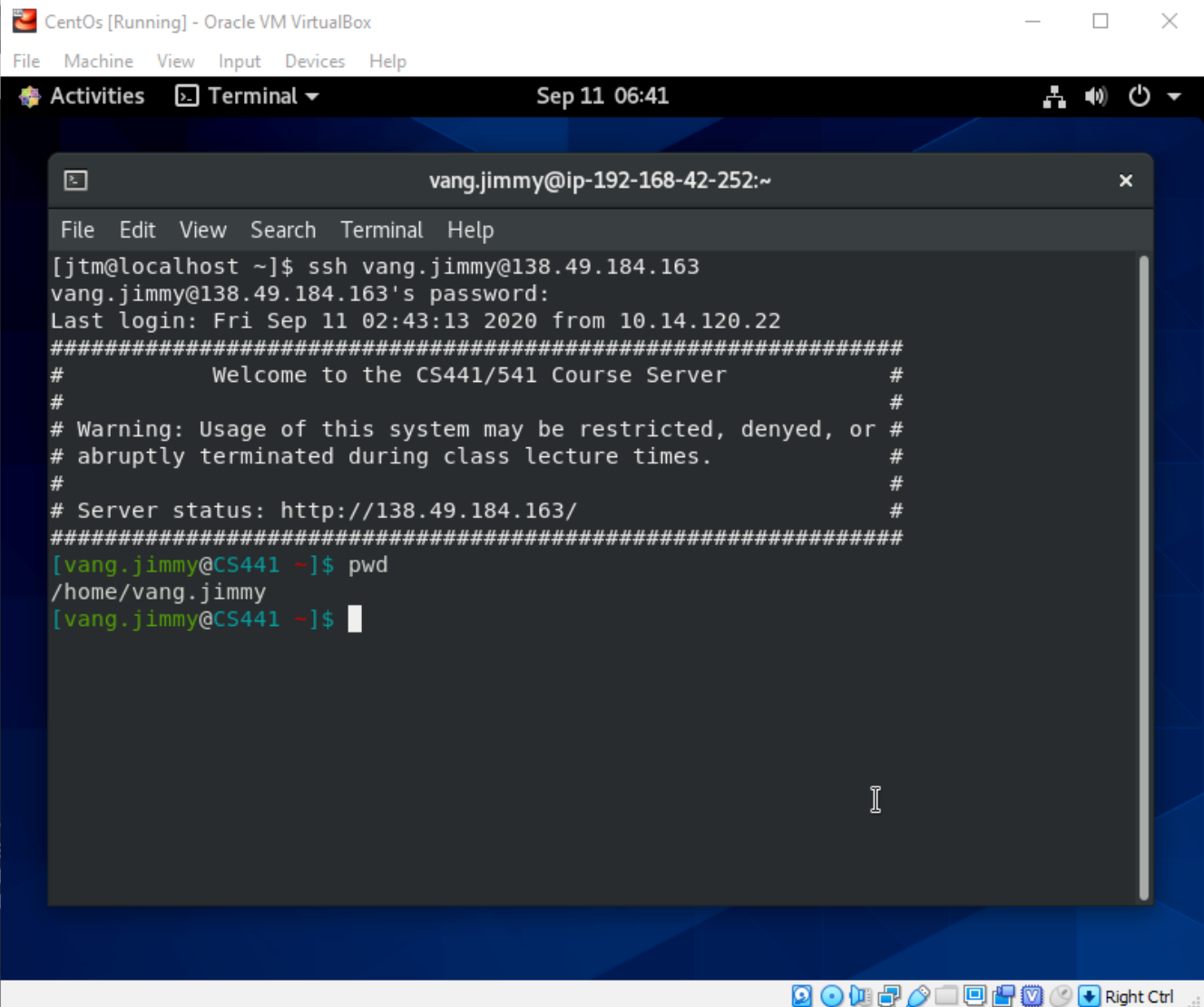


# Project 1 – Environment Setup

This project was done using **CentOS 8.1** installed on the **Oracle VM VirtualBox**.

This is a screenshot of ssh'ing to the class server and printing the working directory.




The screenshot shows a terminal window titled "CentOs [Running] - Oracle VM VirtualBox" with a menu bar (File, Machine, View, Input, Devices, Help) and a status bar (Sep 11 06:41). Inside the terminal, a session is shown where the user 'jtm' at 'localhost' connects via SSH to 'vang.jimmy@138.49.184.163'. The terminal output includes a welcome message, a warning about system usage, and the server status. The user then runs the 'pwd' command, which returns '/home/vang.jimmy'.

```
CentOs [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Sep 11 06:41
vang.jimmy@ip-192-168-42-252:~
File Edit View Search Terminal Help
[jtm@localhost ~]$ ssh vang.jimmy@138.49.184.163
vang.jimmy@138.49.184.163's password:
Last login: Fri Sep 11 02:43:13 2020 from 10.14.120.22
#####
#           Welcome to the CS441/541 Course Server           #
#                                                             #
# Warning: Usage of this system may be restricted, denied, or #
# abruptly terminated during class lecture times.             #
#                                                             #
# Server status: http://138.49.184.163/                       #
#####
[vang.jimmy@CS441 ~]$ pwd
/home/vang.jimmy
[vang.jimmy@CS441 ~]$
```

I fork the “cs441-examples” git repository here.

## Fork ssfoley / cs441-examples

Workspace

 vang.jimmy

Project name \*

Project1

Name \*

cs441-examples

Access level

☒ Private repository

This repository does not allow public forks.

> Advanced settings

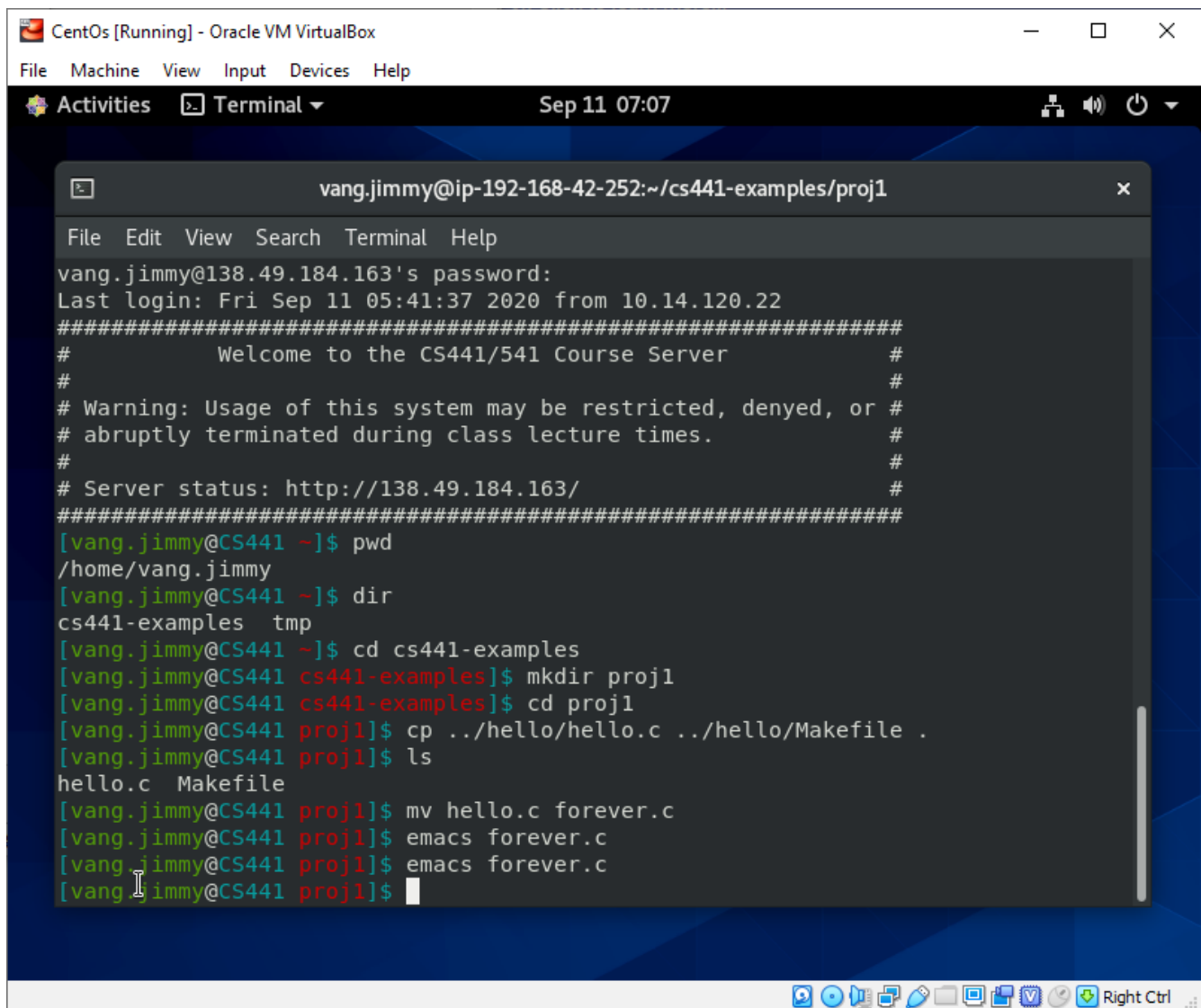
Fork repository

Cancel

Next, I clone the Fork'd git repository onto the class server.

```
[vang.jimmy@CS441 ~]$ git clone https://JimmyVang@bitbucket.org/JimmyVang/cs441-
examples.git -b dev
Cloning into 'cs441-examples'...
Password for 'https://JimmyVang@bitbucket.org':
remote: Counting objects: 111, done.
remote: Compressing objects: 100% (111/111), done.
remote: Total 111 (delta 32), reused 0 (delta 0)
Receiving objects: 100% (111/111), 23.38 KiB | 0 bytes/s, done.
Resolving deltas: 100% (32/32), done.
[vang.jimmy@CS441 ~]$
```

I navigate files and folders on the system using `cd` and `ls`. I also copy the `hello.c` and `forever.c` files from the folder `hello` using the command `cp`.

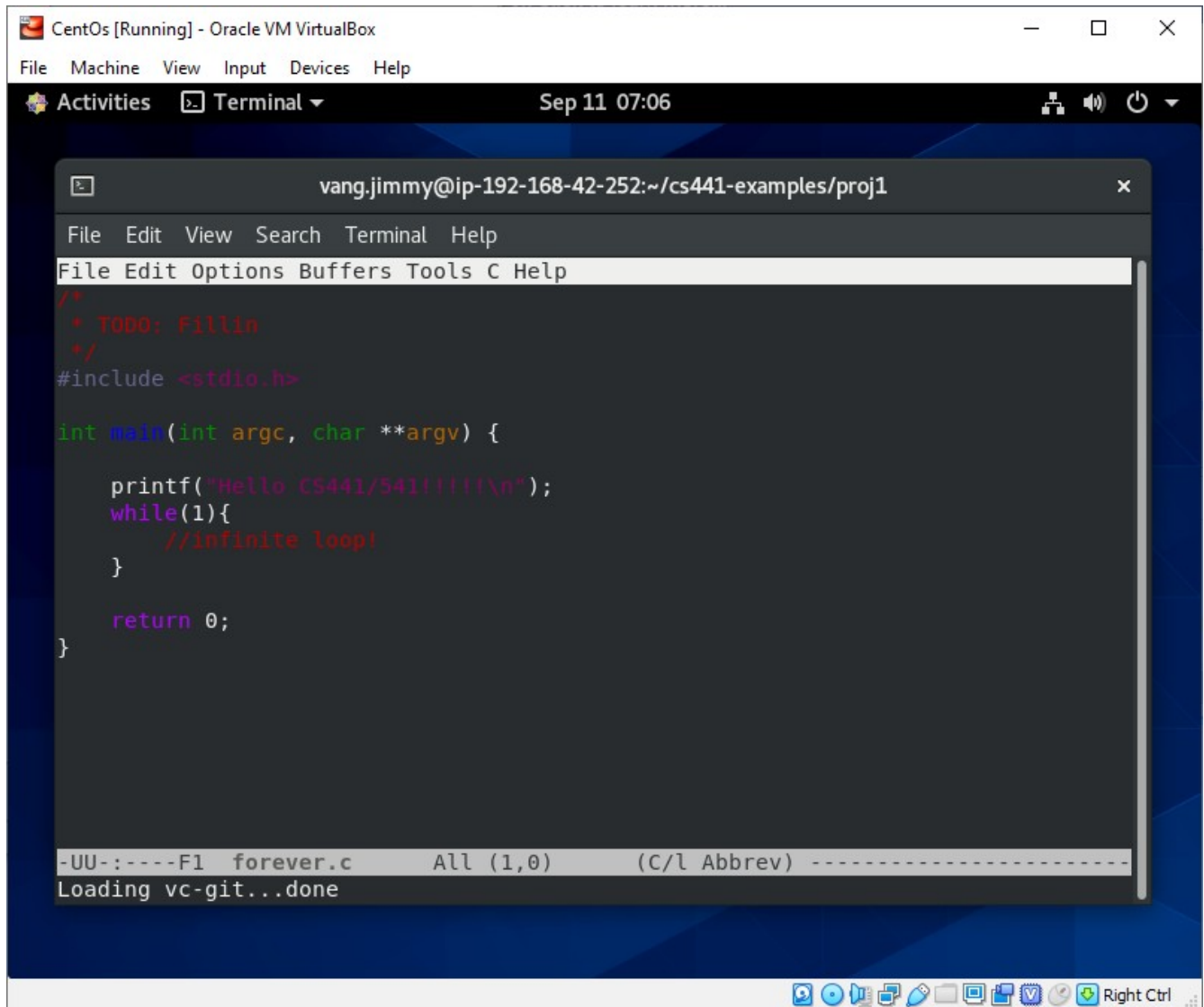


The screenshot shows a terminal window titled "CentOs [Running] - Oracle VM VirtualBox". The terminal is running a session for user "vang.jimmy" at IP "192-168-42-252" in the directory "~/cs441-examples/proj1". The terminal output shows a login message, a welcome message, and a series of commands and their outputs:

```
File Edit View Search Terminal Help
vang.jimmy@138.49.184.163's password:
Last login: Fri Sep 11 05:41:37 2020 from 10.14.120.22
#####
# Welcome to the CS441/541 Course Server #
# #
# Warning: Usage of this system may be restricted, denied, or #
# abruptly terminated during class lecture times. #
# #
# Server status: http://138.49.184.163/ #
#####
[vang.jimmy@CS441 ~]$ pwd
/home/vang.jimmy
[vang.jimmy@CS441 ~]$ dir
cs441-examples tmp
[vang.jimmy@CS441 ~]$ cd cs441-examples
[vang.jimmy@CS441 cs441-examples]$ mkdir proj1
[vang.jimmy@CS441 cs441-examples]$ cd proj1
[vang.jimmy@CS441 proj1]$ cp ../hello/hello.c ../hello/Makefile .
[vang.jimmy@CS441 proj1]$ ls
hello.c Makefile
[vang.jimmy@CS441 proj1]$ mv hello.c forever.c
[vang.jimmy@CS441 proj1]$ emacs forever.c
[vang.jimmy@CS441 proj1]$ emacs forever.c
[vang.jimmy@CS441 proj1]$
```

The terminal window has a menu bar with "File", "Edit", "View", "Search", "Terminal", and "Help". The status bar at the bottom shows system icons and a "Right Ctrl" button.

I use emacs to edit the **forever.c** file.



The screenshot shows a CentOs [Running] - Oracle VM VirtualBox window. The terminal window is titled 'vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1'. The Emacs editor is open, showing the file 'forever.c'. The code in the file is as follows:

```
/*
 * TODO: Fill in
 */
#include <stdio.h>

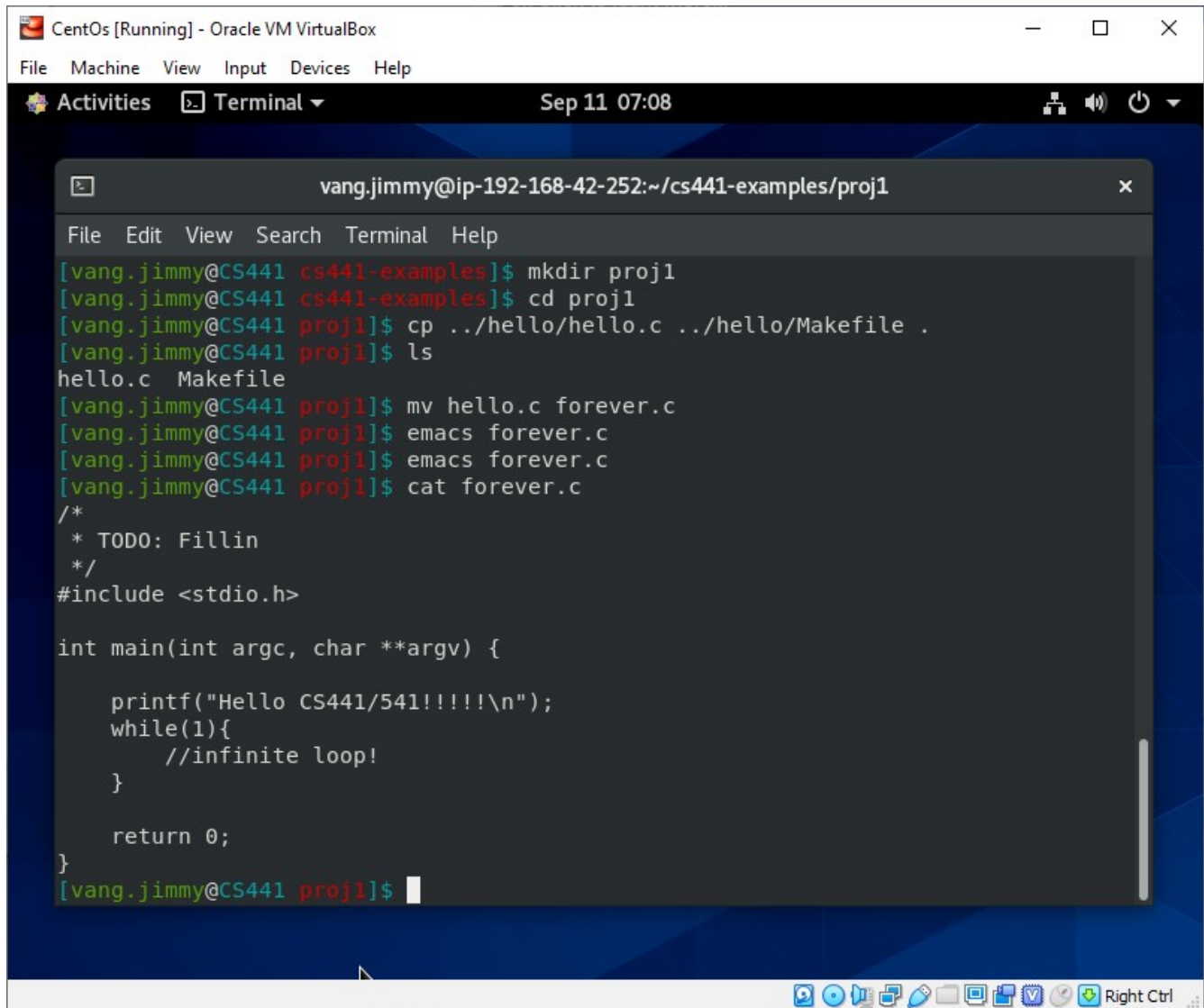
int main(int argc, char **argv) {

    printf("Hello CS441/541!!!!\n");
    while(1){
        //infinite loop!
    }

    return 0;
}
```

The status bar at the bottom of the Emacs window shows '-UU-:----F1 forever.c All (1,0) (C/l Abbrev) -----' and 'Loading vc-git...done'. The system tray at the bottom right shows various icons and a 'Right Ctrl' button.

I use cat to print out the changes to **forever.c** file.



The screenshot shows a CentOs [Running] - Oracle VM VirtualBox window. The terminal is open, showing the user 'vang.jimmy' at IP 'ip-192-168-42-252' in the directory '~/cs441-examples/proj1'. The terminal output shows the following commands and their results:

```
[vang.jimmy@CS441 cs441-examples]$ mkdir proj1
[vang.jimmy@CS441 cs441-examples]$ cd proj1
[vang.jimmy@CS441 proj1]$ cp ../hello/hello.c ../hello/Makefile .
[vang.jimmy@CS441 proj1]$ ls
hello.c  Makefile
[vang.jimmy@CS441 proj1]$ mv hello.c forever.c
[vang.jimmy@CS441 proj1]$ emacs forever.c
[vang.jimmy@CS441 proj1]$ emacs forever.c
[vang.jimmy@CS441 proj1]$ cat forever.c
/*
 * TODO: Fillin
 */
#include <stdio.h>

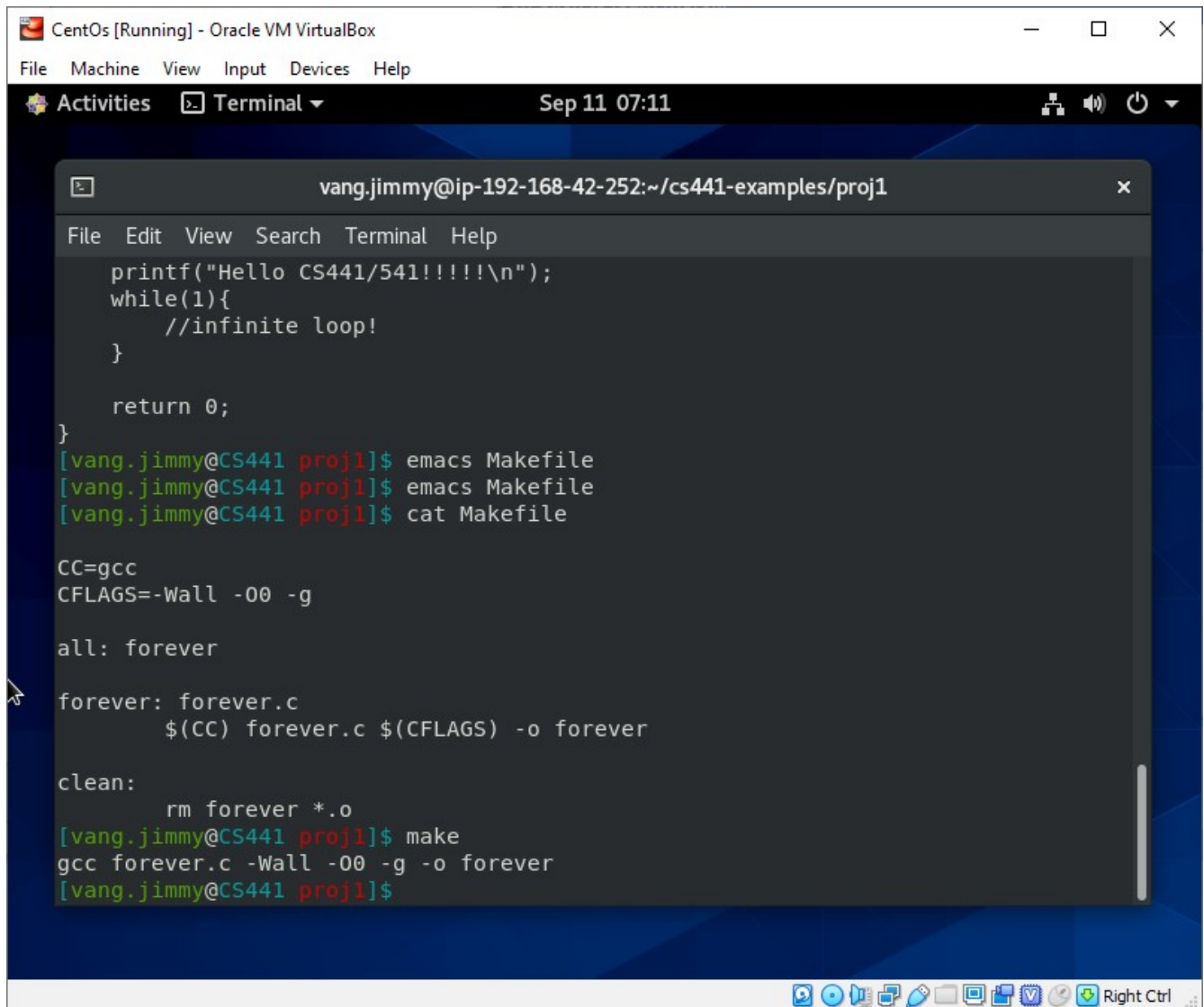
int main(int argc, char **argv) {

    printf("Hello CS441/541!!!!\n");
    while(1){
        //infinite loop!
    }

    return 0;
}
```

The terminal window has a menu bar with 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. The status bar at the bottom shows various system icons and a 'Right Ctrl' button.

I use emacs and to edit **Makefile** then use *cat* to view the changes to **Makefile**. Also, ran the command make to compile and finish the rest of the changes to the repository.



The screenshot shows a terminal window titled 'CentOs [Running] - Oracle VM VirtualBox'. The terminal is running a C program and editing a Makefile. The C code defines a function 'forever' that prints 'Hello CS441/541!!!!\n' and enters an infinite loop. The Makefile sets the compiler to 'gcc' and flags to '-Wall -O0 -g'. It defines a target 'all' that depends on 'forever', and a 'forever' target that compiles 'forever.c' into 'forever'. A 'clean' target removes 'forever.o'. The terminal shows the user running 'emacs Makefile', 'cat Makefile', and 'make', which successfully compiles the program.

```
vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1
File Edit View Search Terminal Help
printf("Hello CS441/541!!!!\n");
while(1){
    //infinite loop!
}

return 0;
}
[vang.jimmy@CS441 proj1]$ emacs Makefile
[vang.jimmy@CS441 proj1]$ emacs Makefile
[vang.jimmy@CS441 proj1]$ cat Makefile

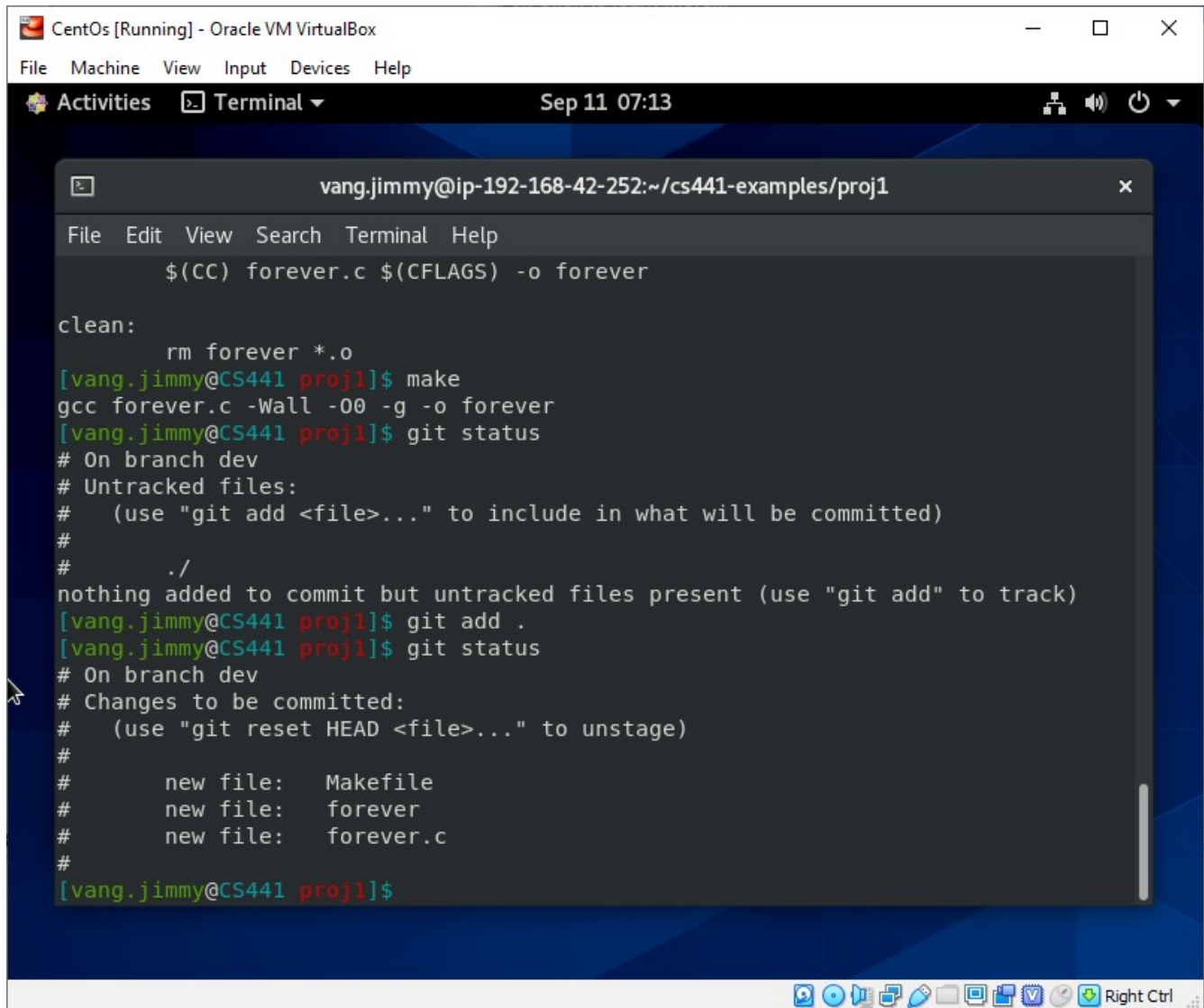
CC=gcc
CFLAGS=-Wall -O0 -g

all: forever

forever: forever.c
    $(CC) forever.c $(CFLAGS) -o forever

clean:
    rm forever *.o
[vang.jimmy@CS441 proj1]$ make
gcc forever.c -Wall -O0 -g -o forever
[vang.jimmy@CS441 proj1]$
```

I use git to add the changes.



The screenshot shows a terminal window titled "vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1". The terminal output shows the user running a series of commands to compile a program and track changes with git. The output indicates that three new files (Makefile, forever, and forever.c) have been added to the repository.

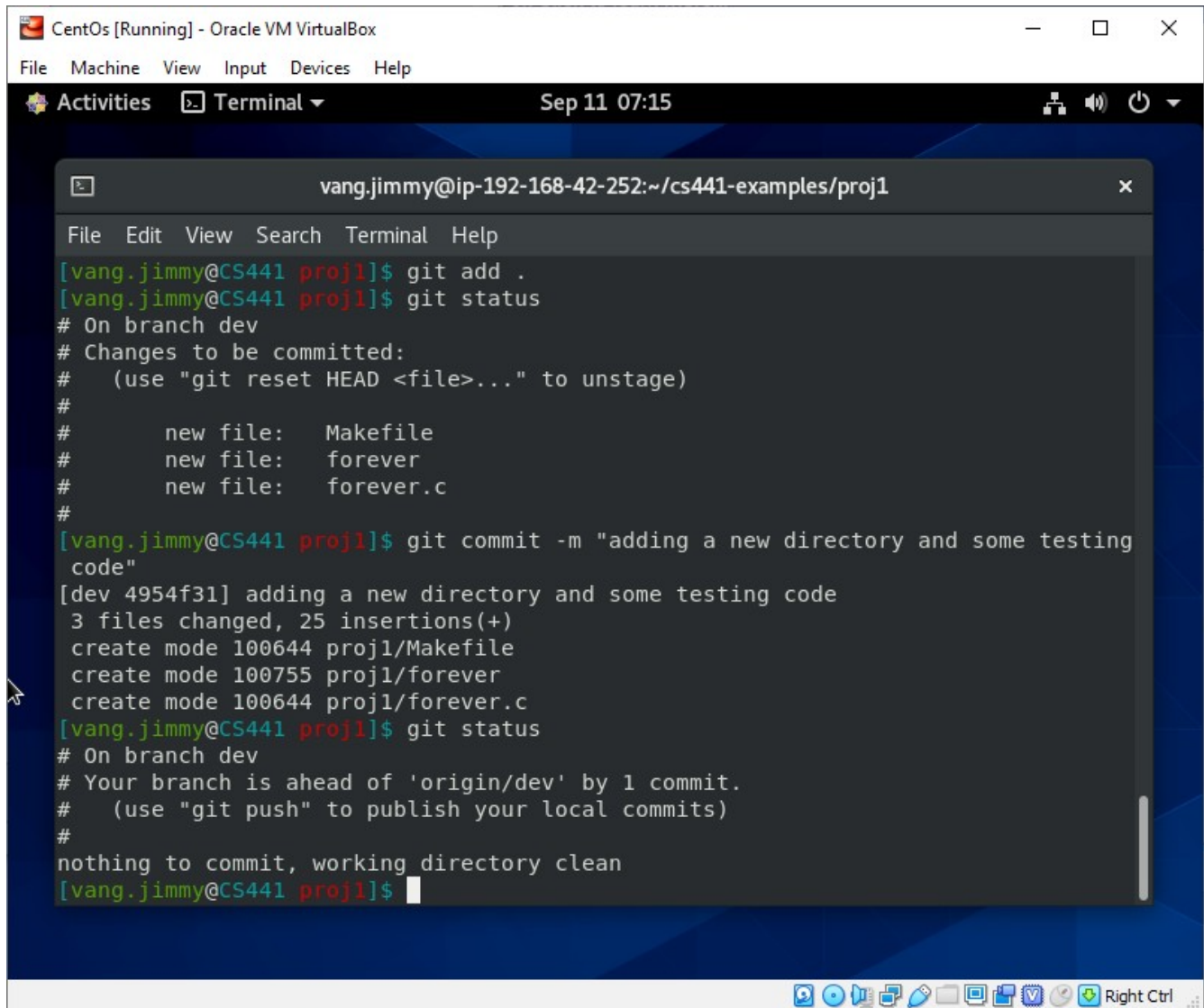
```
CentOs [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Sep 11 07:13

vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1
File Edit View Search Terminal Help
$(CC) forever.c $(CFLAGS) -o forever

clean:
    rm forever *.o
[vang.jimmy@CS441 proj1]$ make
gcc forever.c -Wall -O0 -g -o forever
[vang.jimmy@CS441 proj1]$ git status
# On branch dev
# Untracked files:
#   (use "git add <file>..." to include in what will be committed)
#
#   ./
nothing added to commit but untracked files present (use "git add" to track)
[vang.jimmy@CS441 proj1]$ git add .
[vang.jimmy@CS441 proj1]$ git status
# On branch dev
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#       new file:   Makefile
#       new file:   forever
#       new file:   forever.c
#
[vang.jimmy@CS441 proj1]$
```



I use git to commit the changes.

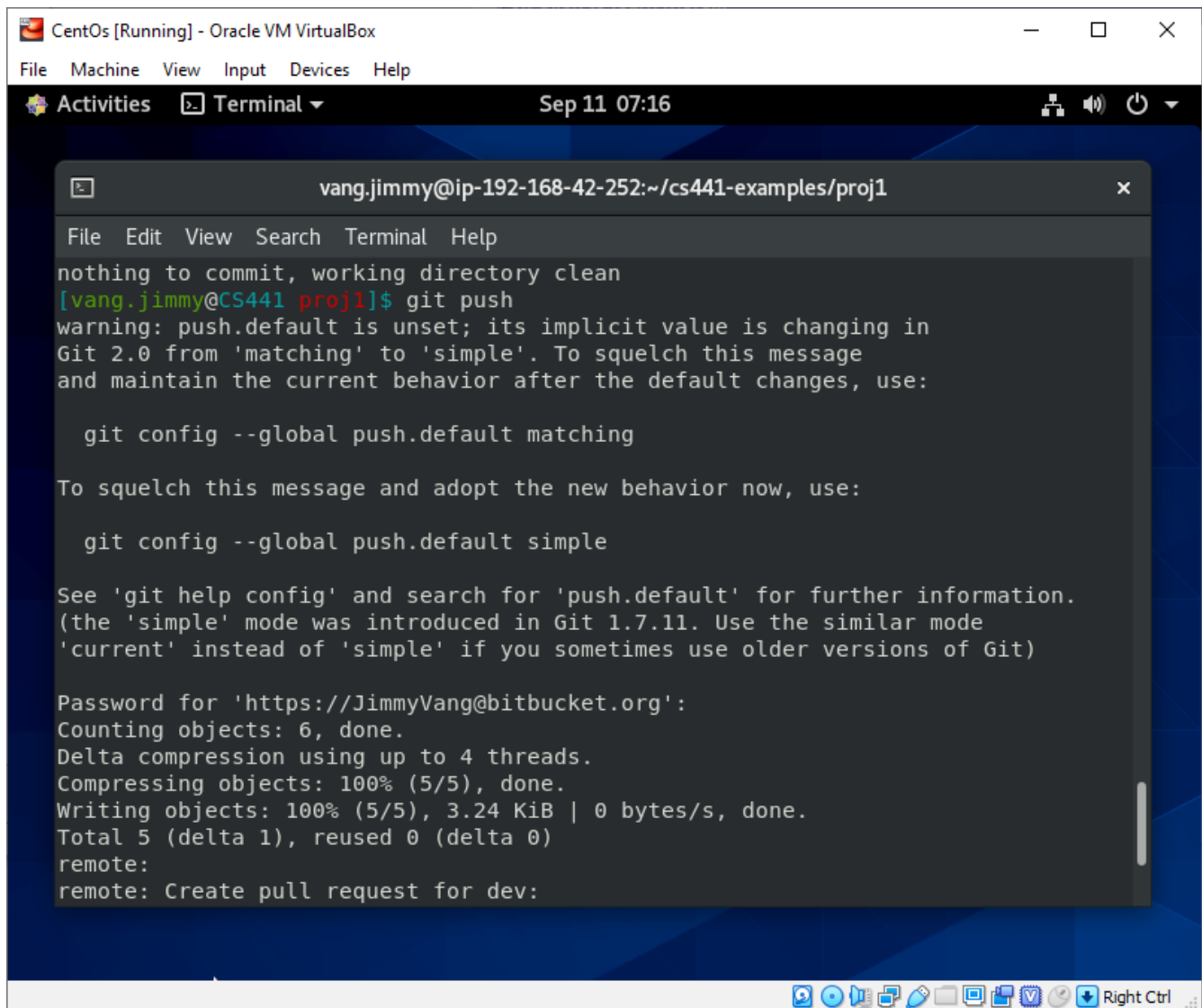


The screenshot shows a CentOs [Running] - Oracle VM VirtualBox window. The terminal window is titled 'vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1'. The terminal output shows the following commands and results:

```
[vang.jimmy@CS441 proj1]$ git add .
[vang.jimmy@CS441 proj1]$ git status
# On branch dev
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#       new file:   Makefile
#       new file:   forever
#       new file:   forever.c
#
[vang.jimmy@CS441 proj1]$ git commit -m "adding a new directory and some testing code"
[dev 4954f31] adding a new directory and some testing code
3 files changed, 25 insertions(+)
create mode 100644 proj1/Makefile
create mode 100755 proj1/forever
create mode 100644 proj1/forever.c
[vang.jimmy@CS441 proj1]$ git status
# On branch dev
# Your branch is ahead of 'origin/dev' by 1 commit.
#   (use "git push" to publish your local commits)
#
nothing to commit, working directory clean
[vang.jimmy@CS441 proj1]$
```



I use git to push the changes onto the **dev** branch of the repository.



The screenshot shows a terminal window titled "vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1". The terminal output shows the execution of a git push command, which results in a warning about the push.default configuration, followed by the configuration of push.default to 'simple', and then a successful push to the remote repository.

```
CentOs [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Sep 11 07:16

vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1
File Edit View Search Terminal Help
nothing to commit, working directory clean
[vang.jimmy@CS441 proj1]$ git push
warning: push.default is unset; its implicit value is changing in
Git 2.0 from 'matching' to 'simple'. To squelch this message
and maintain the current behavior after the default changes, use:

    git config --global push.default matching

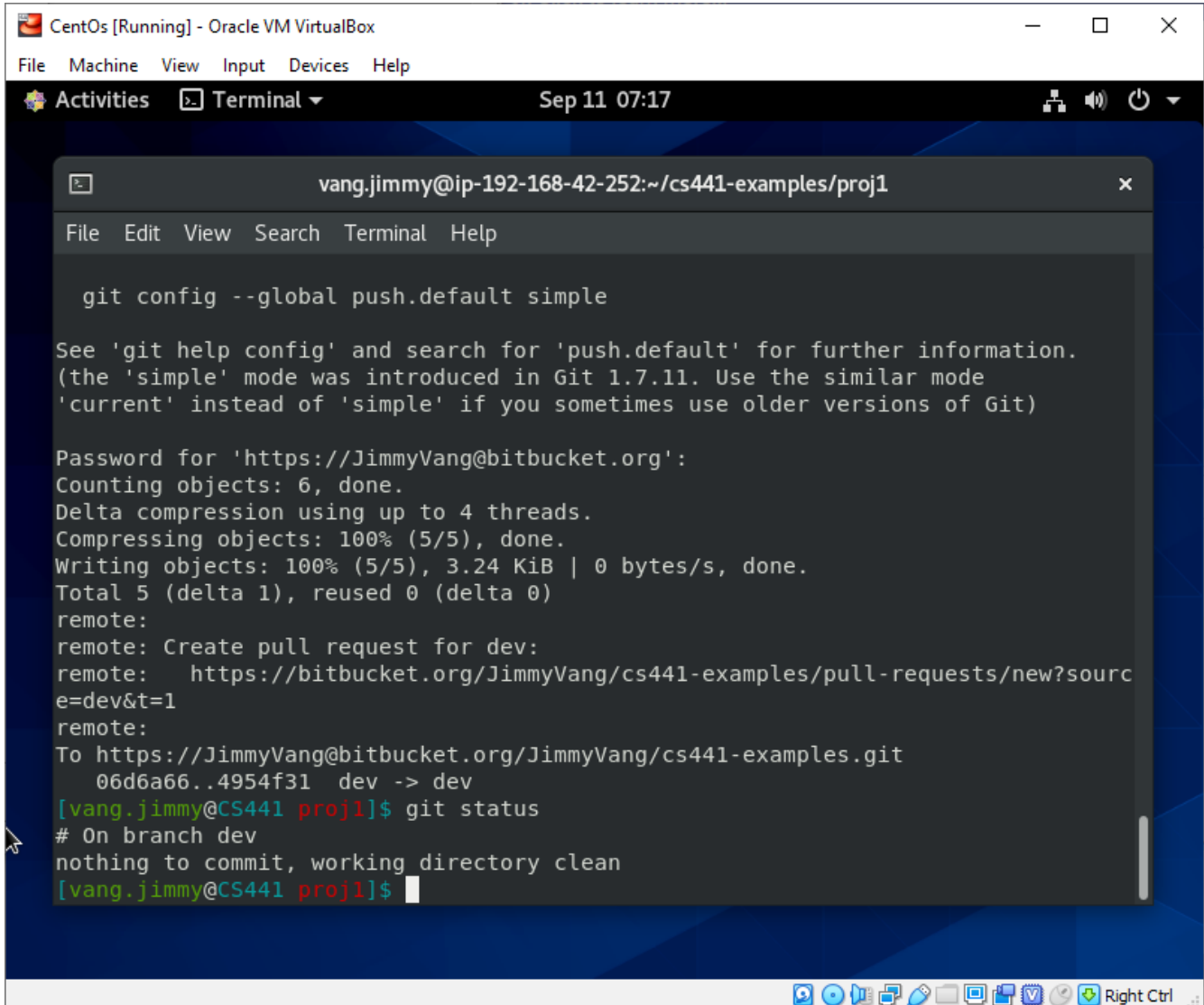
To squelch this message and adopt the new behavior now, use:

    git config --global push.default simple

See 'git help config' and search for 'push.default' for further information.
(the 'simple' mode was introduced in Git 1.7.11. Use the similar mode
'simple' instead of 'simple' if you sometimes use older versions of Git)

Password for 'https://JimmyVang@bitbucket.org':
Counting objects: 6, done.
Delta compression using up to 4 threads.
Compressing objects: 100% (5/5), done.
Writing objects: 100% (5/5), 3.24 KiB | 0 bytes/s, done.
Total 5 (delta 1), reused 0 (delta 0)
remote:
remote: Create pull request for dev:
```

I use *git status* to confirm that the *push* has succeeded.



The screenshot shows a terminal window titled 'vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1'. The terminal output shows the execution of 'git config --global push.default simple', followed by a push to the 'dev' branch on Bitbucket. The push is successful, and the terminal shows the commit hash '06d6a66..4954f31 dev -> dev'. Finally, 'git status' is run, showing 'On branch dev' and 'nothing to commit, working directory clean'.

```
CentOs [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Sep 11 07:17

vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1
File Edit View Search Terminal Help

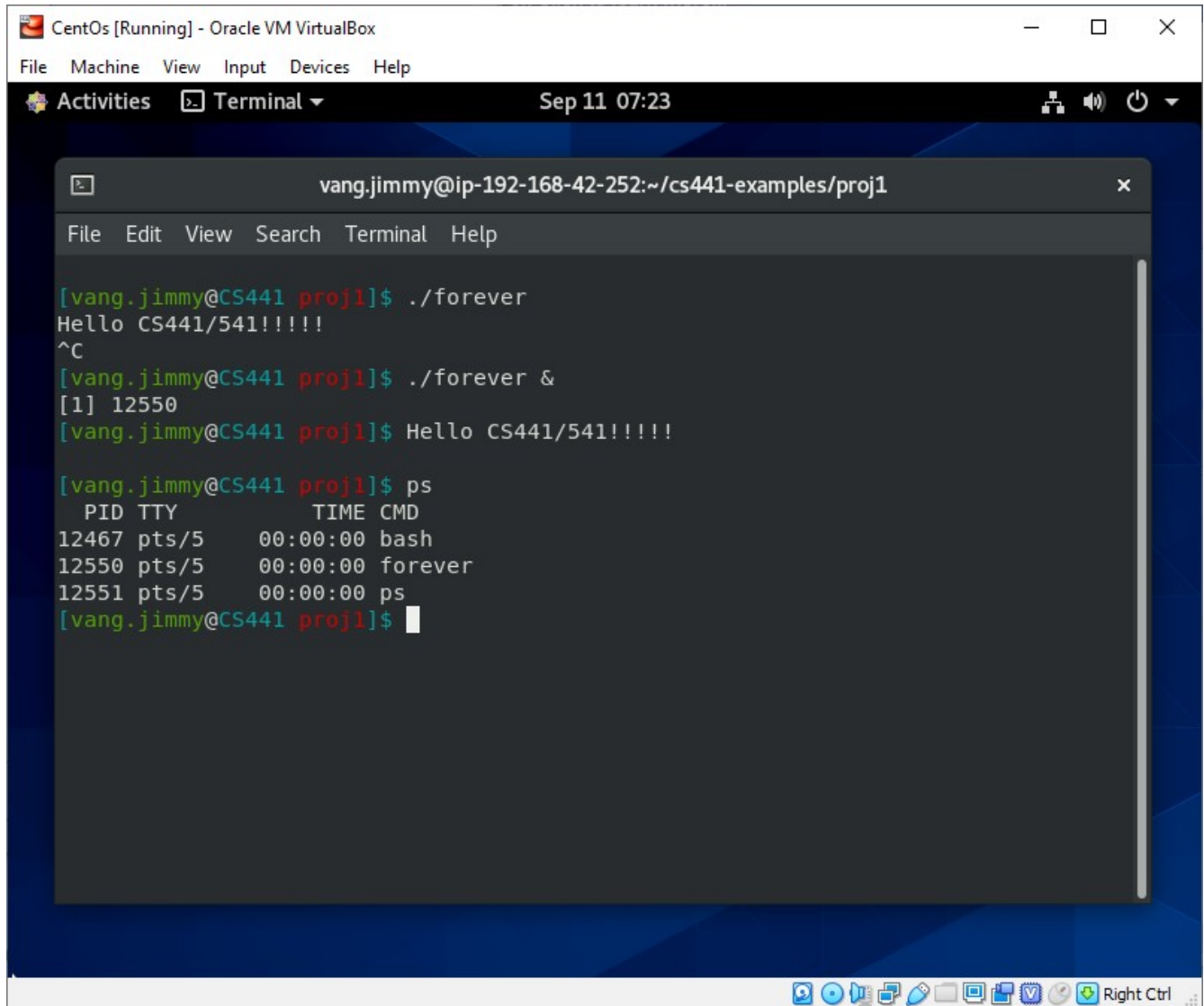
git config --global push.default simple

See 'git help config' and search for 'push.default' for further information.
(the 'simple' mode was introduced in Git 1.7.11. Use the similar mode
'current' instead of 'simple' if you sometimes use older versions of Git)

Password for 'https://JimmyVang@bitbucket.org':
Counting objects: 6, done.
Delta compression using up to 4 threads.
Compressing objects: 100% (5/5), done.
Writing objects: 100% (5/5), 3.24 KiB | 0 bytes/s, done.
Total 5 (delta 1), reused 0 (delta 0)
remote:
remote: Create pull request for dev:
remote:   https://bitbucket.org/JimmyVang/cs441-examples/pull-requests/new?source=dev&t=1
remote:
To https://JimmyVang@bitbucket.org/JimmyVang/cs441-examples.git
   06d6a66..4954f31 dev -> dev
[vang.jimmy@CS441 proj1]$ git status
# On branch dev
nothing to commit, working directory clean
[vang.jimmy@CS441 proj1]$
```

These are screenshots of me playing with the process management. (**fg**, **ps**, **kill** and **sleep**)

I run the compiled **forever.c** file as processes and use the command **ps** to view the processes that are running.



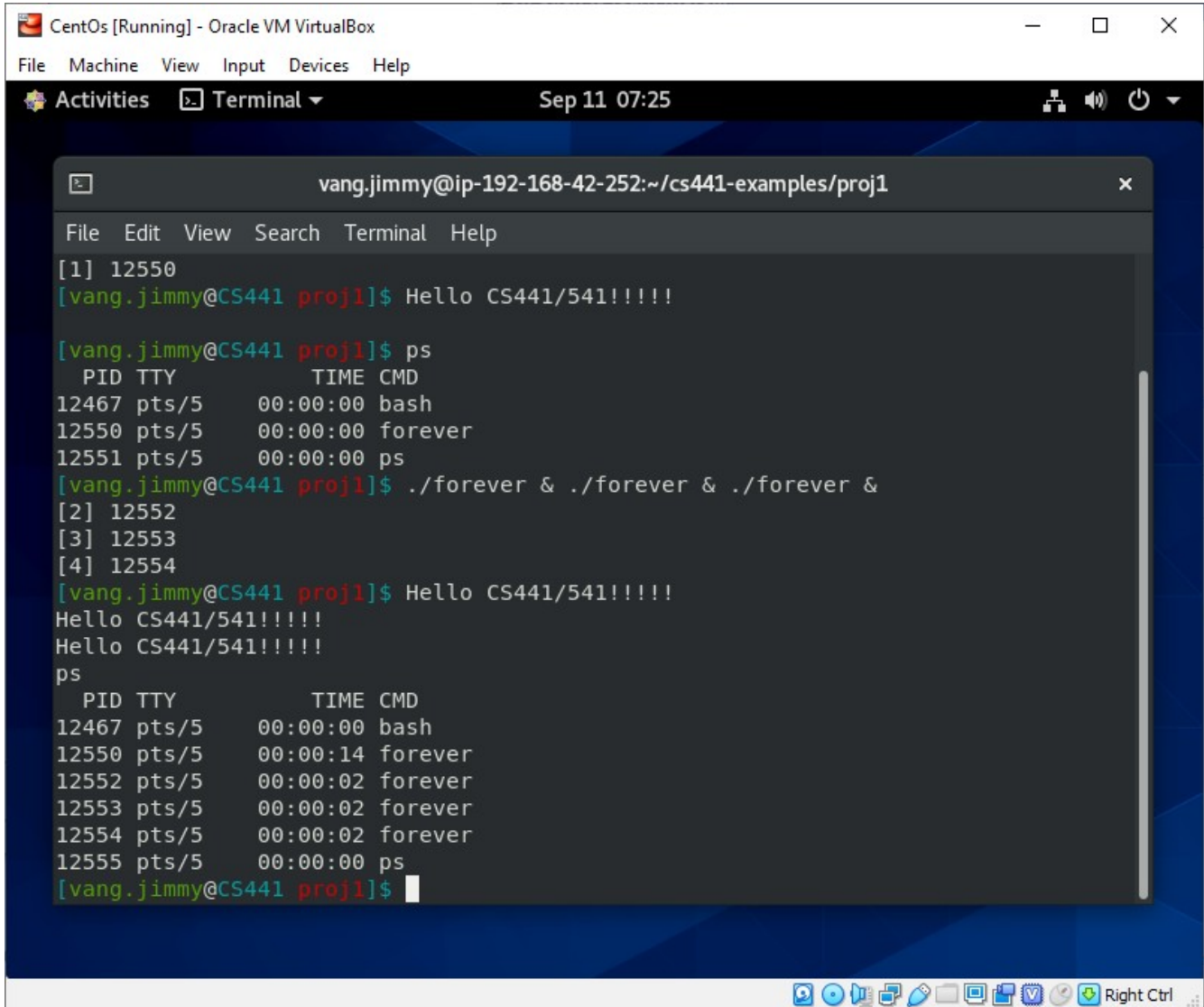
The screenshot shows a terminal window titled 'vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1'. The terminal output is as follows:

```
[vang.jimmy@CS441 proj1]$ ./forever
Hello CS441/541!!!!
^C
[vang.jimmy@CS441 proj1]$ ./forever &
[1] 12550
[vang.jimmy@CS441 proj1]$ Hello CS441/541!!!!

[vang.jimmy@CS441 proj1]$ ps
  PID TTY          TIME CMD
 12467 pts/5        00:00:00 bash
  12550 pts/5        00:00:00 forever
  12551 pts/5        00:00:00 ps
[vang.jimmy@CS441 proj1]$
```

The terminal window is part of an Oracle VM VirtualBox interface, with a menu bar (File, Machine, View, Input, Devices, Help) and a status bar (Sep 11 07:23). The bottom of the screen shows a taskbar with various icons and a 'Right Ctrl' label.

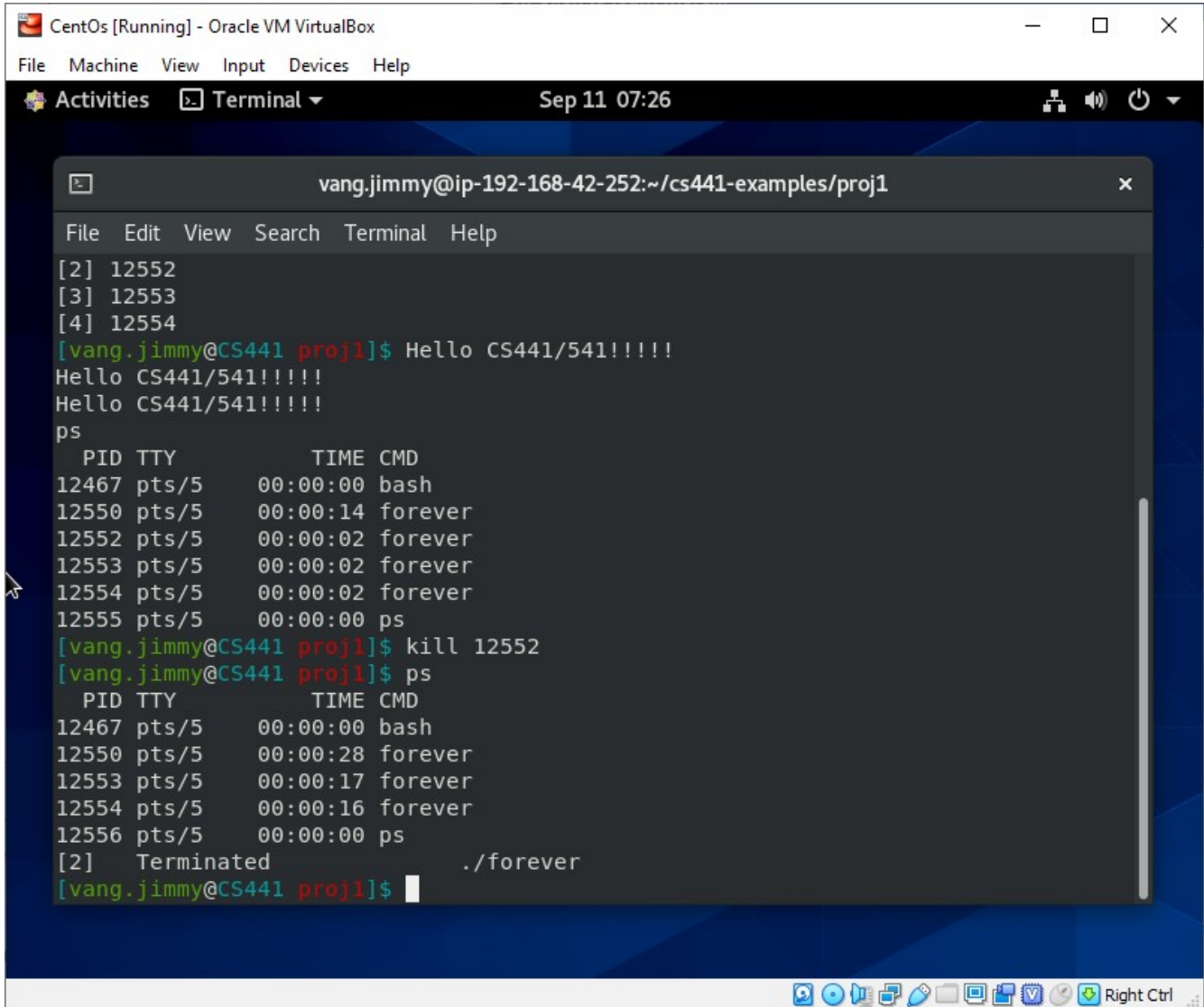
I run more **forever.c** processes and use **ps** to view them all.

A screenshot of a CentOs VM window titled "CentOs [Running] - Oracle VM VirtualBox". The window has a menu bar with "File", "Machine", "View", "Input", "Devices", and "Help". Below the menu bar is a toolbar with "Activities", "Terminal", and a clock showing "Sep 11 07:25". The main area is a terminal window titled "vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1". The terminal shows a series of commands and outputs. First, a command "[1] 12550" is shown, followed by the output "[vang.jimmy@CS441 proj1]\$ Hello CS441/541!!!!". Then, the command "[vang.jimmy@CS441 proj1]\$ ps" is executed, showing a table of processes. Next, the command "[vang.jimmy@CS441 proj1]\$ ./forever & ./forever & ./forever &" is executed, followed by three more "[2] 12552", "[3] 12553", and "[4] 12554" commands. Then, the command "[vang.jimmy@CS441 proj1]\$ Hello CS441/541!!!!" is executed, followed by two more "Hello CS441/541!!!!" outputs. Finally, the command "ps" is executed, showing a table of processes. The terminal window has a menu bar with "File", "Edit", "View", "Search", "Terminal", and "Help". The bottom of the window shows a taskbar with various icons and a "Right Ctrl" button.

```
CentOs [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Sep 11 07:25
vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1
File Edit View Search Terminal Help
[1] 12550
[vang.jimmy@CS441 proj1]$ Hello CS441/541!!!!

[vang.jimmy@CS441 proj1]$ ps
  PID TTY          TIME CMD
 12467 pts/5        00:00:00 bash
  12550 pts/5        00:00:00 forever
  12551 pts/5        00:00:00 ps
[vang.jimmy@CS441 proj1]$ ./forever & ./forever & ./forever &
[2] 12552
[3] 12553
[4] 12554
[vang.jimmy@CS441 proj1]$ Hello CS441/541!!!!
Hello CS441/541!!!!
Hello CS441/541!!!!
ps
  PID TTY          TIME CMD
 12467 pts/5        00:00:00 bash
  12550 pts/5        00:00:14 forever
  12552 pts/5        00:00:02 forever
  12553 pts/5        00:00:02 forever
  12554 pts/5        00:00:02 forever
  12555 pts/5        00:00:00 ps
[vang.jimmy@CS441 proj1]$
```

I run the **kill** command and use **ps** to check if the processes I ran the command **kill** on were killed.

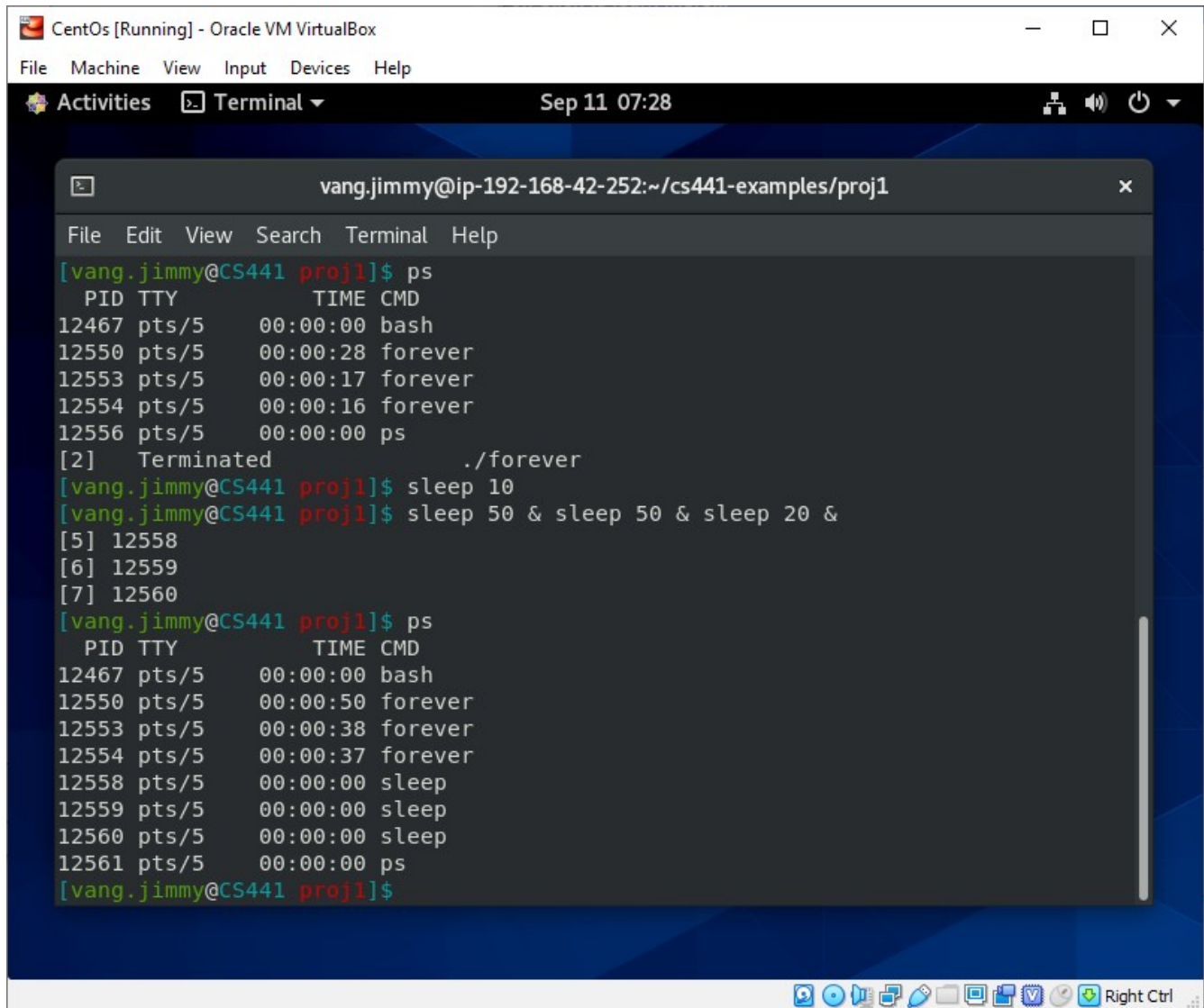


The screenshot shows a terminal window titled "vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1". The terminal output is as follows:

```
[2] 12552
[3] 12553
[4] 12554
[vang.jimmy@CS441 proj1]$ Hello CS441/541!!!!
Hello CS441/541!!!!
Hello CS441/541!!!!
ps
  PID TTY          TIME CMD
 12467 pts/5        00:00:00 bash
 12550 pts/5        00:00:14 forever
 12552 pts/5        00:00:02 forever
 12553 pts/5        00:00:02 forever
 12554 pts/5        00:00:02 forever
 12555 pts/5        00:00:00 ps
[vang.jimmy@CS441 proj1]$ kill 12552
[vang.jimmy@CS441 proj1]$ ps
  PID TTY          TIME CMD
 12467 pts/5        00:00:00 bash
 12550 pts/5        00:00:28 forever
 12553 pts/5        00:00:17 forever
 12554 pts/5        00:00:16 forever
 12556 pts/5        00:00:00 ps
[2] Terminated                ./forever
[vang.jimmy@CS441 proj1]$
```

The terminal window includes a menu bar (File, Edit, View, Search, Terminal, Help) and a status bar at the bottom with system icons and a "Right Ctrl" indicator.

I play around with the command **sleep** and use **ps** to check processes.



The screenshot shows a terminal window titled 'vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1'. The terminal output is as follows:

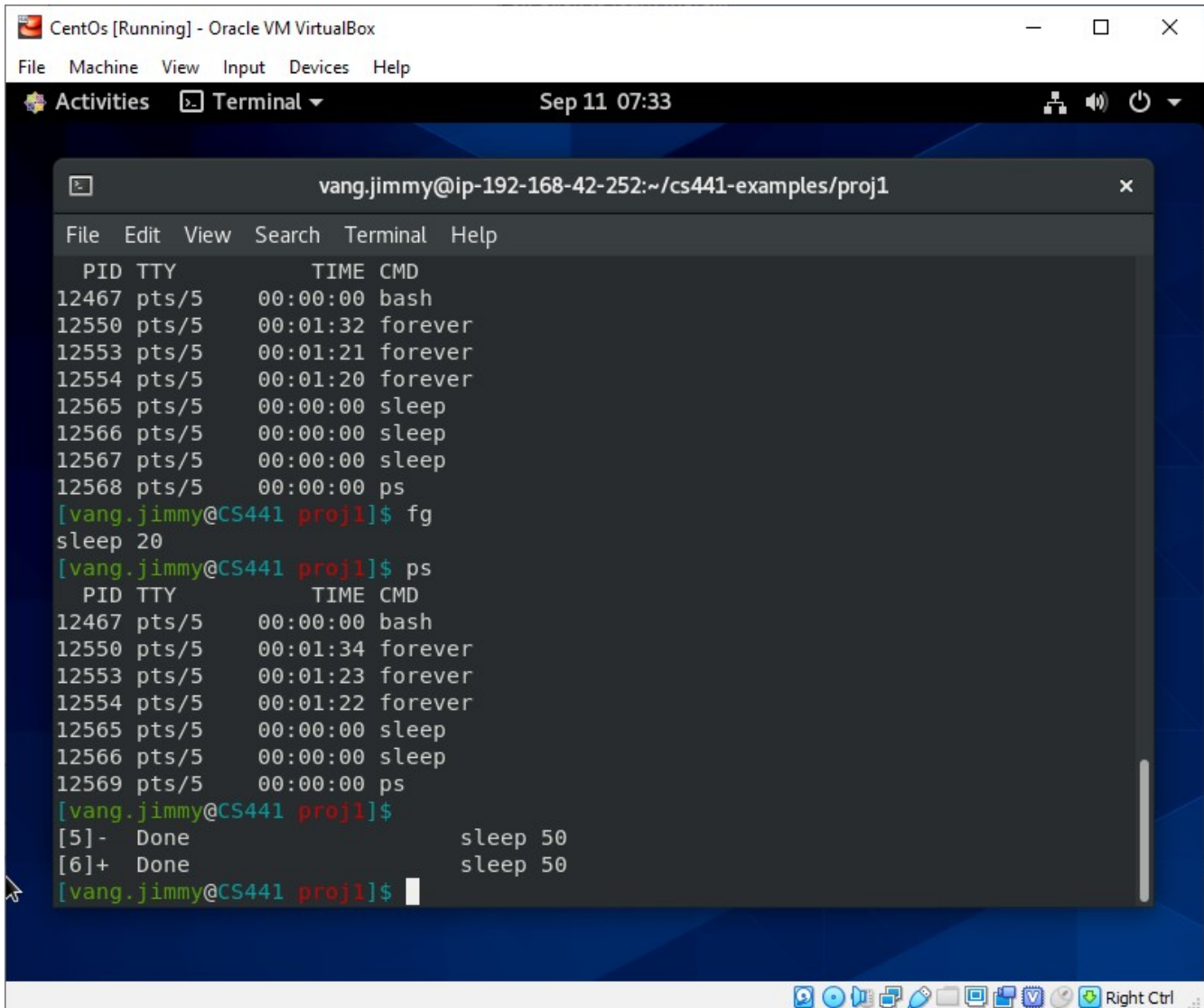
```
[vang.jimmy@CS441 proj1]$ ps
  PID TTY          TIME CMD
 12467 pts/5        00:00:00 bash
 12550 pts/5        00:00:28 forever
 12553 pts/5        00:00:17 forever
 12554 pts/5        00:00:16 forever
 12556 pts/5        00:00:00 ps
[2] Terminated ./forever
[vang.jimmy@CS441 proj1]$ sleep 10
[vang.jimmy@CS441 proj1]$ sleep 50 & sleep 50 & sleep 20 &
[5] 12558
[6] 12559
[7] 12560
[vang.jimmy@CS441 proj1]$ ps
  PID TTY          TIME CMD
 12467 pts/5        00:00:00 bash
 12550 pts/5        00:00:50 forever
 12553 pts/5        00:00:38 forever
 12554 pts/5        00:00:37 forever
 12558 pts/5        00:00:00 sleep
 12559 pts/5        00:00:00 sleep
 12560 pts/5        00:00:00 sleep
 12561 pts/5        00:00:00 ps
[vang.jimmy@CS441 proj1]$
```

The terminal window is part of a larger application titled 'CentOs [Running] - Oracle VM VirtualBox'. The top bar shows 'Activities' and 'Terminal' tabs, along with the date 'Sep 11 07:28'. The bottom of the window features a standard Linux desktop taskbar with various icons and a 'Right Ctrl' button.



I use the **fg** command, which then brings one *sleep* program with 20 seconds into the foreground.

The *sleep* program finishes after 20 seconds and I use **ps** to see if the programs are finished and gone. After about 50 seconds, I check the other background *sleep* programs with **ps** and see that they have finished running.

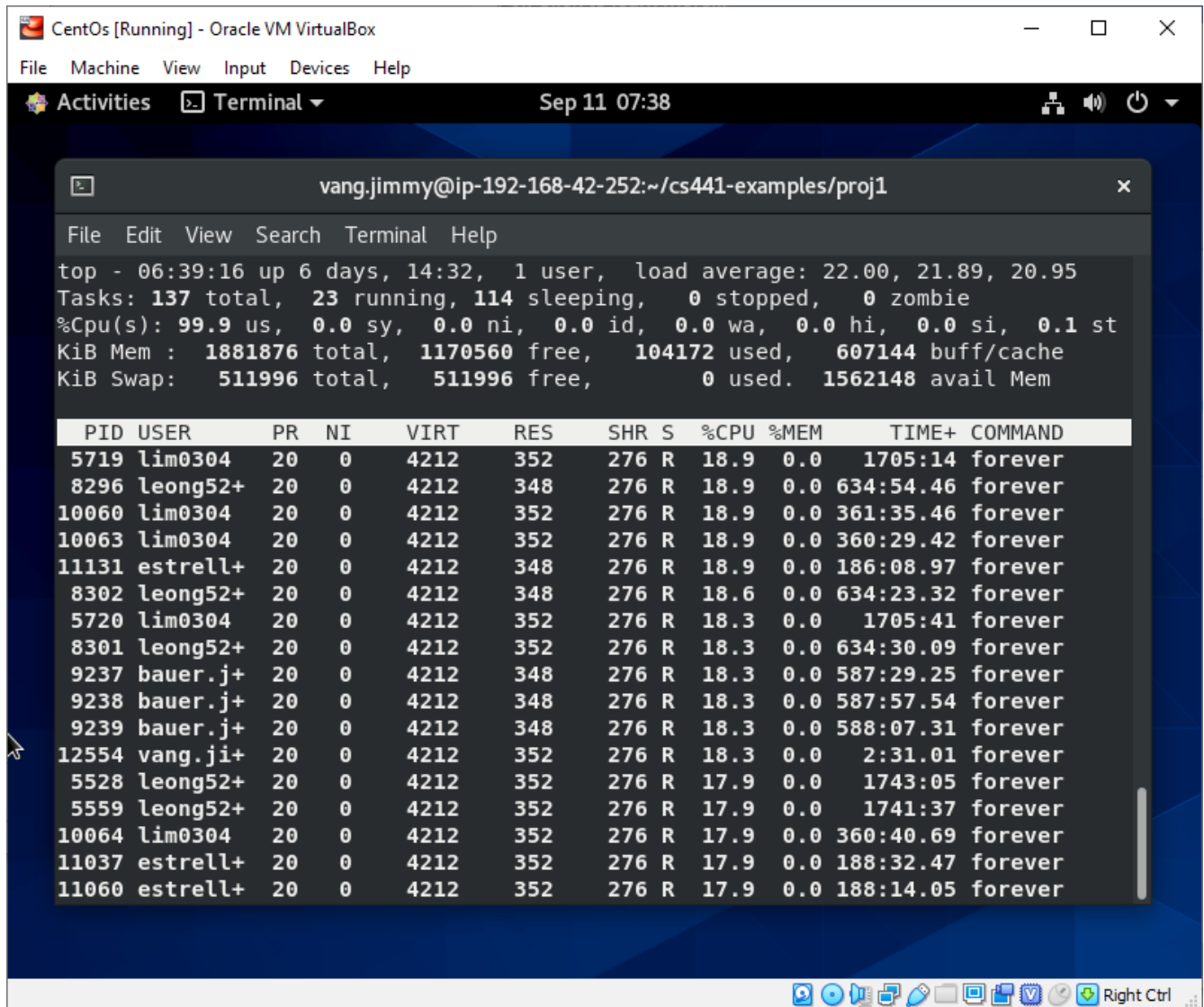


The screenshot shows a terminal window titled "vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1". The terminal output is as follows:

```
File Edit View Search Terminal Help
PID TTY      TIME CMD
12467 pts/5    00:00:00 bash
12550 pts/5    00:01:32 forever
12553 pts/5    00:01:21 forever
12554 pts/5    00:01:20 forever
12565 pts/5    00:00:00 sleep
12566 pts/5    00:00:00 sleep
12567 pts/5    00:00:00 sleep
12568 pts/5    00:00:00 ps
[vang.jimmy@CS441 proj1]$ fg
sleep 20
[vang.jimmy@CS441 proj1]$ ps
  PID TTY      TIME CMD
 12467 pts/5    00:00:00 bash
 12550 pts/5    00:01:34 forever
 12553 pts/5    00:01:23 forever
 12554 pts/5    00:01:22 forever
 12565 pts/5    00:00:00 sleep
 12566 pts/5    00:00:00 sleep
 12569 pts/5    00:00:00 ps
[vang.jimmy@CS441 proj1]$
[5]-  Done                  sleep 50
[6]+  Done                  sleep 50
[vang.jimmy@CS441 proj1]$
```



Lastly, I execute the command **top**. I see all of the processes that are currently running on the CentOS VM and a bunch more information about the OS.



```
CentOs [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Sep 11 07:38
vang.jimmy@ip-192-168-42-252:~/cs441-examples/proj1
File Edit View Search Terminal Help
top - 06:39:16 up 6 days, 14:32, 1 user, load average: 22.00, 21.89, 20.95
Tasks: 137 total, 23 running, 114 sleeping, 0 stopped, 0 zombie
%Cpu(s): 99.9 us, 0.0 sy, 0.0 ni, 0.0 id, 0.0 wa, 0.0 hi, 0.0 si, 0.1 st
KiB Mem : 1881876 total, 1170560 free, 104172 used, 607144 buff/cache
KiB Swap: 511996 total, 511996 free, 0 used. 1562148 avail Mem

  PID USER      PR  NI  VIRT  RES  SHR  S  %CPU  %MEM    TIME+  COMMAND
 5719 lim0304   20   0   4212   352   276  R   18.9   0.0   1705:14  forever
 8296 leong52+  20   0   4212   348   276  R   18.9   0.0   634:54.46  forever
10060 lim0304   20   0   4212   352   276  R   18.9   0.0   361:35.46  forever
10063 lim0304   20   0   4212   352   276  R   18.9   0.0   360:29.42  forever
11131 estrell+  20   0   4212   348   276  R   18.9   0.0   186:08.97  forever
 8302 leong52+  20   0   4212   348   276  R   18.6   0.0   634:23.32  forever
 5720 lim0304   20   0   4212   352   276  R   18.3   0.0   1705:41  forever
 8301 leong52+  20   0   4212   352   276  R   18.3   0.0   634:30.09  forever
 9237 bauer.j+  20   0   4212   348   276  R   18.3   0.0   587:29.25  forever
 9238 bauer.j+  20   0   4212   348   276  R   18.3   0.0   587:57.54  forever
 9239 bauer.j+  20   0   4212   348   276  R   18.3   0.0   588:07.31  forever
12554 vang.ji+  20   0   4212   352   276  R   18.3   0.0    2:31.01  forever
 5528 leong52+  20   0   4212   352   276  R   17.9   0.0   1743:05  forever
 5559 leong52+  20   0   4212   352   276  R   17.9   0.0   1741:37  forever
10064 lim0304   20   0   4212   352   276  R   17.9   0.0   360:40.69  forever
11037 estrell+  20   0   4212   352   276  R   17.9   0.0   188:32.47  forever
11060 estrell+  20   0   4212   352   276  R   17.9   0.0   188:14.05  forever
```