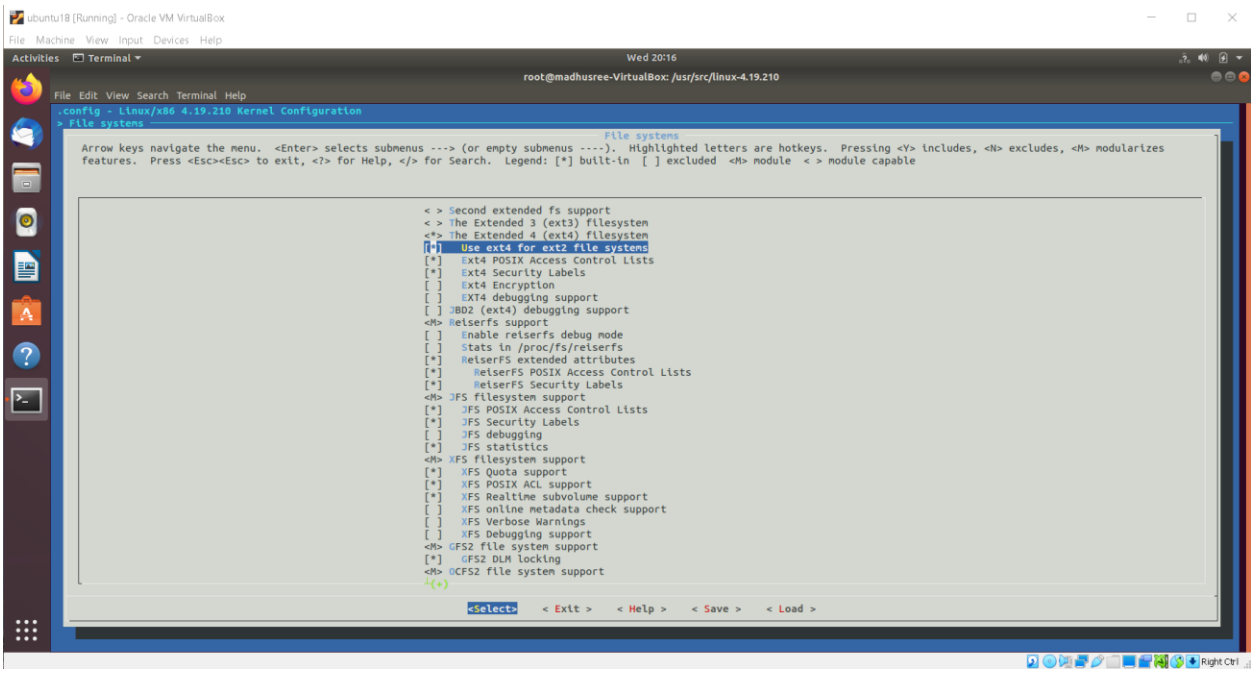


7. Compile the Kernel

```
sudo make menuconfig
```

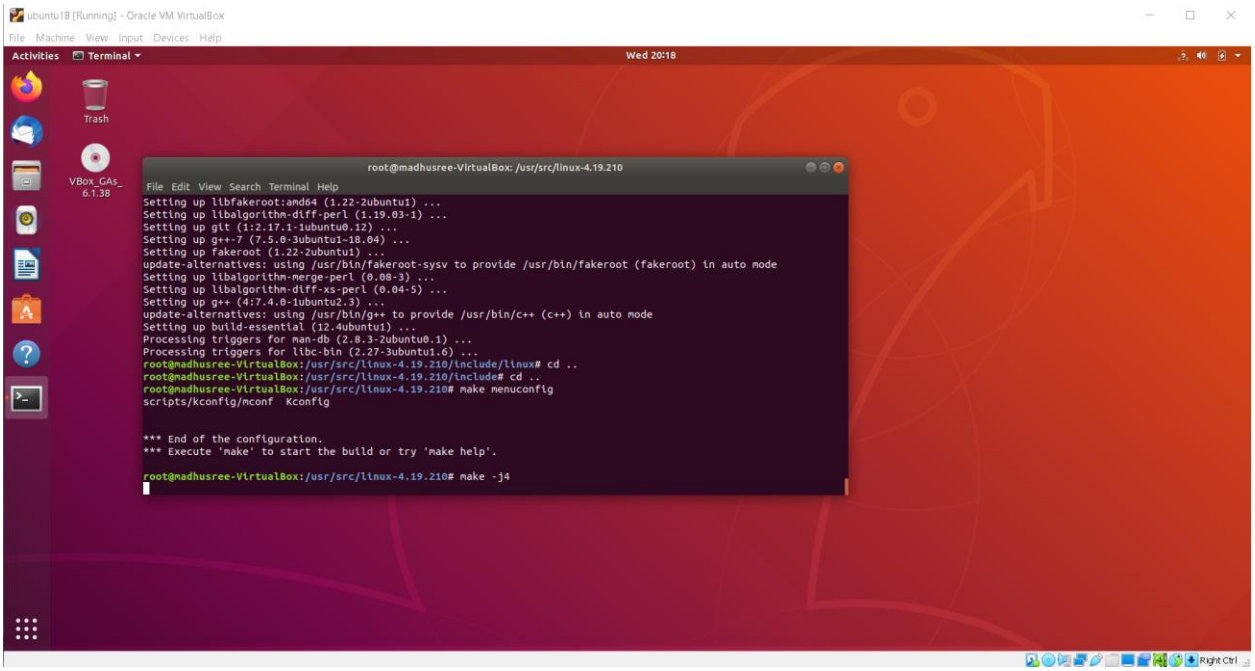


Check if ext4 is chosen in file systems



sudo make -j4

-j 4 because we have allotted 4 cores to our VM. It will make the compilation process faster

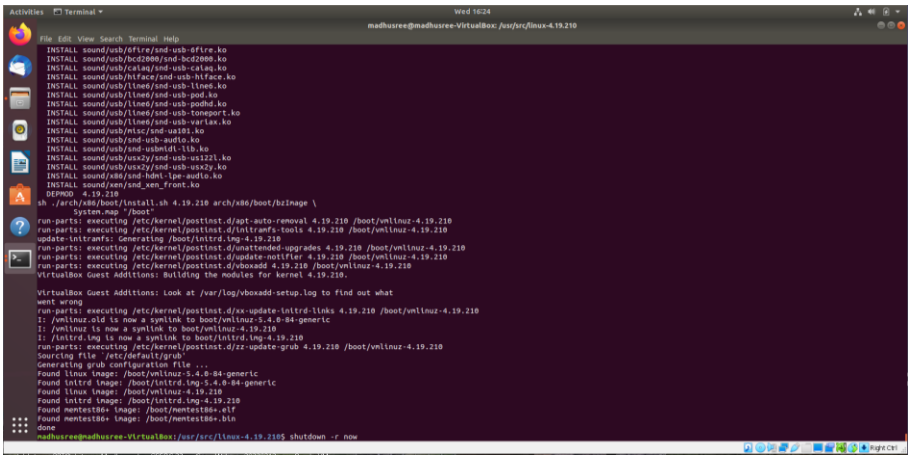


sudo make modules_install install

It will create some files under /boot/ directory and it will automatically make an entry in grub.cfg.

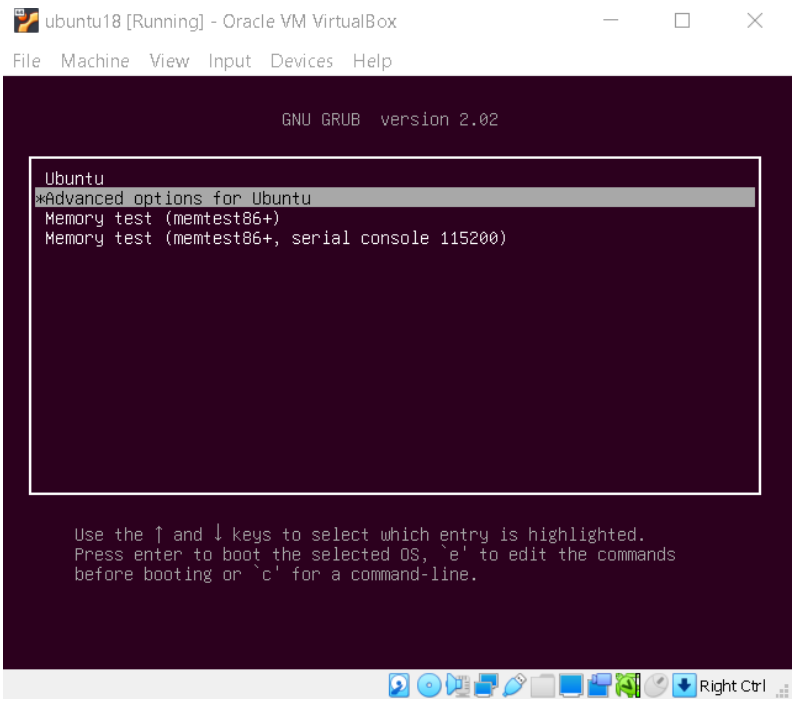
8. Reboot the system

```
shutdown -r now
```

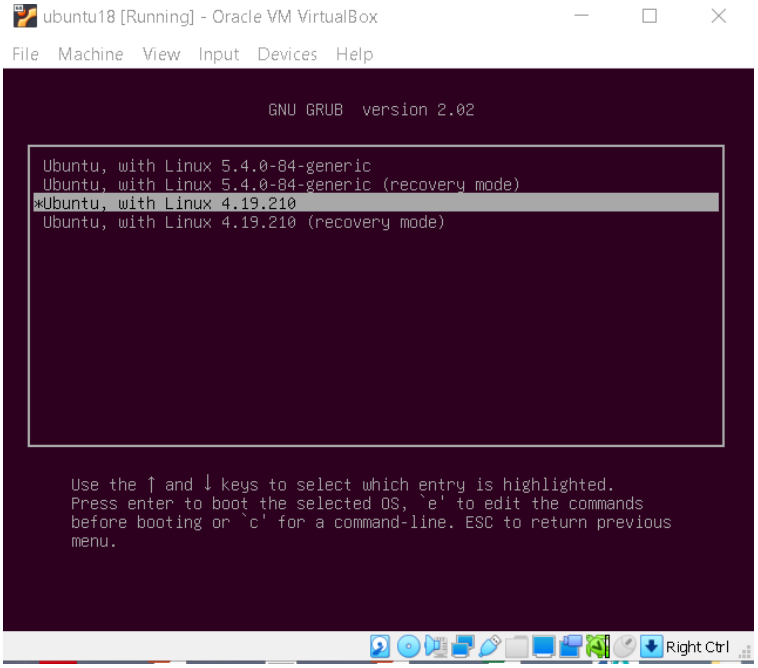


9. Boot the system using kernel linux-4.19.210

9.1. Select advanced options for Ubuntu

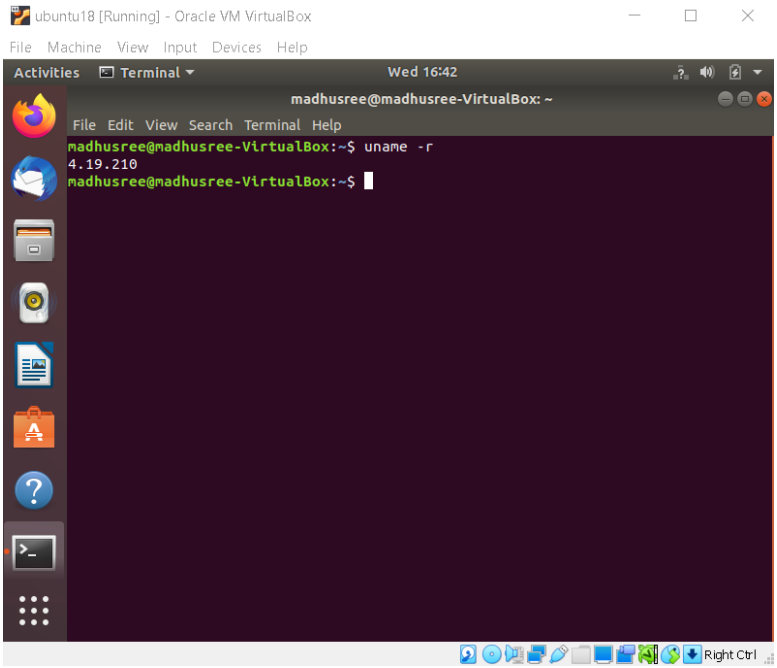


9.2 Select Ubuntu with Linux 4.19.210



10. Confirm the kernel

`uname -r`



11. Create madhusreegetpid.c in ~/home and add the code

12. Compile and execute the code