Submission Details:

Name: Smitha Venkatesh
Student ID: 011825177
Git Commit ID:
commit df8ba95c572a187ed2aa7403e97a7a7f58c01f00

2) Describe in detail the steps you used to complete the assignment.
Answer:

Steps:
Check if VMX is enabled

1)$sudo apt-get update

2)$sudo apt-get install cpu-checker

3)$ kvm-ok

[/dev/kvm exists. KVM acceleration can be used]

Downloading Linux kernel code

1)$git clone https://github.com/torvalds/linux.git

[This is cloning to local repository /linux]

2)Go to the local directory (/linux) cd linux

3)$git log

commit df8ba95c572a187ed2aa7403e97a7a7f58c01f00
Merge: 42062b9 b12cbb2
Author: Linus Torvalds <torvalds@linux-foundation.org>
Date: Thu Nov 30 18:56:41 2017 -0500

4)$sudo apt-get install libncurses5-dev

5)$make menuconfig

6)$sudo apt-get install libssl-dev

7)$sudo make && sudo make modules && sudo make modules_install && sudo make install

8)$uname -r

4.10.0-28-generic

9)Reboot

10)$uname -r

4.15.0-rc1+

11) Edit the code in linux/arch/x86/kvm/vmx.c to perform the functionality of assignment

12)Install Virt Manager:

$sudo apt install qemu-kvm
$kvm-ok
$sudo apt-get install virt-manager

13)Build the KVM module: [Steps to test and build the new module after any changes]

$sudo make SUBDIRS=arch/x86/kvm/

14) $lsmod | grep kvm

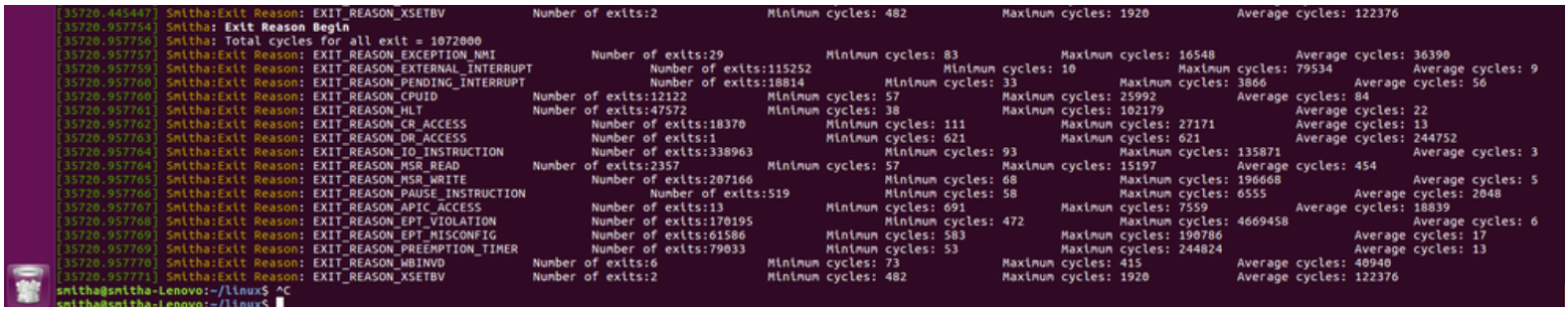
15) Remove the leaf modules first and later the dependent module.

$sudo rmmod kvm_intel
$sudo rmmod kvm

16) Build the kernel modules:

$sudo insmod arch/x86/kvm/kvm.ko
$sudo insmod arch/x86/kvm/kvm-intel.ko

17) Start a Guest VM and run dmesg in Host VM to see the number of counts of each exits.



18) Commit the changes to git

$git config --global user.email "smithav17@gmail.com"
$ git config --global user.name "Smitha Venkatesh"
$ git commit -a
$ git log

commit 1b191478a8818b3847e4b370241b8b8309420b92
Author: Smitha Venkatesh <smithav17@gmail.com>
Date: Sat Dec 2 17:56:49 2017 -0800
Edited arch/x86/kvm/vmx.c according to 283 assignment3 functionality

19) Get the diff file:

$git diff HEAD~1 > cmpe283-3.diff

3)Note whether or not you used a larger count of exits between outputs (1000 or 2000 exits vs the suggested 500).

Answer:
I am displaying the statistics information for every 1000 total exits

4) Include a sample of your print output from dmesg (take just one set of outputs)
Sample Output

[34411.661552] Smitha: Exit Reason Begin
[34411.661557] Smitha: Total cycles for all exit = 350000
[34411.661562] Smitha:Exit Reason: EXIT_REASON_EXCEPTION_NMI Number of exits:12 Minimum cycles: 109 Maximum cycles: 16548 Average cycles: 27701

[34411.661565] Smitha:Exit Reason: EXIT_REASON_EXTERNAL_INTERRUPT Number of exits:13262 Minimum cycles: 10 Maximum cycles: 24108 Average cycles: 26

[34411.661568] Smitha:Exit Reason: EXIT_REASON_PENDING_INTERRUPT Number of exits:2555 Minimum cycles: 34 Maximum cycles: 2249 Average cycles: 136

[34411.661571] Smitha:Exit Reason: EXIT_REASON_CPUID Number of exits:11115 Minimum cycles: 57 Maximum cycles: 25992 Average cycles: 31

[34411.661573] Smitha:Exit Reason: EXIT_REASON_HLT Number of exits:5411 Minimum cycles: 38 Maximum cycles: 6038 Average cycles: 64

[34411.661576] Smitha:Exit Reason: EXIT_REASON_CR_ACCESS Number of exits:18370 Minimum cycles: 111 Maximum cycles: 27171 Average cycles: 13

[34411.661579] Smitha:Exit Reason: EXIT_REASON_DR_ACCESS Number of exits:1 Minimum cycles: 621 Maximum cycles: 621 Average cycles: 244752

[34411.661582] Smitha:Exit Reason: EXIT_REASON_IO_INSTRUCTION Number of exits:246624 Minimum cycles: 93 Maximum cycles: 126678 Average cycles: 1

[34411.661584] Smitha:Exit Reason: EXIT_REASON_MSR_READ Number of exits:226 Minimum cycles: 57 Maximum cycles: 5283 Average cycles: 1534

[34411.661586] Smitha:Exit Reason: EXIT_REASON_MSR_WRITE Number of exits:13674 Minimum cycles: 68 Maximum cycles: 121362 Average cycles: 25

[34411.661589] Smitha:Exit Reason: EXIT_REASON_PAUSE_INSTRUCTION Number of exits:54 Minimum cycles: 58 Maximum cycles: 1745 Average cycles: 6138

[34411.661592] Smitha:Exit Reason: EXIT_REASON_APIC_ACCESS Number of exits:13 Minimum cycles: 691 Maximum cycles: 7559 Average cycles: 18839

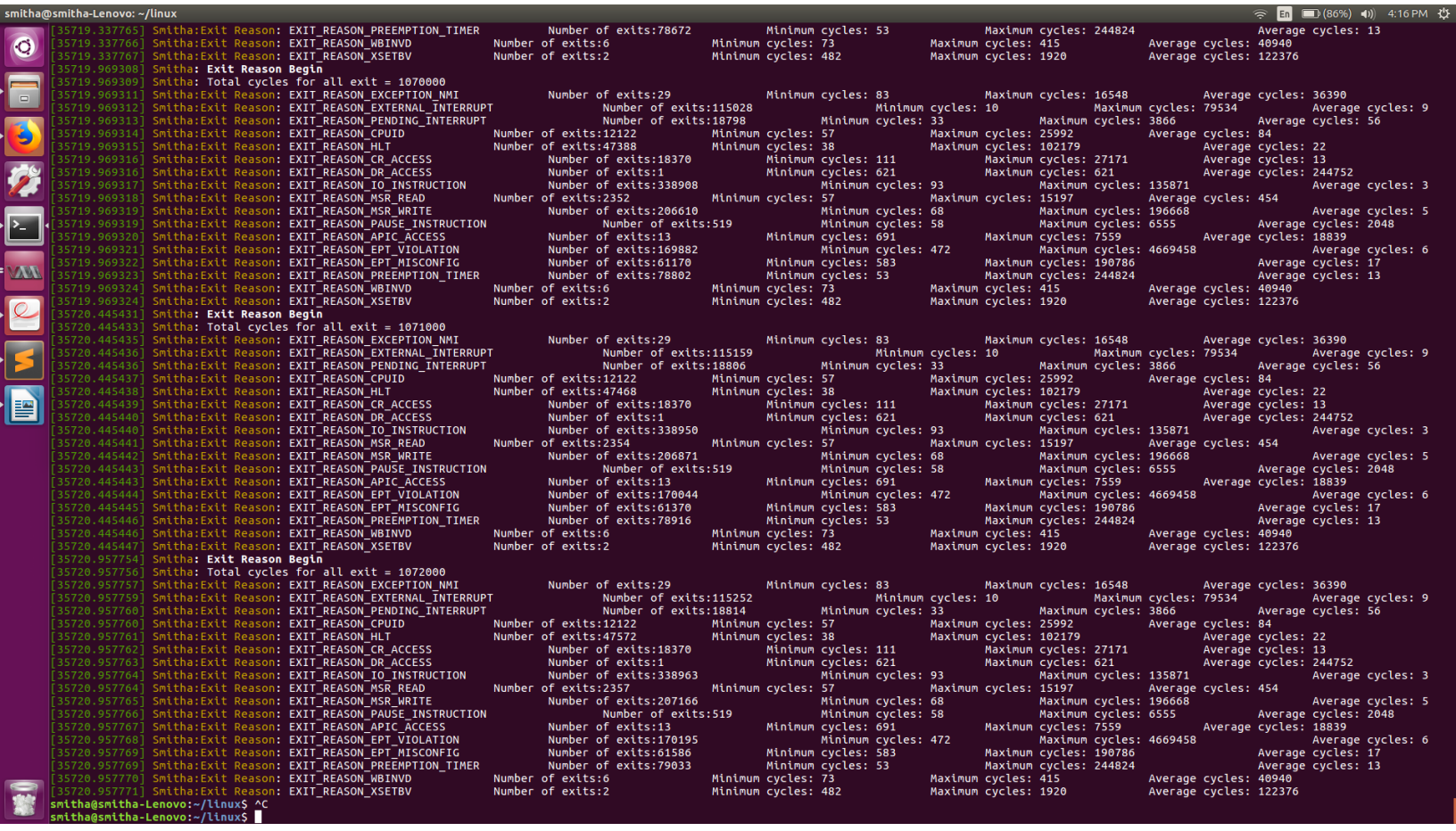
[34411.661595] Smitha:Exit Reason: EXIT_REASON_EPT_VIOLATION Number of exits:18523 Minimum cycles: 539 Maximum cycles: 1709028 Average cycles: 18

[34411.661597] Smitha:Exit Reason: EXIT_REASON_EPT_MISCONFIG Number of exits:15630 Minimum cycles: 583 Maximum cycles: 134980 Average cycles: 22

[34411.661600] Smitha:Exit Reason: EXIT_REASON_PREEMPTION_TIMER Number of exits:4522 Minimum cycles: 58 Maximum cycles: 38304 Average cycles: 77

[34411.661602] Smitha:Exit Reason: EXIT_REASON_WBINVD Number of exits:6 Minimum cycles: 73 Maximum cycles: 415 Average cycles: 40940

[34411.661605] Smitha:Exit Reason: EXIT_REASON_XSETBV Number of exits:2 Minimum cycles: 482 Maximum cycles: 1920 Average cycles: 122376



5) What did you learn from the count of exits? Was the count what you expected? If not, why not

Answer:
The total count of exits show how frequently there is a switch between guest VM and the Hyperwiser. Most of the VM exits happen due to IO_INSTRUCTION, EXTERNAL_INTERRUPT, MSR_WRITE, CPUID and these counts are expected to be higher in number.

The count of exits due to IO_INSTRUCTION, EXTERNAL_INTERRUPT, MSR_WRITE, CPUID are all more as all of these instructions have to be executed by the Hyperwiser. The guest VM cannot execute these because it may change all the contents of memory which it is not supposed to access. So whenever these instructions are encountered, VM exit occurs and the Hyperwiser handles it.