Pre Step:

Log In Virtual Box: Y:\Subject\vm_image\EmbeddedSystem

Start: StartTheVM_50gram_2024

Connect to Putty:

Serial Line:COM3

Connection type: Serial

Speed: 115200

NFS remote directory mounting:

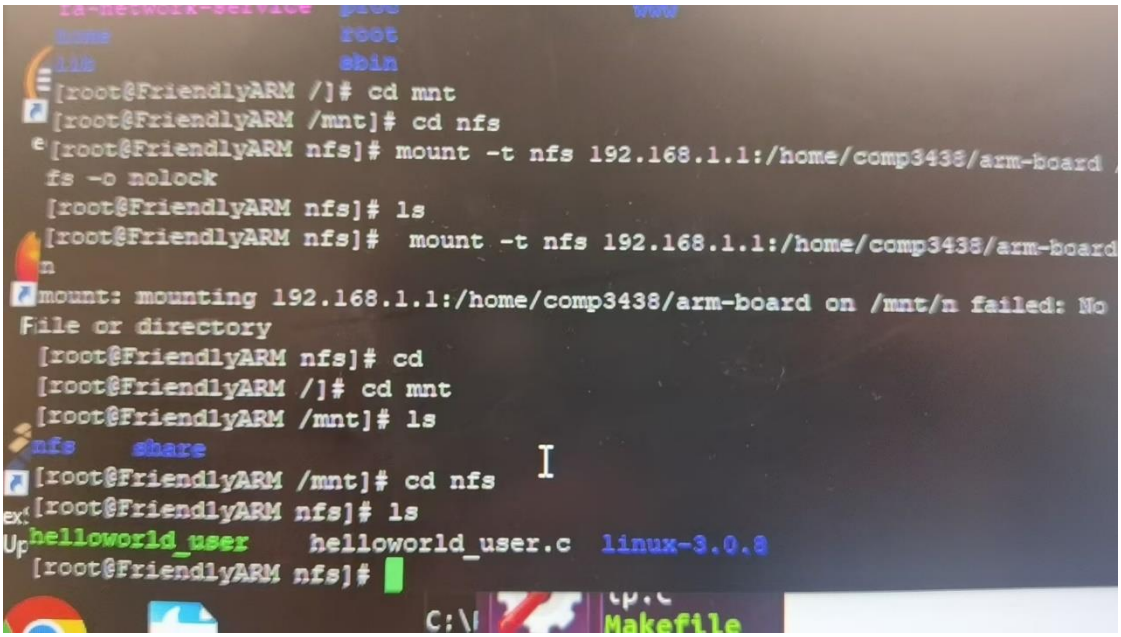
Enter:

cd /mnt

ls nfs

mount -t nfs 192.168.1.1:/home/comp3438/arm-board /mnt/nfs -o nolock

Result should have after compilation:



Open

https://elixir.bootlin.com/

Search

linux-3.0.8

Identifier: MODULE_LICENSE

Click Into: include/linux/module.h, line 140 (as a macro)

for Linux kernel source code

Step 1 and 2 (Proper download of device and application source code in correct directory):

In Virtual Embedded Machine:

Go to Firefox browser Blackboard Lecture 9 then Download the helloworld.zip file

OR

Download the helloworld.zip file from original computer blackboard and copy into shared folder:

(Original machine documents/shared)

(Embedded Computer top left Devices-Shared Folder)

Enter the following command in the /home/comp3438/arm-board/linux-3.0.8/drivers/char position

First Command:

sudo bash

COMP3438 Enterpassword:12345

Then following command to copy

cp /media/sf_Shared/helloworld_driver.c .

To copy the helloworld_driver.c file into the embedded machine

cp /media/sf_Shared/helloworld_user.c .

To copy the helloworld_user.c file into the embedded machine

cp /media/sf_Shared/Kconfig .

cp /media/sf_Shared/Makefile .

Target:

Put helloworld_driver.c file into /home/comp3438/arm-board/linux-3.0.8/drivers/char

Put helloworld_user.c file into /home/comp3438/arm-board

Put replace Makefile and Kconfig in /home/comp3438/arm-board/linux-3.0.8/drivers/char

Remove executable nature of helloworld_driver.c:

chown comp3438:comp3438 helloworld_driver.c

chmod a-x helloworld_driver.c

chown comp3438:comp3438 helloworld_user.c

chmod a-x helloworld_user.c

Step 3 (Driver Compilation) :

At /home/comp3438/arm-board/linux-3.0.8/drivers/char

Vim Makefile

Add

obj-$(CONFIG_HELLO_WORLD) += helloworld_driver.o

at the lowest of Makefile

Next

Vim Kconfig

Shift+g to go to end of the file

Enter before last line:

```
config HELLO_WORLD
        tristate "The hello world char driver"
        depends on CPU_S5PV210
```

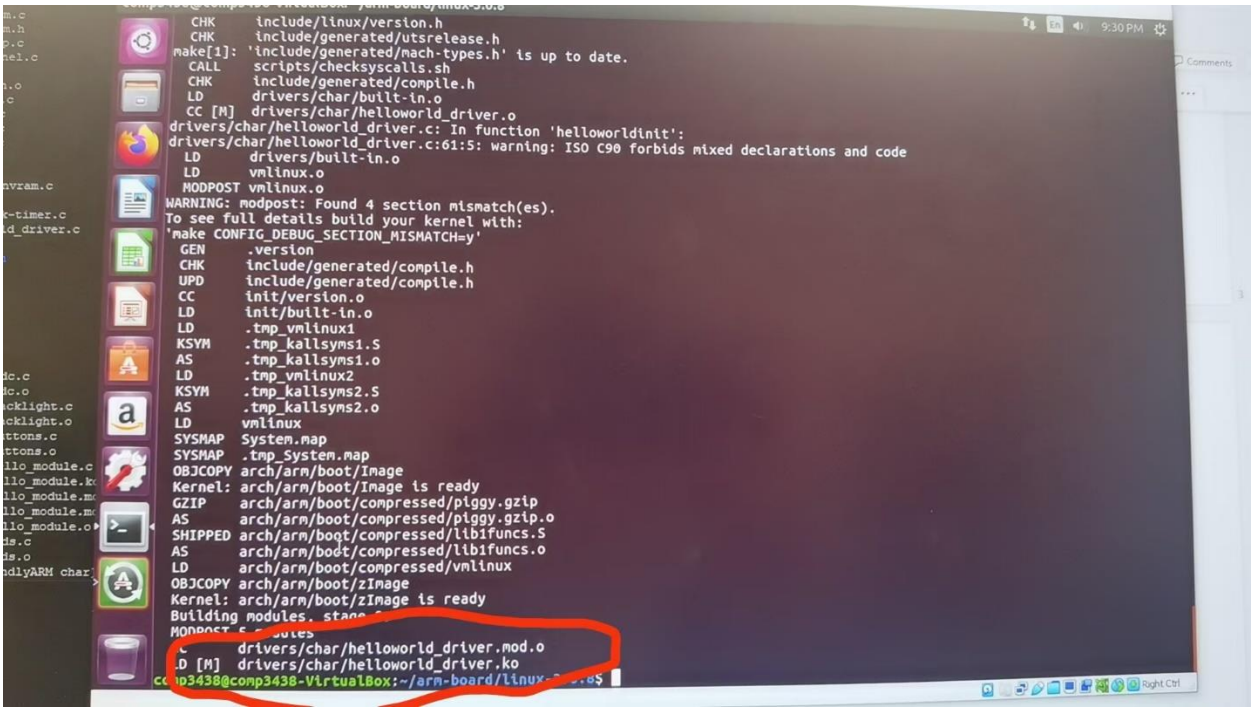
Next return back to linux-3.0.08 (two times cd ..)

Then enter: make menuconfig

Inside the GUI go Device Drivers, then Character Devices, Finally enter “M” for Hello World Driver Configuration

TAB to Exit

Then start compilation by entering:make



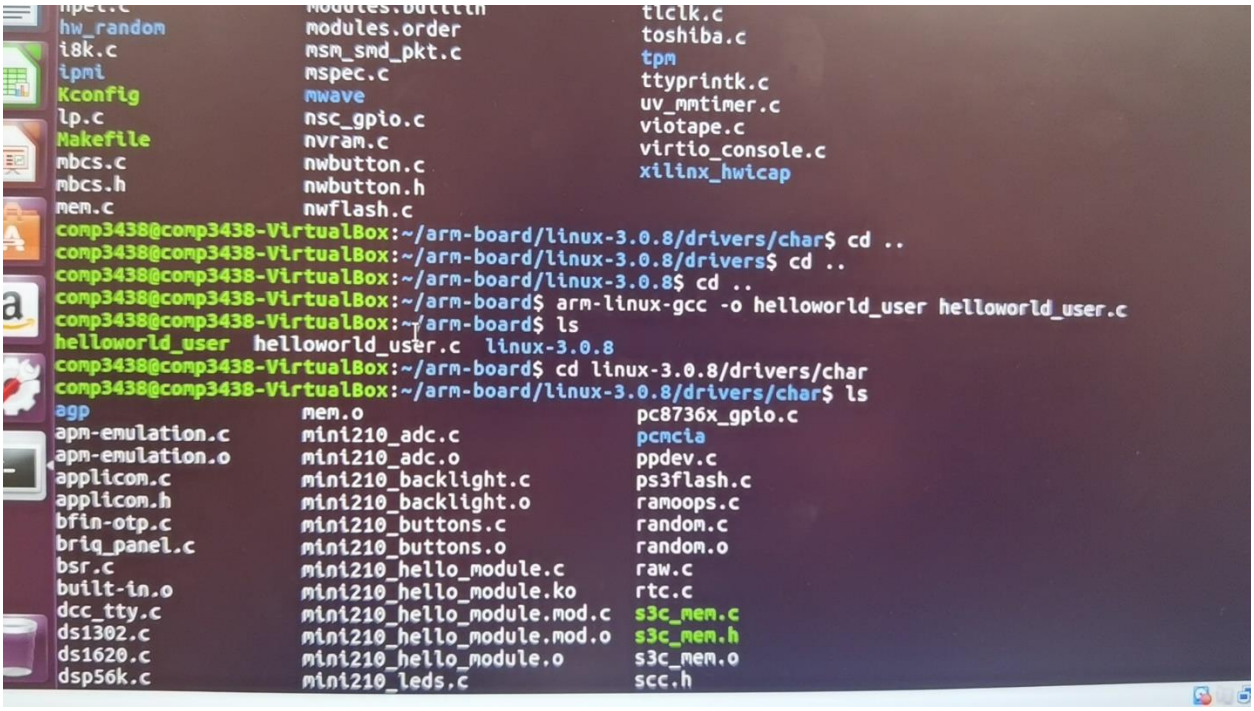
Successful compilation

Step 4 (Driver loading and device file set up):

Enter the following codes to generate a file to run later in directory (/home/comp3438/arm-board):

arm-linux-gcc -o helloworld_user helloworld_user.c

Expecting Result:



Step 5 (Application Execution):

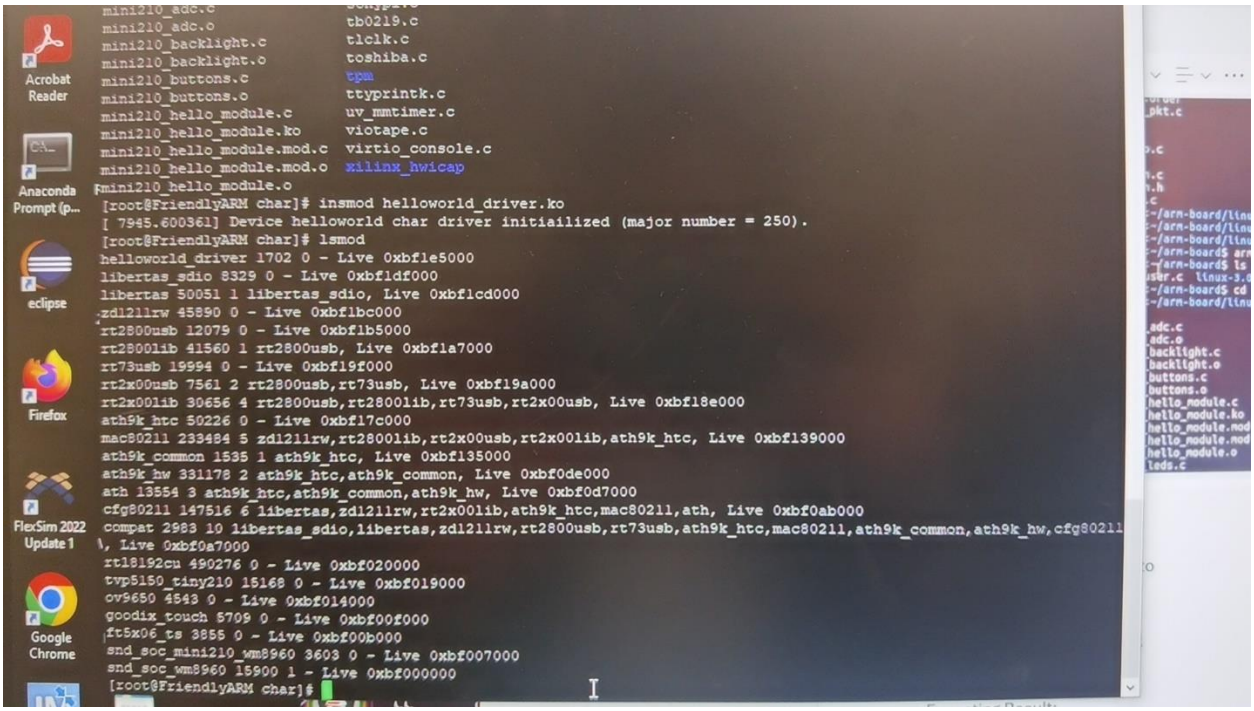
Return back to putty and go to linux-3.0.8/drivers/char

Run code:

insmod helloworld_driver.ko

Result should be like this :

cat /proc/devices (Check logs about the kernel, faked files, 250-helloworld char driver)



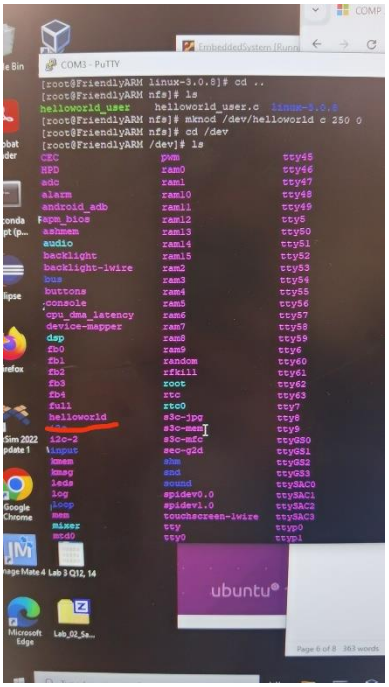
Then create a device file: (go back to nfs three times cd ..)

Enter cd /dev and then ls to check:

Major number 250 and minor number is 1 as listed at S_N 1 in helloworld_driver.c

mknod /dev/helloworld c 250 1

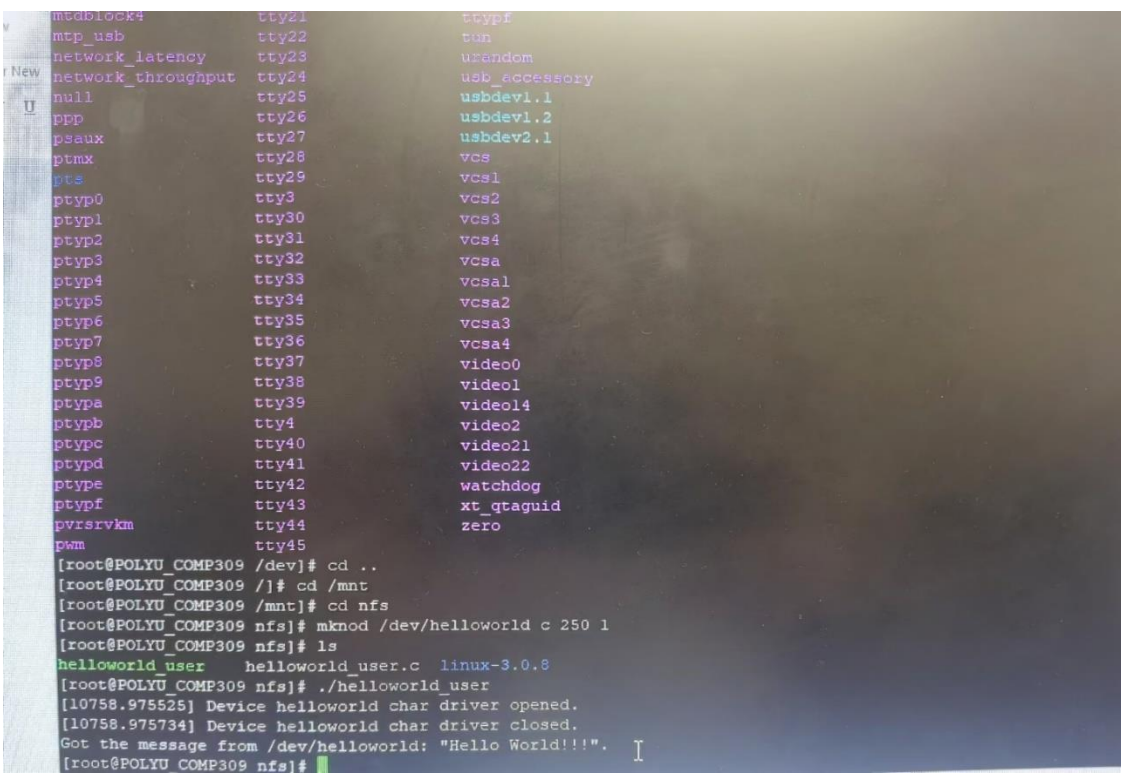
Expected result:



After device code created, we can do execution, return back to nfs and run the code entering :

./helloworld_user

Expecting Result:

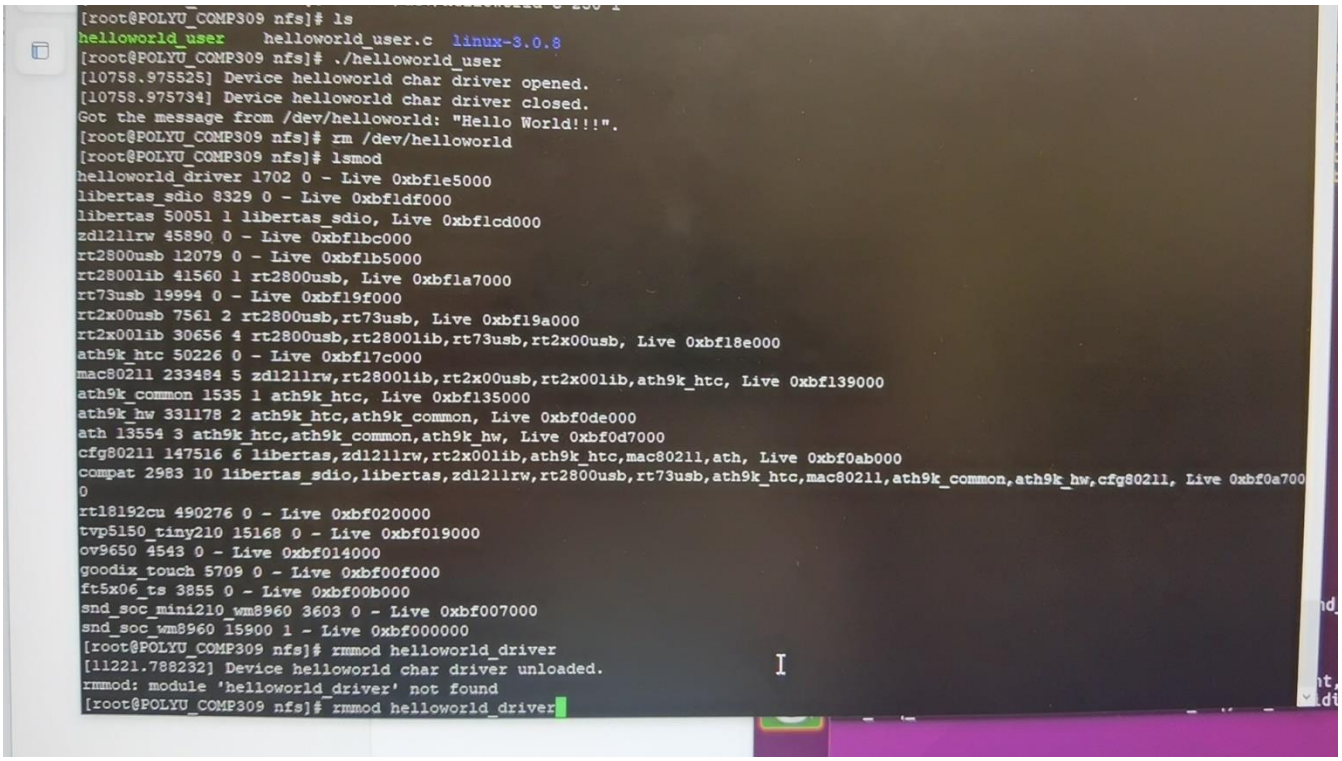


Step 6 (Device file deletion and driver unloading):

Delete Device file call command : rm /dev/helloworld

Driver Unloading call command : rmmod helloworld_driver

Expecting Result:



```
[root@POLYU_COMP309 nfs]# ls
helloworld_user    helloworld_user.c  linux-3.0.8
[root@POLYU_COMP309 nfs]# ./helloworld_user
[10758.975525] Device helloworld char driver opened.
[10758.975734] Device helloworld char driver closed.
Got the message from /dev/helloworld: "Hello World!!!".
[root@POLYU_COMP309 nfs]# rm /dev/helloworld
[root@POLYU_COMP309 nfs]# lsmod
helloworld_driver 1702 0 - Live 0xbf1e5000
libertas_sdio 8329 0 - Live 0xbf1df000
libertas 50051 1 libertas_sdio, Live 0xbf1cd000
zd1211rw 45890 0 - Live 0xbf1bc000
rt2800usb 12079 0 - Live 0xbf1b5000
rt2800lib 41560 1 rt2800usb, Live 0xbf1a7000
rt73usb 19994 0 - Live 0xbf19f000
rt2x00usb 7561 2 rt2800usb,rt73usb, Live 0xbf19a000
rt2x00lib 30656 4 rt2800usb,rt2800lib,rt73usb,rt2x00usb, Live 0xbf18e000
ath9k_htc 50226 0 - Live 0xbf17c000
mac80211 233484 5 zd1211rw,rt2800lib,rt2x00usb,rt2x00lib,ath9k_htc, Live 0xbf139000
ath9k_common 1535 1 ath9k_htc, Live 0xbf135000
ath9k_hw 331178 2 ath9k_htc,ath9k_common, Live 0xbf0de000
ath 13554 3 ath9k_htc,ath9k_common,ath9k_hw, Live 0xbf0d7000
cfg80211 147516 6 libertas,zd1211rw,rt2x00lib,ath9k_htc,mac80211,ath, Live 0xbf0ab000
compat 2983 10 libertas_sdio,libertas,zd1211rw,rt2800usb,rt73usb,ath9k_htc,mac80211,ath9k_common,ath9k_hw,cfg80211, Live 0xbf0a700
0
rtl8192cu 490276 0 - Live 0xbf020000
tvp5150_tiny210 15168 0 - Live 0xbf019000
ov9650 4543 0 - Live 0xbf014000
goodix_touch 5709 0 - Live 0xbf00f000
ft5x06_ts 3855 0 - Live 0xbf00b000
snd_soc_mini210_wm8960 3603 0 - Live 0xbf007000
snd_soc_wm8960 15900 1 - Live 0xbf000000
[root@POLYU_COMP309 nfs]# rmmod helloworld_driver
[11221.788232] Device helloworld char driver unloaded.
rmmod: module 'helloworld_driver' not found
[root@POLYU_COMP309 nfs]# rmmod helloworld_driver
```

Project Rubric:

	Fail	Unsatisfactory	Novice	Competent	Excellent	Outstanding
Quality of the Development and Demo. This rubric is related to intended learning outcome (a) organize the functionalities and components of a computer system into different layers, and have a good understanding of the role of system programming and the scope of duties and tasks of a system programmer; (b)grasp the concepts and principles, and be familiar with the approaches and methods of developing system level software (e.g. compiler, and networking software); (c) apply the knowledge and techniques learnt to develop solutions to real world problems; (d) select and make use of the OS kernel functions and their APIs, standard programming languages, and utility tools; (e) organize and manage software built for deployment and demonstration; and (f) analyze requirements and solve problems using systematic planning and development approaches.	**0** (0.00%) No show	**12** (12.00%) The student can successfully and correctly realize part of the steps to develop and demo the task, but less than two of the steps are realized completely successfully and correctly. The complete set of steps to develop and demo the task include: 1. download or develop the driver source code in the proper directory, 2. download or develop the the application source code in the proper directory, 3. driver compilation, 4.driver loading and device file set up, 5.application execution, 6. device file deletion and driver unloading.	**24** (24.00%) The student can successfully and correctly complete at least two steps to develop and demo the task. These steps include: 1. download or develop the driver source code in the proper directory, 2. download or develop the the application source code in the proper directory, 3. driver compilation, 4.driver loading and device file set up, 5.application execution, 6. device file deletion and driver unloading.	**36** (36.00%) The student can successfully and correctly complete at least four steps to develop and demo the task. These steps include: 1. download or develop the driver source code in the proper directory, 2. download or develop the the application source code in the proper directory, 3. driver compilation, 4.driver loading and device fi le set up, 5.application execution, 6. device file deletion and driver unloading.	**48** (48.00%) The student can successfully and correctly complete all the steps to develop and demo the task. These steps include: 1. download or develop the driver source code in the proper directory, 2. download or develop the the application source code in the proper directory, 3. driver compilation, 4.driver loading and device fi le set up, 5.application execution, 6. device file deletion and driver unloading.	**60** (60.00%) The student can successfully and correctly complete all the steps to develop and demo the task. These steps include: 1. download or develop the driver source code in the proper directory, 2. download or develop the the application source code in the proper directory, 3. driver compilation, 4.driver loading and device fi le set up, 5.application execution, 6. device file deletion and driver unloading. Besides, the student can successfully and correctly complete small changes to satisfy ad hoc change requests proposed in theQ&A.
Quality of the Presentation and Q&A. This rubric is related to intended learning outcome (a), (b), (c), (d), (e), and (f).	**0** (0.00%) No show	**8** (8.00%) The student can present and explain part of the steps to develop and demo the task, but less than two of the steps are presented and explained completely. The complete set of steps to develop and demo the task include: 1. download or develop the driver source code in the proper directory, 2. download or develop the the application source code in the proper directory, 3. driver compilation, 4.driver loading and device file set up, 5.application execution, 6. device file deletion and driver unloading.	**16** (16.00%) The student can present and explain at least two steps (to develop and demo the task) completely. These steps include: 1. download or develop the driver source code in the proper directory, 2. download or develop the the application source code in the proper directory, 3. driver compilation, 4.driver loading and device file set up, 5.application execution, 6. device file deletion and driver unloading.	**24** (24.00%) The student can present and explain at least four steps (to develop and demo the task) completely. These steps include: 1. download or develop the driver source code in the proper directory, 2. download or develop the the application source code in the proper directory, 3. driver compilation, 4.driver loading and device file set up, 5.application execution, 6. device file deletion and driver unloading.	**32** (32.00%) The student can present and explain all steps (to develop and demo the task) completely. These steps include: 1. download or develop the driver source code in the proper directory, 2. download or develop the the application source code in the proper directory, 3. driver compilation, 4.driver loading and device file set up, 5.application execution, 6. device file deletion and driver unloading.	**40** (40.00%) The student can present and explain all steps (to develop and demo the task) completely. These steps include: 1. download or develop the driver source code in the proper directory, 2. download or develop the the application source code in the proper directory, 3. driver compilation, 4.driver loading and device file set up, 5.application execution, 6. device file deletion and driver unloading. Besides, the student can present and explain his/her small changes to satisfy ad hoc change requests proposed in theQ&A.