

Hands-on Lab: BeagleBone Black Board

COSC2440: Computer Organization and
Architecture

Due Date: Oct. 04, 2017

Show your TA the blinking light to
receive credit!

You must attend your assigned lab to receive credit!

Dr. Kevin Long

A) *Original Instructions:*

https://github.com/gnawali/purple/blob/master/assignment_hw5.md

B) Installation:

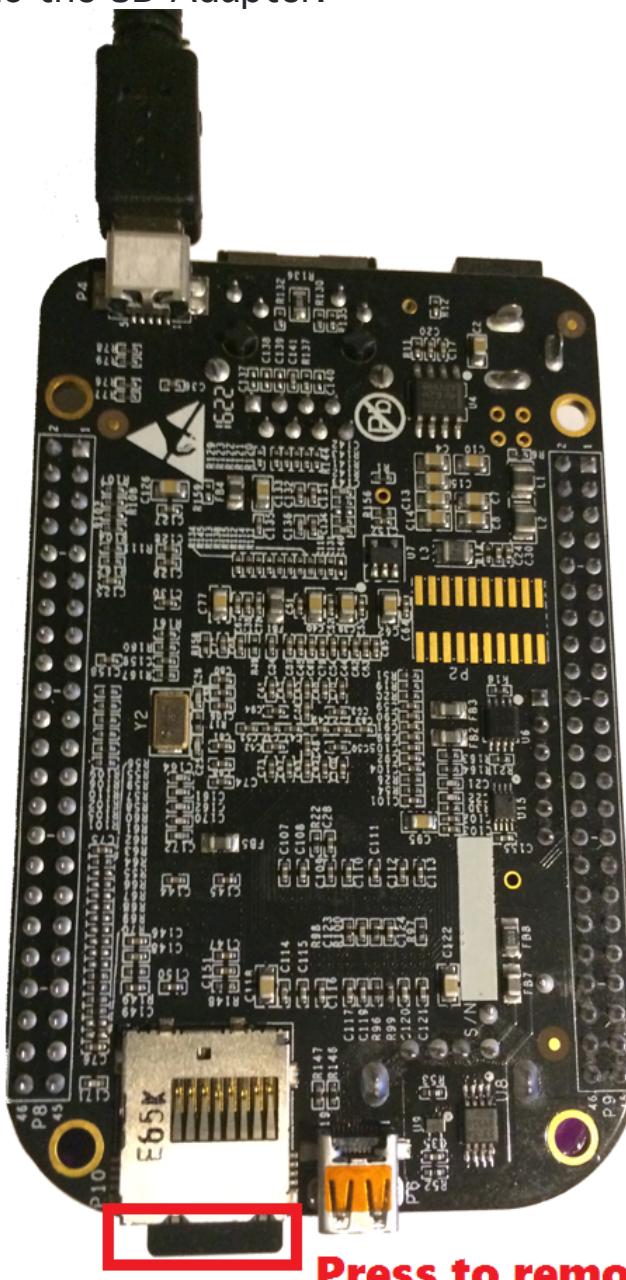
- (1) Everything is installed in the lab's PCs in PGH376.
- (2) If you like to use your laptop instead of lab's machines, then you need to download & install the necessary tools.
 - (a) If you are at the lab, you may copy the folder "BeagleBone" from the C drive and install everything inside "Windows 10 Installation" folder.
 - (b) If you don't have access to the lab machine, then download the following files:
 1. OS Image [about 700MB], then extract the file using 7-zip:
<https://debian.beagleboard.org/images/bone-debian-8.6-lxqt-4gb-armhf-2016-11-06-4gb.img.xz>
 2. 7-zip:
<http://www.7-zip.org/download.html>
 3. Win32 Disk Imager:
<https://sourceforge.net/projects/win32diskimager/>
 4. BeagleBone Black Board Drivers:
http://www.1-2-3-4-5-6.net/beaglebone/black/BONE_D64_signed.zip
 5. Putty:
<http://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html>

?]If you prefer to use your laptop, please download/install everything before coming to the lab. Also, these instructions are for Windows, but you may use your Mac if wish to do so. Refer to A) Original Instructions to figure out instructions for Mac.

C) Lab Instructions

Step 0: Remove the USB cable that connects the board with the PC from the PC if it is connected.

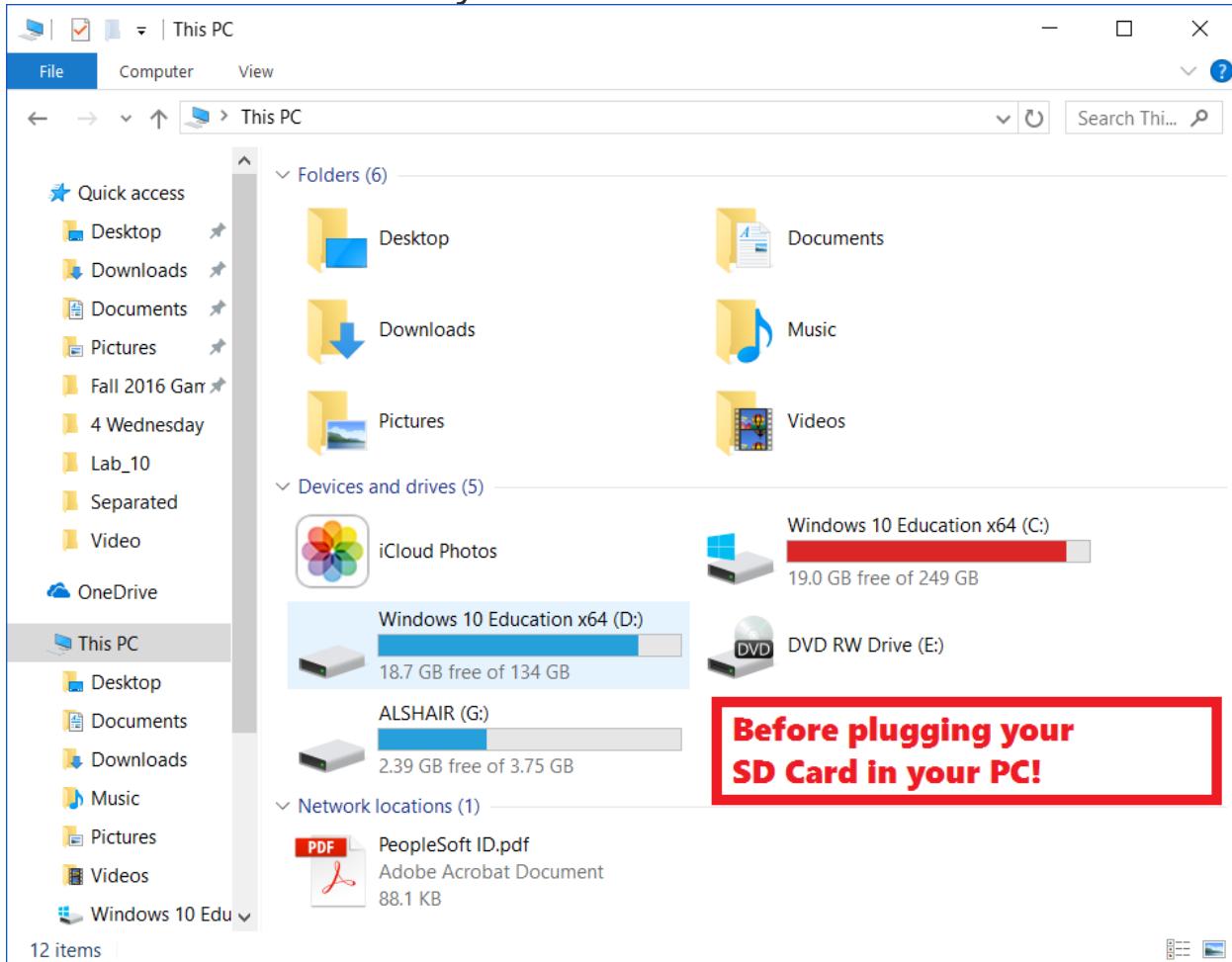
Step 1: Remove the micro SD card from the bottom of the board, then insert it into the SD Adapter.



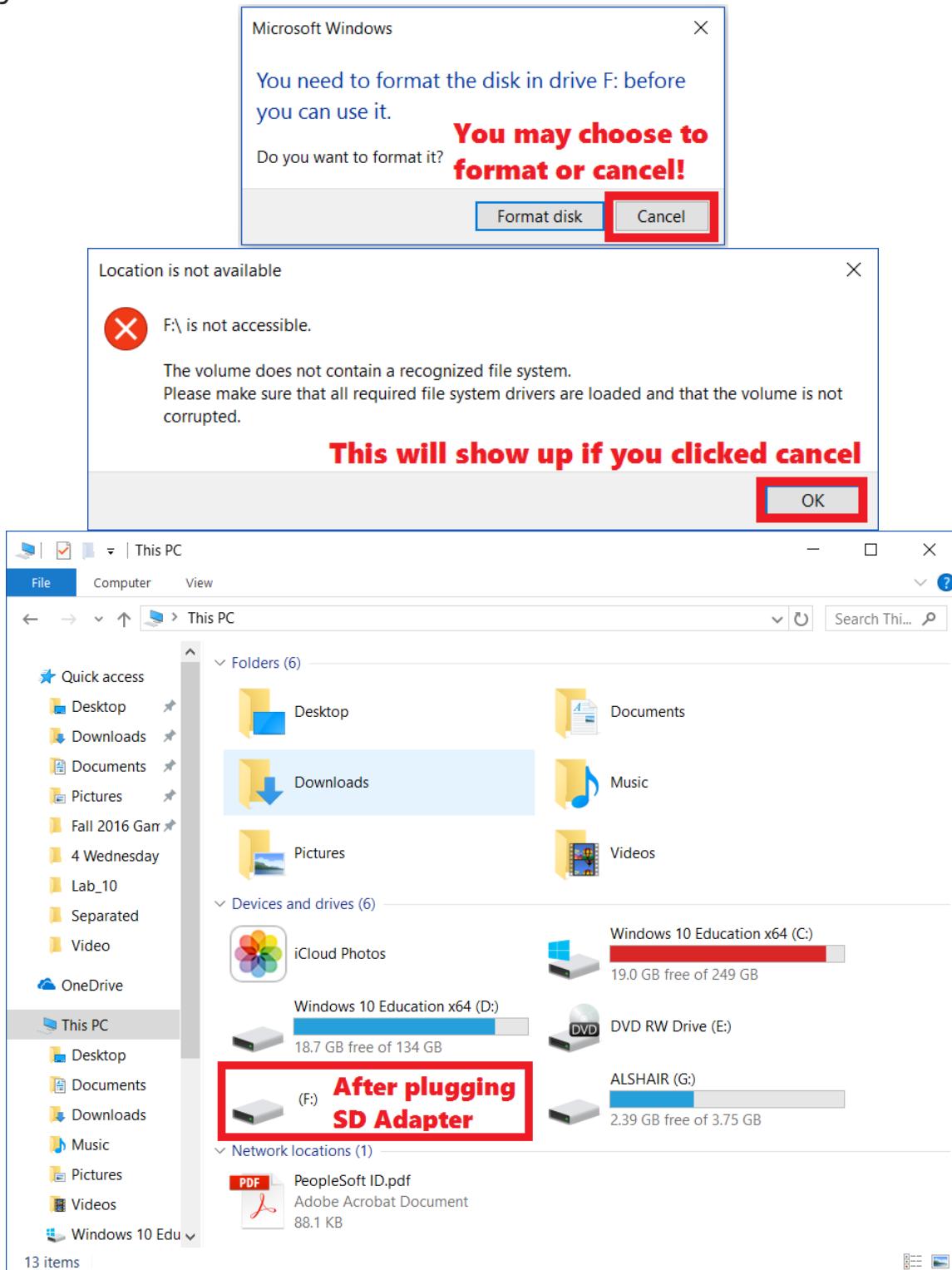


Insert Micro SD into Adapter

Screenshot below shows you This PC without the SD drive.



Step 2: Insert the SD card in your PC. Screenshot below will show you new drive that you cannot open and it may ask you to format it. In my case the SD drive is F, in your case it maybe more likely D or any other letter.



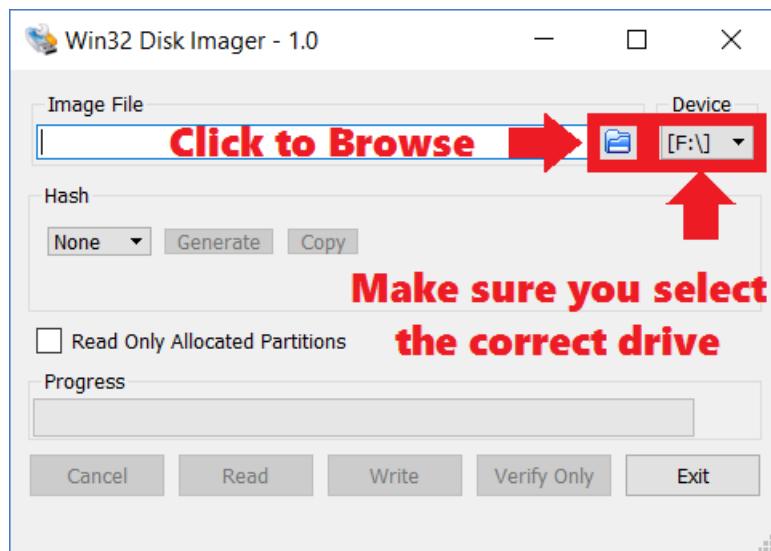
Step 3: Open “Win32DiskImager” application, if you are using the lab PC, it should be in the desktop.

If you are not using the lab's PC. Then download and install it from: <https://sourceforge.net/projects/win32diskimager/>



Step 4: Make sure you select the correct drive, in my case, it is F. Then click the open file icon.

?If you remove the SD card from the PC while the “Win32DiskImager” app is open, you must close and reopen the “Win32DiskImager” app to be able to recognize the SD card after you insert it in the PC.



Step 5: Select the correct image, “bone-debian-8.6-lxqt-4gb-armhf-2016-11-06-4gb.img”

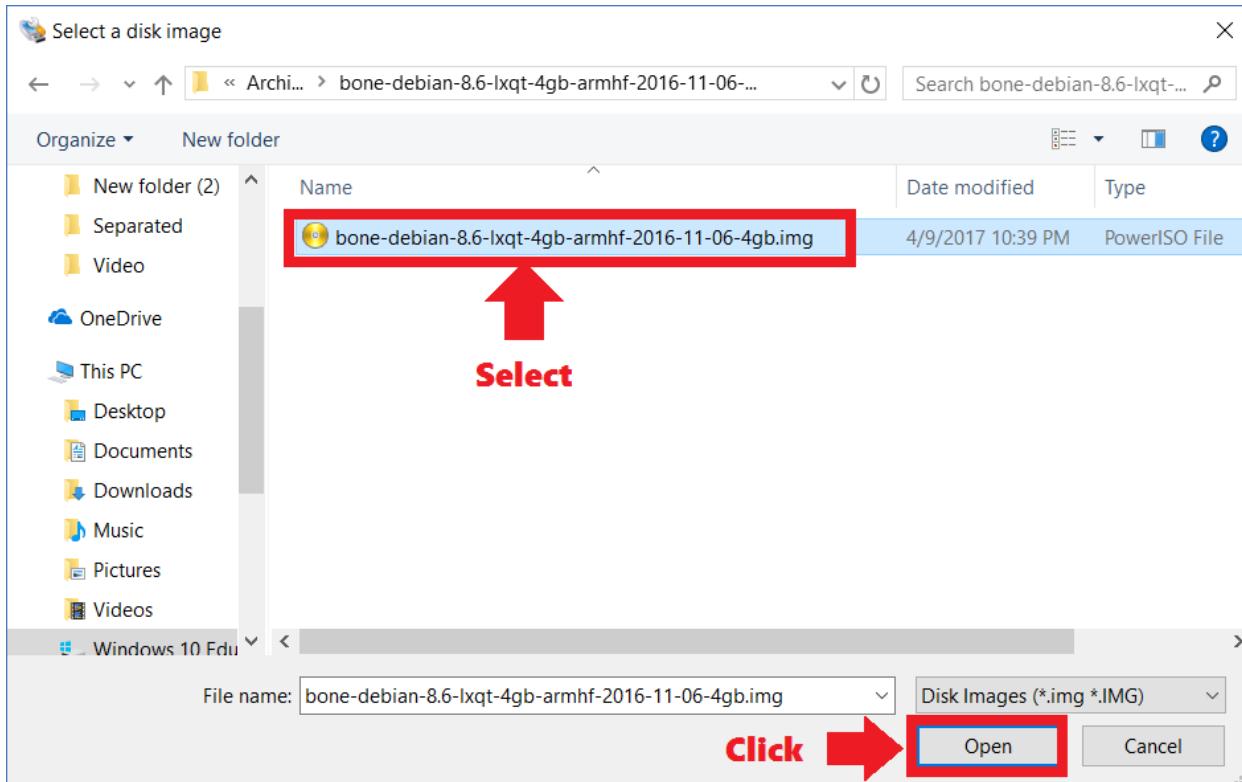
If you are using the lab's PC, the file should be saved in the C drive: “C:\BeagleBone\Architecture Image\bone-debian-8.6-lxqt-4gb-armhf-2016-11-06-4gb.img\bone-debian-8.6-lxqt-4gb-armhf-2016-11-06-4gb.img”

If you are not using the lab's PC. Then you will need to download the image from: <https://debian.beagleboard.org/images/bone-debian-8.6-lxqt-4gb-armhf-2016-11-06-4gb.img.xz>

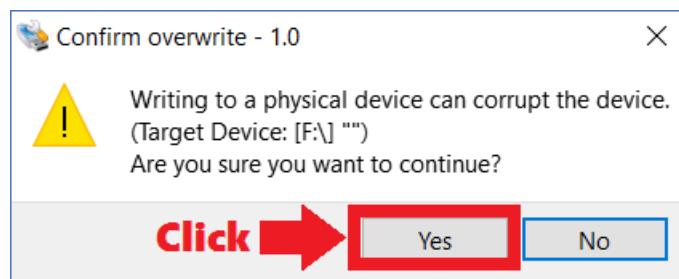
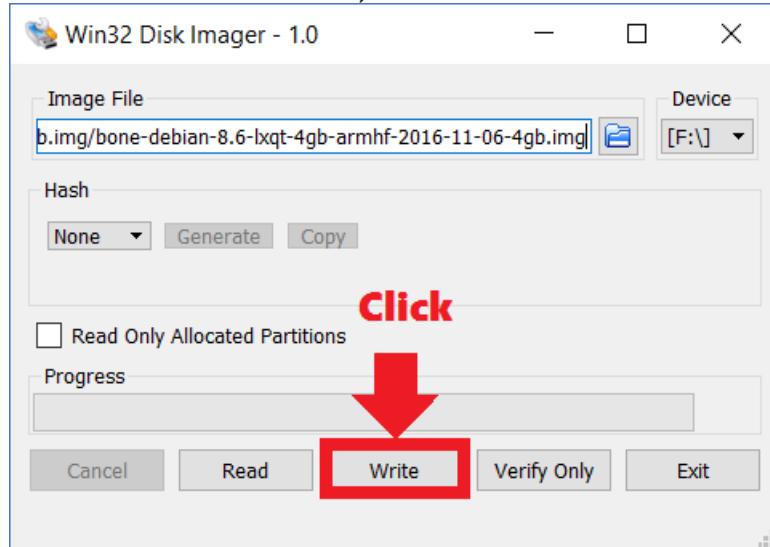
You need to extract the image from the downloaded file by right clicking on the file after download is complete and selecting “7-zip” then “Extract to “bone-debian-8.6-lxqt-4gb-armhf-2016-11-06-4gb.img/””

If you don't have 7-zip, download and install it from:

<http://www.7-zip.org/download.html>



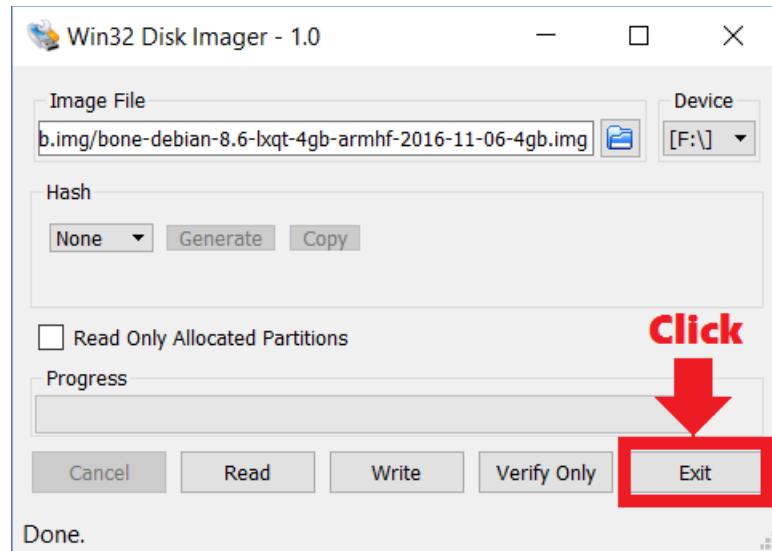
Step 6: Click on “Write” button, then click “Yes”.



Step 7: Wait for approximately 10 minutes or less while the app is burning the image into the SD card. At the end, you will receive a message that the write was successful. Click OK.



Step 8: Click on “Exit” button to exit the “Win32DiskImager” app.



Step 9: Remove the SD adapter from the PC, then remove the micro SD card from the SD adapter.



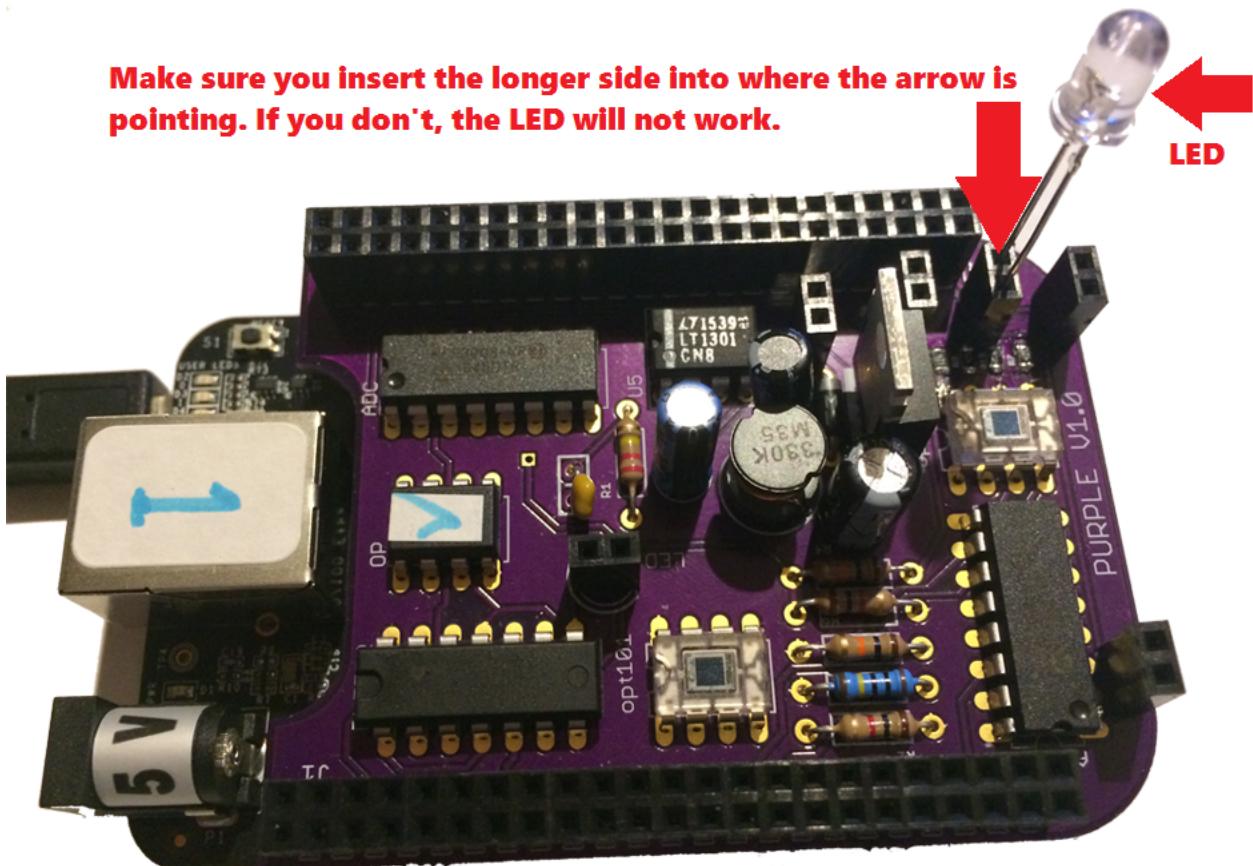
Step 10: Insert the micro SD card in your BeagleBone Board.



Insert Micro SD Card into your board

Step 11: Insert LED into your board as shown in the screenshot below:

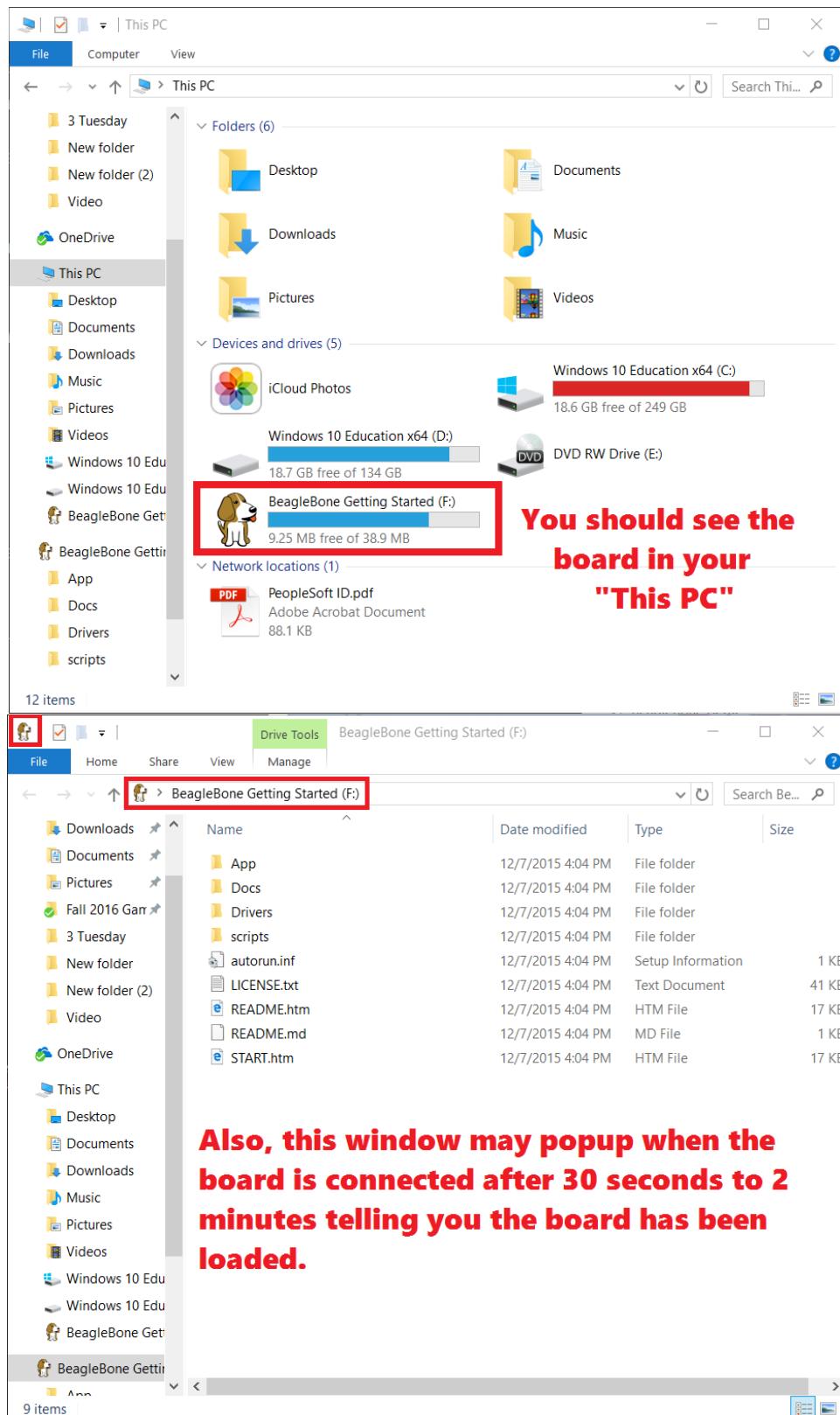
Make sure you insert the longer side into where the arrow is pointing. If you don't, the LED will not work.



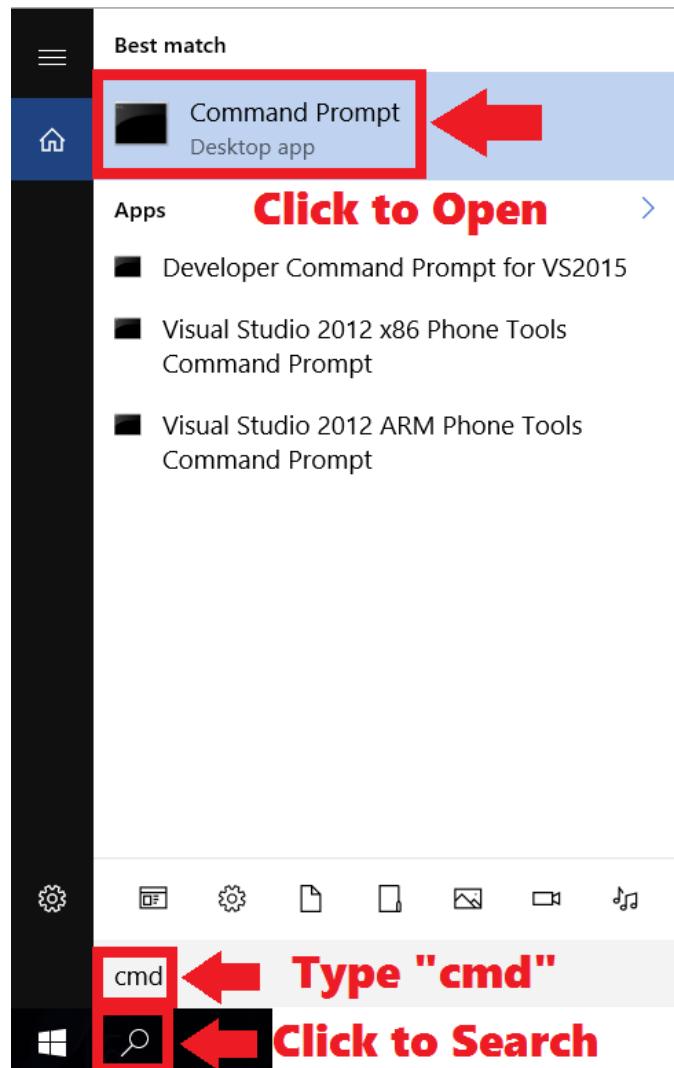
Step 12: Connect the USB cable to your board and PC.

If you are not using lab's PC, download and install the board drivers from: <http://beagleboard.org/getting-started#step2>

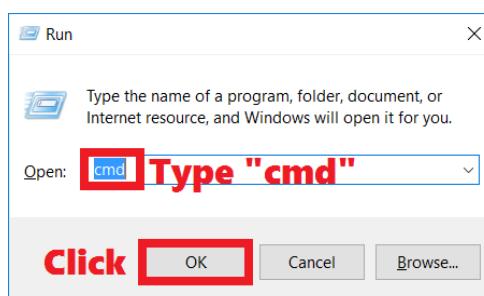
Step 13: Wait until your PC is reading the board. This could take 30 seconds to 2 minutes.



Step 14: You need to make sure that you are ready to SSH to the board. To do this, open the Command Prompt by going to search and type “cmd”.



OR click on “Windows Key + R”, then type “cmd”, then pressing OK.



Copy the following highlighted lines including the empty line:

```
cls  
ipconfig
```

Paste to the command prompt by right clicking at the location of the cursor.

We need to look for IP address: 192.168.7.1 to determine if the device is ready to SSH to it or not.

This screenshot does **NOT** show the IP address 192.168.7.1

```
C:\Users\Mohammed Alshair>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . : cs.uh.edu

Wireless LAN adapter Local Area Connection* 2:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . :

Wireless LAN adapter Wi-Fi:
  Connection-specific DNS Suffix . : attlocal.net
  IPv6 Address. . . . . : 2602:306:323b:4570:ccec:6a72:aef:6571
  Temporary IPv6 Address. . . . . : 2602:306:323b:4570:18a7:fe85:1d8e:afe5
  Temporary IPv6 Address. . . . . : 2602:306:323b:4570:38be:8204:a354:8b49
  Link-local IPv6 Address . . . . . : fe80::ccec:6a72:aef:6571%14
  IPv4 Address. . . . . : 192.168.1.68
  Subnet Mask. . . . . : 255.255.255.0
  Default Gateway . . . . . : fe80::de7f:aaff:fe58:87a5%14
                                         192.168.1.254

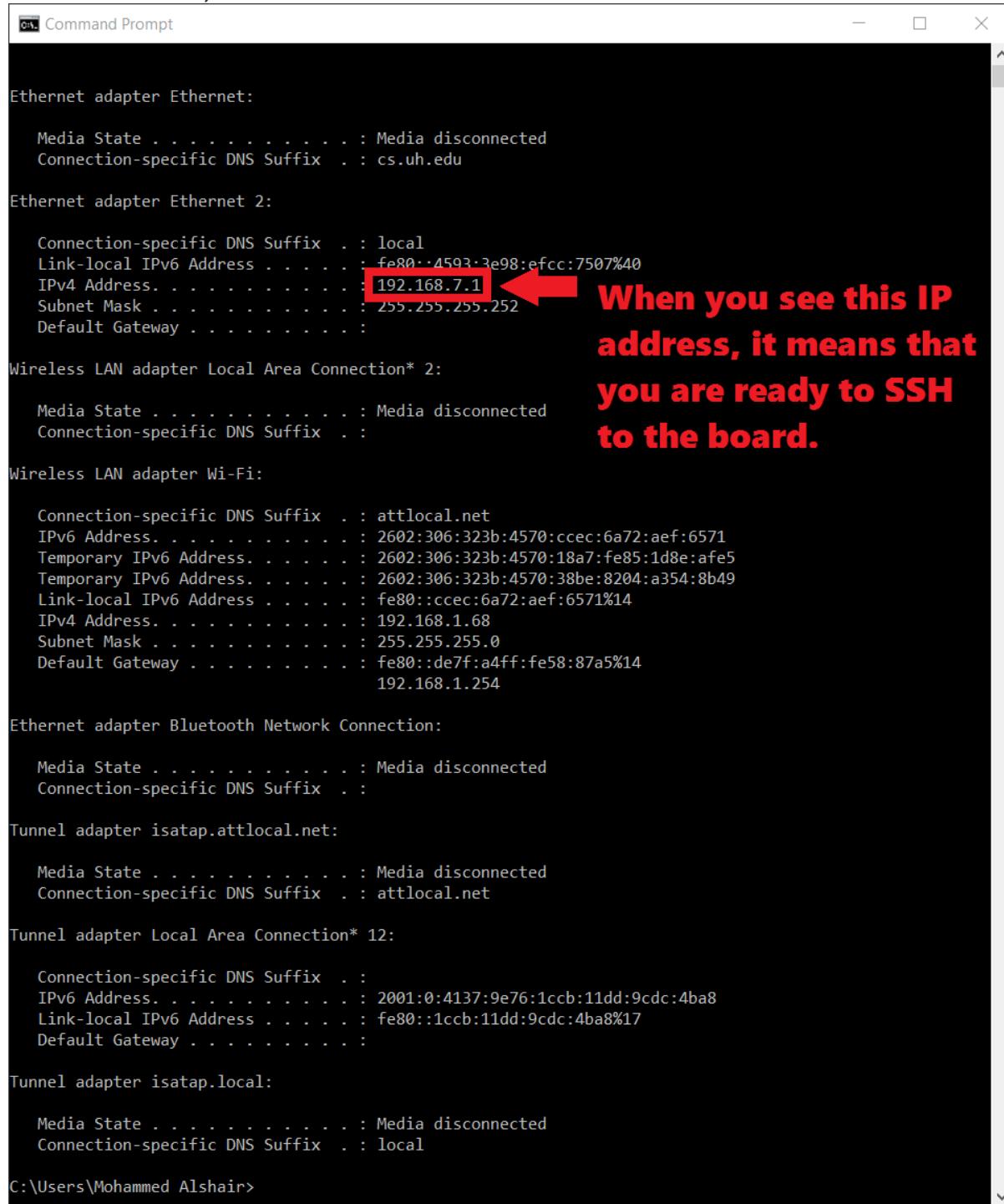
Ethernet adapter Bluetooth Network Connection:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . :

Tunnel adapter isatap.attlocal.net:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . : attlocal.net

Tunnel adapter Local Area Connection* 12:
  Connection-specific DNS Suffix . :
  IPv6 Address. . . . . : 2001:0:4137:9e76:1ccb:11dd:9cdc:4ba8
  Link-local IPv6 Address . . . . . : fe80::1ccb:11dd:9cdc:4ba8%17
  Default Gateway . . . . . :
```

```
cls  
ipconfig
```

You need to keep re-entering the above commands until you see the IP address, 192.168.7.1 as shown in the screenshot below:



```
cmd: Command Prompt

Ethernet adapter Ethernet:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . : cs.uh.edu

Ethernet adapter Ethernet 2:
  Connection-specific DNS Suffix . : local
  Link-local IPv6 Address . . . . . : fe80::4593:3e98:efcc:7507%40
  IPv4 Address. . . . . : 192.168.7.1 <-- Red arrow points here
  Subnet Mask . . . . . : 255.255.255.252
  Default Gateway . . . . . :

Wireless LAN adapter Local Area Connection* 2:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . :

Wireless LAN adapter Wi-Fi:
  Connection-specific DNS Suffix . : attlocal.net
  IPv6 Address . . . . . : 2602:306:323b:4570:ccec:6a72:aef:6571
  Temporary IPv6 Address . . . . . : 2602:306:323b:4570:18a7:fe85:1d8e:afe5
  Temporary IPv6 Address . . . . . : 2602:306:323b:4570:38be:8204:a354:8b49
  Link-local IPv6 Address . . . . . : fe80::ccec:6a72:aef:6571%14
  IPv4 Address . . . . . : 192.168.1.68
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : fe80::de7f:a4ff:fe58:87a5%14
                                192.168.1.254

Ethernet adapter Bluetooth Network Connection:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . :

Tunnel adapter isatap.attlocal.net:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . : attlocal.net

Tunnel adapter Local Area Connection* 12:
  Connection-specific DNS Suffix . :
  IPv6 Address . . . . . : 2001:0:4137:9e76:1ccb:11dd:9cdc:4ba8
  Link-local IPv6 Address . . . . . : fe80::1ccb:11dd:9cdc:4ba8%17
  Default Gateway . . . . . :

Tunnel adapter isatap.local:
  Media State . . . . . : Media disconnected
  Connection-specific DNS Suffix . : local

C:\Users\Mohammed Alshair>
```

When you see this IP address, it means that you are ready to SSH to the board.

Step 15: Open “Putty” application, if you are using the lab PC, it should be in the desktop.

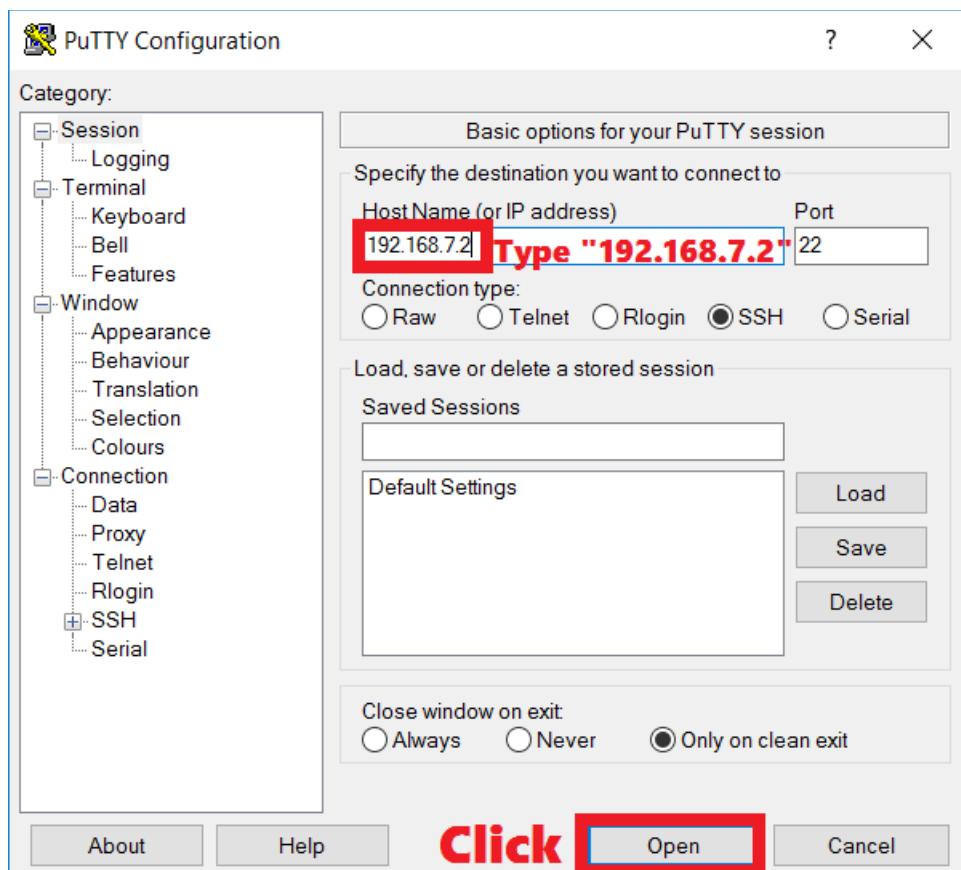
If you are not using the lab's PC. Then download and install it from:

<http://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html>

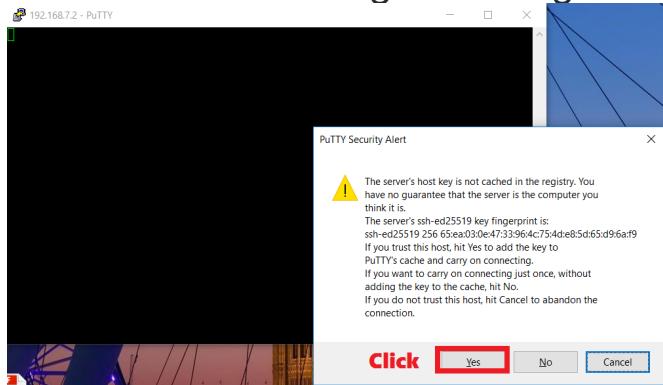


Step 15: Enter the following IP address under “Host Name (or IP address), then click Open:

192.168.7.2



Step 16: Click “Yes”. This usually shows up once when you connect for the 1st time after burning new image to the SD card.



Step 17: Enter the following username, then press enter:

debian

```
192.168.7.2 - PuTTY

login as: debian
Debian GNU/Linux 8

BeagleBoard.org Debian Image 2016-11-06

Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian

default username:password is [debian:temppwd]

debian@192.168.7.2's password: █
```

A screenshot of a PuTTY session window titled "192.168.7.2 - PuTTY". The terminal window displays the following text:
login as: debian
Debian GNU/Linux 8

BeagleBoard.org Debian Image 2016-11-06

Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian

default username:password is [debian:temppwd]

debian@192.168.7.2's password: █

Step 18: Enter the password shown in the screen, then press enter (it should be):

temppwd

*** You will **NOT** see the characters that you type, it is normal.

```
debian@beaglebone: ~

login as: debian
Debian GNU/Linux 8

BeagleBoard.org Debian Image 2016-11-06

Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian

default username:password is [debian:temppwd]

debian@192.168.7.2's password: █
debian@beaglebone:~$ █
```

A screenshot of a PuTTY session window titled "debian@beaglebone: ~". The terminal window displays the following text:
login as: debian
Debian GNU/Linux 8

BeagleBoard.org Debian Image 2016-11-06

Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian

default username:password is [debian:temppwd]

debian@192.168.7.2's password: █

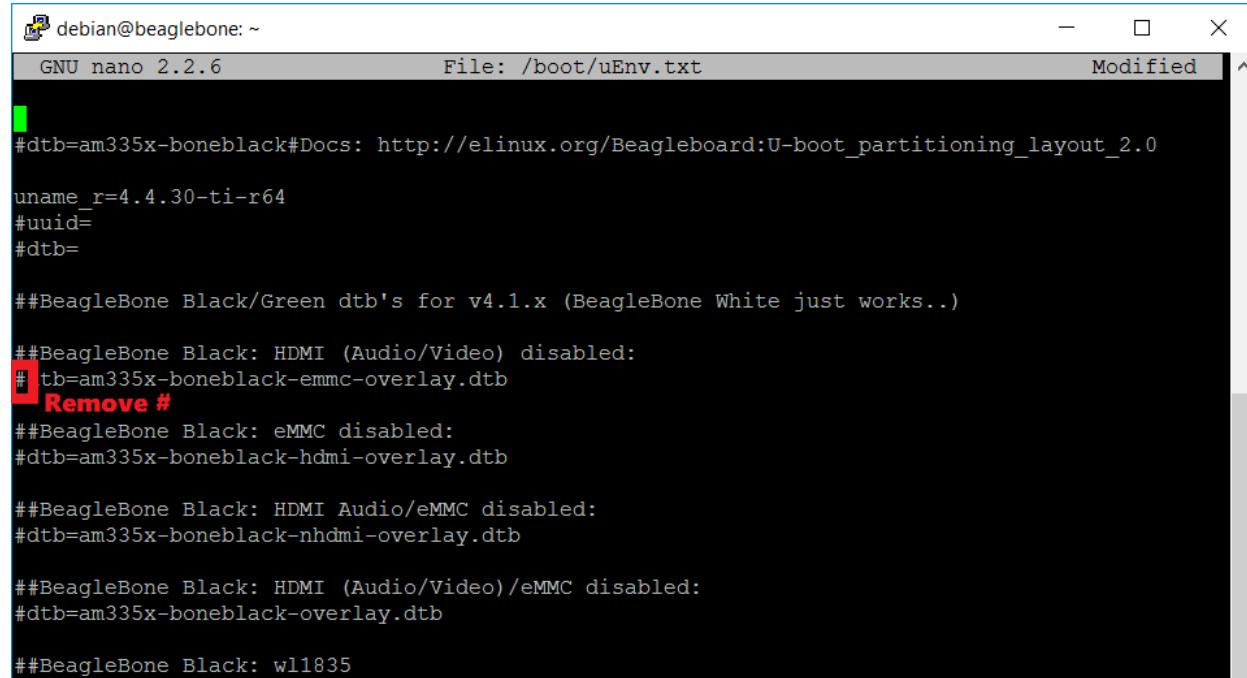
debian@beaglebone:~\$ █

Step 19: Copy the following highlighted lines including the empty line:

```
sudo -s  
cat /D.txt  
uname -a  
nano /boot/uEnv.txt
```

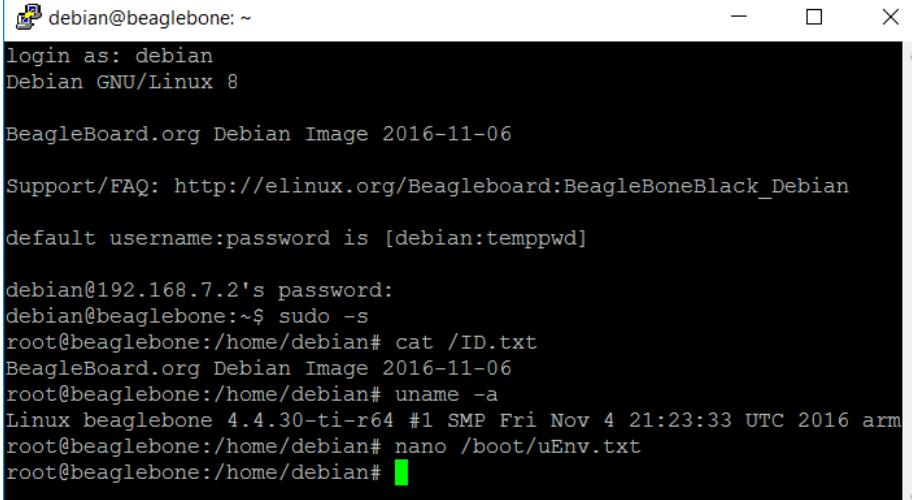
Then Paste to the putty command prompt by right clicking at the location of the cursor.

Step 20: Change Line 10 from
#dtb=am335x-boneblack-emmc-overlay.dtb
TO
dtb=am335x-boneblack-emmc-overlay.dtb
By removing **#** at the beginning of the line.



```
debian@beaglebone: ~  
GNU nano 2.2.6 File: /boot/uEnv.txt Modified  
  
#dtb=am335x-boneblack#Docs: http://elinux.org/Beagleboard:U-boot_partitioning_layout_2.0  
uname_r=4.4.30-ti-r64  
#uuid=  
#dtb=  
  
##BeagleBone Black/Green dtb's for v4.1.x (BeagleBone White just works..)  
  
##BeagleBone Black: HDMI (Audio/Video) disabled:  
# dtb=am335x-boneblack-emmc-overlay.dtb  
# Remove #  
##BeagleBone Black: eMMC disabled:  
#dtb=am335x-boneblack-hdmi-overlay.dtb  
  
##BeagleBone Black: HDMI Audio/eMMC disabled:  
#dtb=am335x-boneblack-nhdmi-overlay.dtb  
  
##BeagleBone Black: HDMI (Audio/Video) /eMMC disabled:  
#dtb=am335x-boneblack-overlay.dtb  
  
##BeagleBone Black: wl1835
```

Step 21: Press “Ctrl+X”, then press “Y” for yes, then press “Enter” to exit the file.



```
debian@beaglebone: ~
login as: debian
Debian GNU/Linux 8

BeagleBoard.org Debian Image 2016-11-06

Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian

default username:password is [debian:temppwd]

debian@192.168.7.2's password:
debian@beaglebone:~$ sudo -s
root@beaglebone:/home/debian# cat /ID.txt
BeagleBoard.org Debian Image 2016-11-06
root@beaglebone:/home/debian# uname -a
Linux beaglebone 4.4.30-ti-r64 #1 SMP Fri Nov 4 21:23:33 UTC 2016 arm
root@beaglebone:/home/debian# nano /boot/uEnv.txt
root@beaglebone:/home/debian#
```

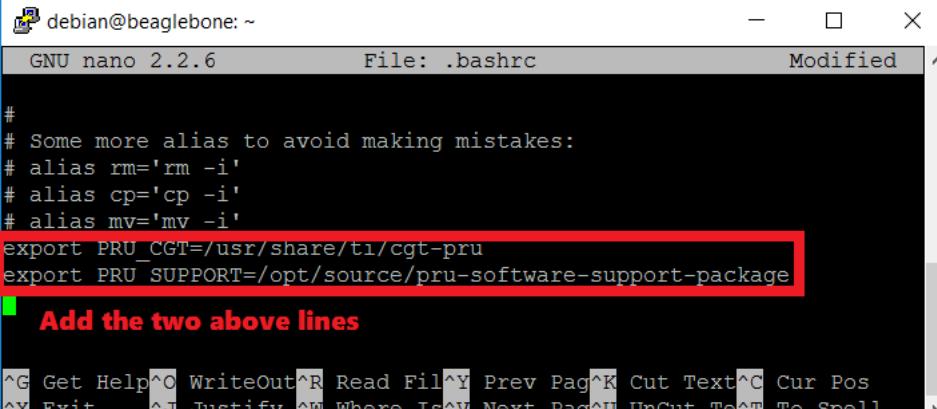
Step 22: Copy the following highlighted lines including the empty line:

```
which clpru
cd
nano .bashrc
```

Then Paste to the putty command prompt by right clicking at the location of the cursor.

Step 23: Copy and paste the following two lines to the bottom of the file:

```
export PRU_CGT=/usr/share/ti/cgt-pru
export PRU_SUPPORT=/opt/source/pru-software-support-package
```



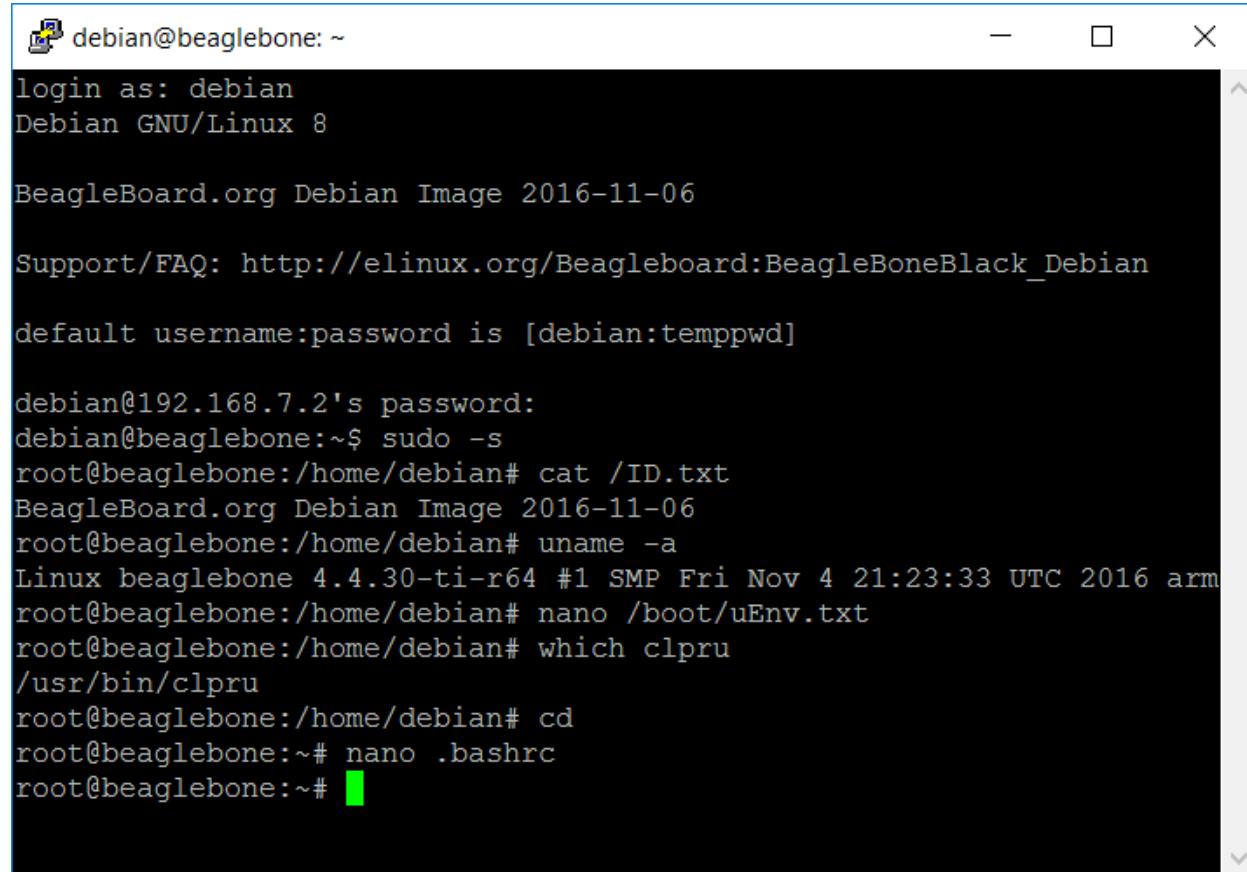
GNU nano 2.2.6 File: .bashrc Modified

```
# Some more alias to avoid making mistakes:
# alias rm='rm -i'
# alias cp='cp -i'
# alias mv='mv -i'
export PRU_CGT=/usr/share/ti/cgt-pru
export PRU_SUPPORT=/opt/source/pru-software-support-package
```

Add the two above lines

^G Get Help ^O WriteOut ^R Read File ^Y Prev Pag ^K Cut Text ^C Cur Pos
^X Exit ^J Justify ^W Where Is ^V Next Pag ^U UnCut Te ^T To Spell

Step 24: Press “Ctrl+X”, then press “Y” for yes, then press “Enter” to exit the file.



```
debian@beaglebone: ~
login as: debian
Debian GNU/Linux 8

BeagleBoard.org Debian Image 2016-11-06

Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian

default username:password is [debian:temppwd]

debian@192.168.7.2's password:
debian@beaglebone:~$ sudo -s
root@beaglebone:/home/debian# cat /ID.txt
BeagleBoard.org Debian Image 2016-11-06
root@beaglebone:/home/debian# uname -a
Linux beaglebone 4.4.30-ti-r64 #1 SMP Fri Nov 4 21:23:33 UTC 2016 armv7l
root@beaglebone:/home/debian# nano /boot/uEnv.txt
root@beaglebone:/home/debian# which clpru
/usr/bin/clpru
root@beaglebone:/home/debian# cd
root@beaglebone:~# nano .bashrc
root@beaglebone:~#
```

Step 25: Copy the following highlighted lines including the empty line:

```
sudo -s
$PRU_CGT
cd $PRU_CGT
mkdir -p bin
cd bin
ln -s `which clpru` .
ln -s `which lnkpru` .
cd /opt/source/dtb-4.4-ti
nano src/arm/am335x-boneblack-emmc-overlay.dts
```

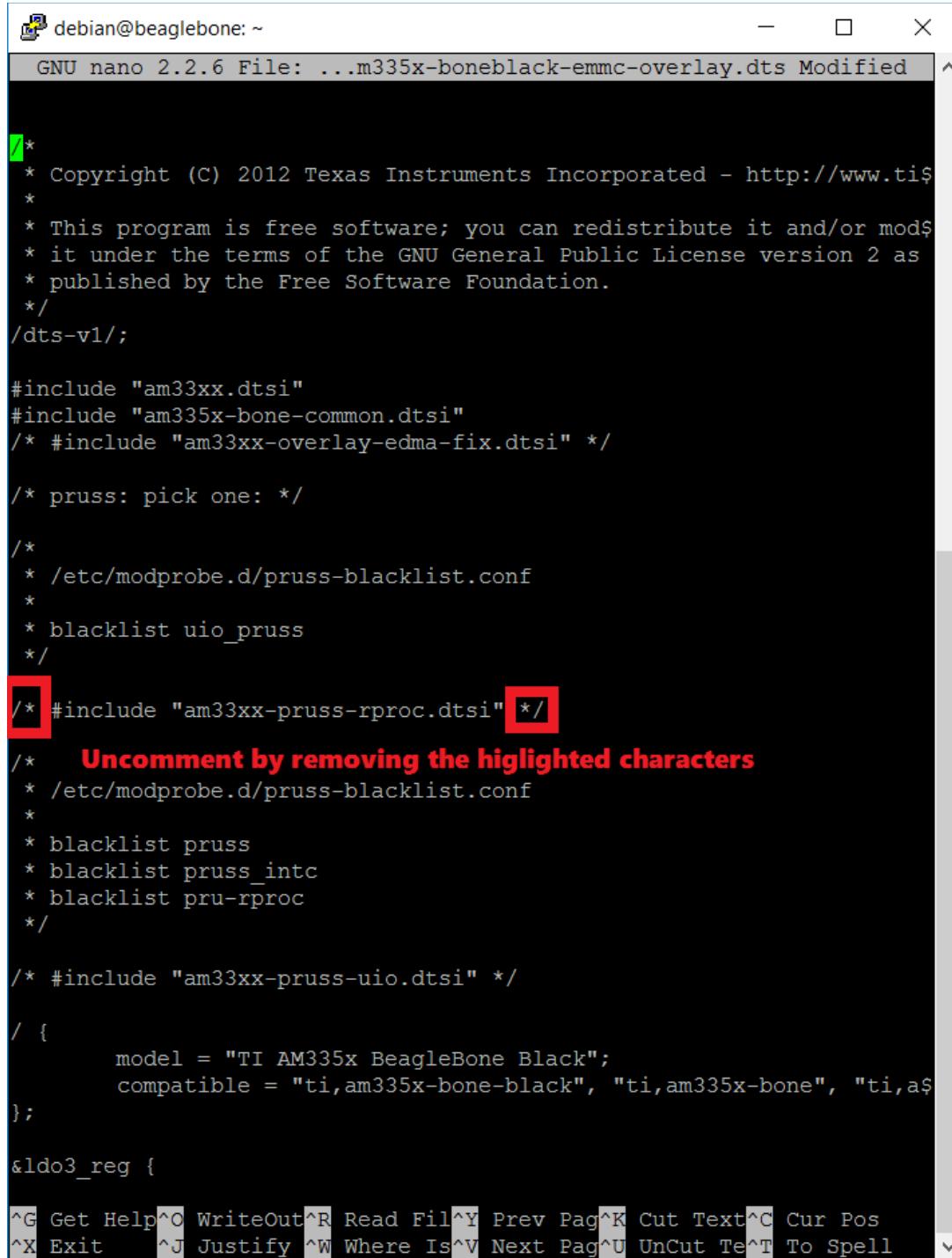
Then Paste to the putty command prompt by right clicking at the location of the cursor.

Step 26: Uncomment Line 22 by changing Line 22 from
/* #include "am33xx-pruss-rproc.dtsi" */

TO

#include "am33xx-pruss-rproc.dtsi"

By removing /* at the beginning of the line and */ at the end of the line.



```
debian@beaglebone: ~
GNU nano 2.2.6 File: ...m335x-boneblack-emmc-overlay.dts Modified ^

/*
 * Copyright (C) 2012 Texas Instruments Incorporated - http://www.ti.com/
 *
 * This program is free software; you can redistribute it and/or modify
 * it under the terms of the GNU General Public License version 2 as
 * published by the Free Software Foundation.
 */
/dts-v1/;

#include "am33xx.dtsi"
#include "am335x-bone-common.dtsi"
/* #include "am33xx-overlay-edma-fix.dtsi" */

/* pruss: pick one: */

/*
 * /etc/modprobe.d/pruss-blacklist.conf
 *
 * blacklist uio_pruss
 */
/* #include "am33xx-pruss-rproc.dtsi" */

Uncomment by removing the highlighted characters
/* /etc/modprobe.d/pruss-blacklist.conf
 *
 * blacklist pruss
 * blacklist pruss_intc
 * blacklist pru-rproc
 */

/* #include "am33xx-pruss-uio.dtsi" */

{
    model = "TI AM335x BeagleBone Black";
    compatible = "ti,am335x-bone-black", "ti,am335x-bone", "ti,am335x";
};

&ldo3_reg {

^G Get Help ^O WriteOut ^R Read Fil ^Y Prev Pag ^K Cut Text ^C Cur Pos
^X Exit      ^J Justify ^W Where Is ^V Next Pag ^U UnCut Te ^T To Spell
```

Step 27: Press “Ctrl+X”, then press “Y” for yes, then press “Enter” to exit the file.

```
debian@beaglebone: ~
login as: debian
Debian GNU/Linux 8

BeagleBoard.org Debian Image 2016-11-06

Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian

default username:password is [debian:tempPWD]

debian@192.168.7.2's password:
debian@beaglebone:~$ sudo -s
root@beaglebone:/home/debian# cat /ID.txt
BeagleBoard.org Debian Image 2016-11-06
root@beaglebone:/home/debian# uname -a
Linux beaglebone 4.4.30-ti-r64 #1 SMP Fri Nov 4 21:23:33 UTC 2016 armv7l GNU/Linux
root@beaglebone:/home/debian# nano /boot/uEnv.txt
root@beaglebone:/home/debian# which clpru
/usr/bin/clpru
root@beaglebone:/home/debian# cd
root@beaglebone:~# nano .bashrc
root@beaglebone:~# sudo -s
root@beaglebone:~# $PRU_CGT
bash: /usr/share/ti/cgt-pru: Is a directory
root@beaglebone:~# cd $PRU_CGT
root@beaglebone:/usr/share/ti/cgt-pru# mkdir -p bin
root@beaglebone:/usr/share/ti/cgt-pru# cd bin
root@beaglebone:/usr/share/ti/cgt-pru/bin# ln -s `which clpru` .
root@beaglebone:/usr/share/ti/cgt-pru/bin# ln -s `which lnkpru` .
root@beaglebone:/usr/share/ti/cgt-pru/bin# cd /opt/source/dtb-4.4-ti
root@beaglebone:/opt/source/dtb-4.4-ti# nano src/arm/am335x-boneblack-
-emmc-overlay.dts
root@beaglebone:/opt/source/dtb-4.4-ti#
```

Step 28: Copy the following highlighted lines including the empty line:

```
make
make install
echo "blacklist uio_pru" > /etc/modprobe.d/pruss-blacklist.conf
reboot
```

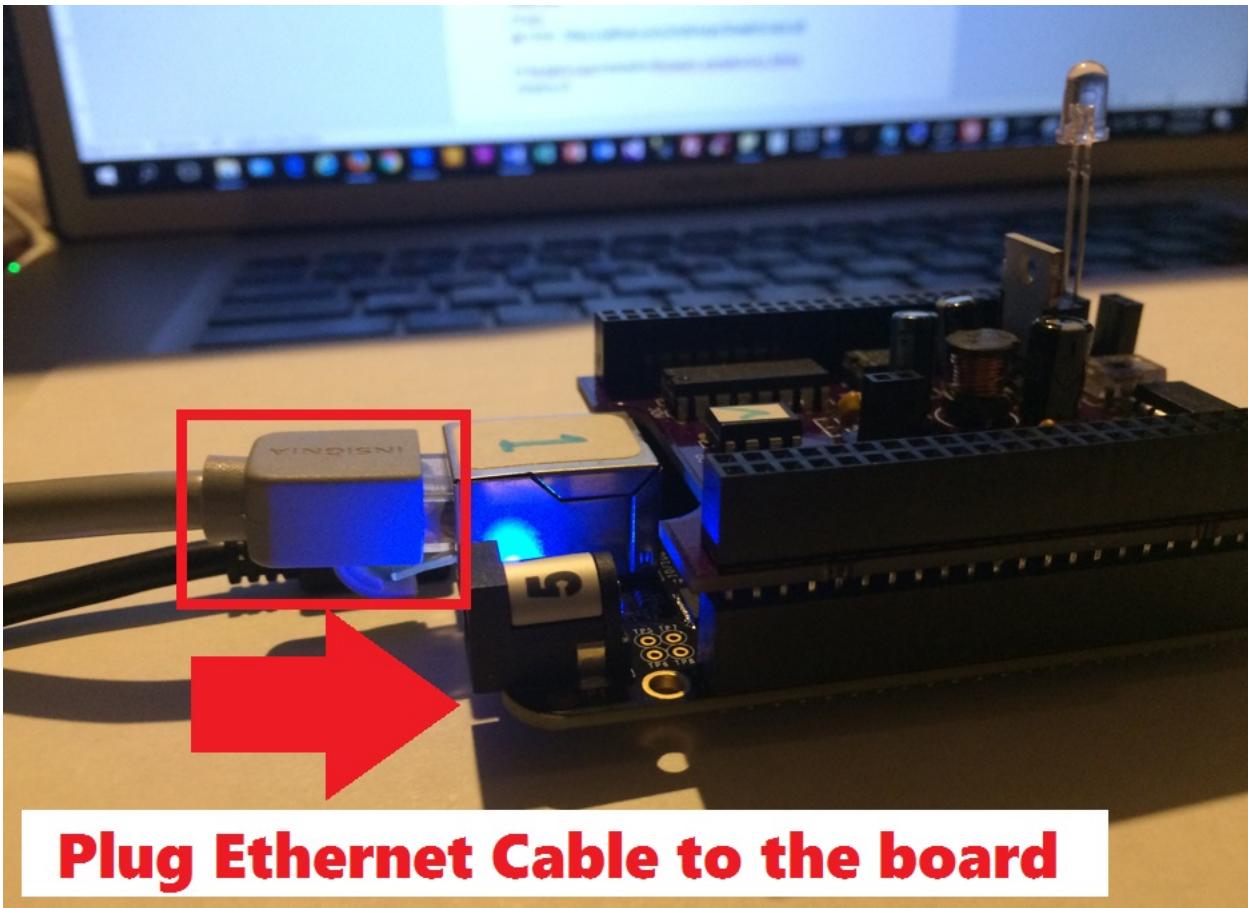
Then Paste to the putty command prompt by right clicking at the location of the cursor.

```
debian@beaglebone: ~
'src/arm/omap3-overo-palo35.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-overo-palo35.dt
b'
'src/arm/omap3-overo-palo43.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-overo-palo43.dt
b'
'src/arm/omap3-overo-storm-alto35.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-overo-sto
rm-alto35.dtb'
'src/arm/omap3-overo-storm-chestnut43.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-overo-
storm-chestnut43.dtb'
'src/arm/omap3-overo-storm-gallop43.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-overo-s
torm-gallop43.dtb'
'src/arm/omap3-overo-storm-palo35.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-overo-sto
rm-palo35.dtb'
'src/arm/omap3-overo-storm-palo43.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-overo-sto
rm-palo43.dtb'
'src/arm/omap3-overo-storm-summit.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-overo-sto
rm-summit.dtb'
'src/arm/omap3-overo-storm-tobi.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-overo-sto
rm-tobi.dtb'
'src/arm/omap3-overo-storm-tobiduo.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-overo-sto
rm-tobiduo.dtb'
'src/arm/omap3-overo-summit.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-overo-sto
rm-summit.dtb'
'src/arm/omap3-overo-tobi.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-overo-sto
rm-tobi.dtb'
'src/arm/omap3-overo-tobiduo.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-overo-sto
rm-tobiduo.dtb'
'src/arm/omap3-pandora-1ghz.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-pandora-1ghz.
dtb'
'src/arm/omap3-pandora-600mhz.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-pandora-600mh
z.dtb'
'src/arm/omap3-sbc-t3517.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-sbc-t3517.dtb'
'src/arm/omap3-sbc-t3530.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-sbc-t3530.dtb'
'src/arm/omap3-sbc-t3730.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-sbc-t3730.dtb'
'src/arm/omap3-thunder.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-thunder.dtb'
'src/arm/omap3-zoom3.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3-zoom3.dtb'
'src/arm/omap3430-sdp.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap3430-sdp.dtb'
'src/arm/omap4-duovero-parlor.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap4-duovero-parlo
r.dtb'
'src/arm/omap4-panda-a4.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap4-panda-a4.dtb'
'src/arm/omap4-panda-es.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap4-panda-es.dtb'
'src/arm/omap4-panda.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap4-panda.dtb'
'src/arm/omap4-sdp-es23plus.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap4-sdp-es23plus.dt
b'
'src/arm/omap4-sdp.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap4-sdp.dtb'
'src/arm/omap4-var-dvk-om44.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap4-var-dvk-om44.dt
b'
'src/arm/omap4-var-stk-om44.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap4-var-stk-om44.dt
b'
'src/arm/omap5-cm-t54.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap5-cm-t54.dtb'
'src/arm/omap5-igep0050.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap5-igep0050.dtb'
'src/arm/omap5-sbc-t54.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap5-sbc-t54.dtb'
'src/arm/omap5-uevm.dtb' -> '/boot/dtbs/4.4.30-ti-r64/omap5-uevm.dtb'
root@beaglebone:/opt/source/dtb-4.4-ti# echo "blacklist uio_pruss" > /etc/modprobe.
d/pruss-blacklist.conf
root@beaglebone:/opt/source/dtb-4.4-ti# reboot
```

Step 29: Reboot command will disconnect you from the board. When that happens, you need to click OK, then close putty command prompt. Then repeat the following steps to reconnect to the board:

Step 13, Step 14, Step 15, Step 16, Step 17, Step 18

Step 30: Connect the ethernet cable to your board.

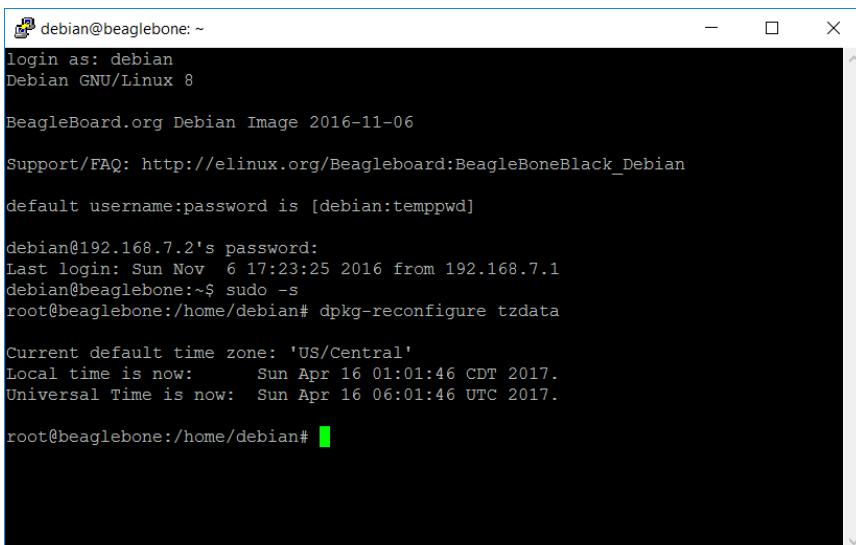
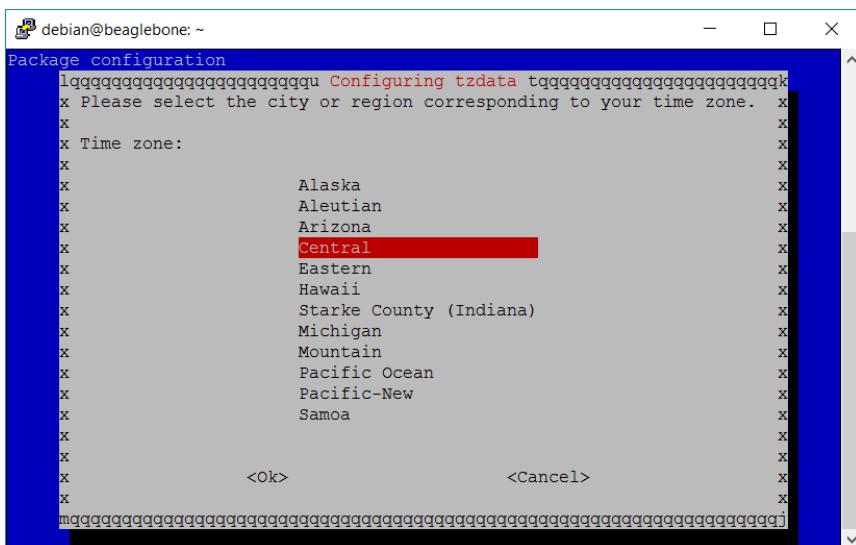


Step 31: Copy the following highlighted lines including the empty line:

```
sudo -s  
dpkg-reconfigure tzdata
```

Then Paste to the putty command prompt by right clicking at the location of the cursor.

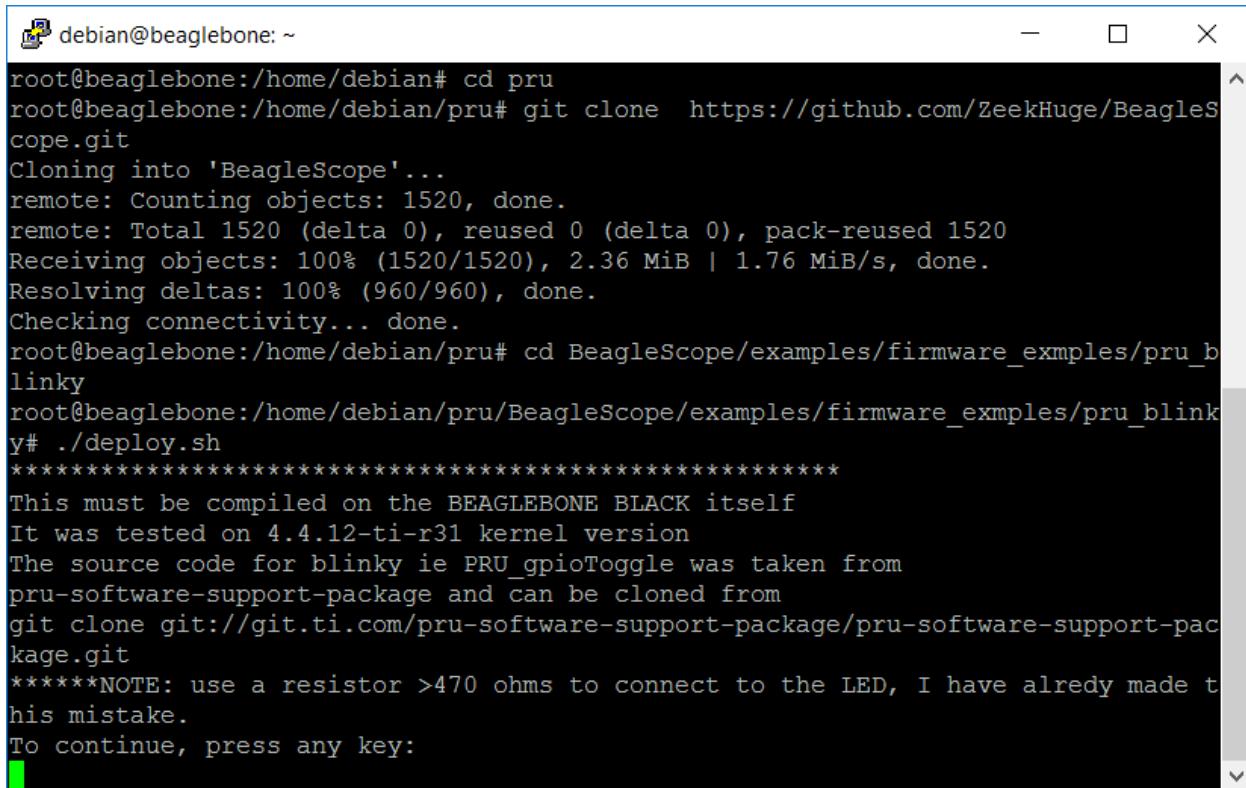
Step 32: Select “US”, then press “Enter”, then select “Central”, then press “Enter” as shown in the screenshots below:



Step 33: Copy the following highlighted lines including the empty line:

```
mkdir pru
cd pru
git clone https://github.com/ZeekHuge/BeagleScope.git
cd BeagleScope/examples/firmware_exmples/pru_blinky
./deploy.sh
```

Then Paste to the putty command prompt by right clicking at the location of the cursor.



```
debian@beaglebone: ~
root@beaglebone:/home/debian# cd pru
root@beaglebone:/home/debian/pru# git clone https://github.com/ZeekHuge/BeagleScope.git
Cloning into 'BeagleScope'...
remote: Counting objects: 1520, done.
remote: Total 1520 (delta 0), reused 0 (delta 0), pack-reused 1520
Receiving objects: 100% (1520/1520), 2.36 MiB | 1.76 MiB/s, done.
Resolving deltas: 100% (960/960), done.
Checking connectivity... done.
root@beaglebone:/home/debian/pru# cd BeagleScope/examples/firmware_exmples/pru_blinky
root@beaglebone:/home/debian/pru/BeagleScope/examples/firmware_exmples/pru_blinky# ./deploy.sh
*****
This must be compiled on the BEAGLEBONE BLACK itself
It was tested on 4.4.12-ti-r31 kernel version
The source code for blinky ie PRU_gpioToggle was taken from
pru-software-support-package and can be cloned from
git clone git://git.ti.com/pru-software-support-package/pru-software-support-package.git
*****NOTE: use a resistor >470 ohms to connect to the LED, I have already made this mistake.
To continue, press any key:
```

Step 34: Press “Enter” to continue. If you don’t see any errors, then you should see the LED blinking every 1 second.

```
debian@beaglebone: ~
This must be compiled on the BEAGLEBONE BLACK itself
It was tested on 4.4.12-ti-r31 kernel version
The source code for blinky ie PRU_gpioToggle was taken from
pru-software-support-package and can be cloned from
git clone git://git.ti.com/pru-software-support-package/pru-software-support-pac
kage.git
*****NOTE: use a resistor >470 ohms to connect to the LED, I have already made t
his mistake.
To continue, press any key:

-Building project

*****
Cleaning project: PRU_gpioToggle

Removing files in the "gen" directory

Finished cleaning project: PRU_gpioToggle
*****

*****
Building project: PRU_gpioToggle

Building file: PRU_gpioToggle.c
Invoking: PRU Compiler
/usr/share/ti/cgt-pru/bin/clpru --include_path=/usr/share/ti/cgt-pru/include --i
nclude_path=../../..//include --include_path=../../..//include/am335x -v3 -O2 --di
splay_error_number --Endian=little --hardware_mac=on --obj_directory=gen --pp_d
irectory=gen -ppd -ppa -fe gen/PRU_gpioToggle.object PRU_gpioToggle.c

Building target: gen/PRU_gpioToggle.out
Invoking: PRU Linker
/usr/share/ti/cgt-pru/bin/clpru -v3 -O2 --display_error_number --Endian=little -
--hardware_mac=on --obj_directory=gen --pp_directory=gen -ppd -ppa -z -i/usr/shar
e/ti/cgt-pru/lib -i/usr/share/ti/cgt-pru/include --reread_libs --warn_sections -
--stack_size=0x100 --heap_size=0x100 -o gen/PRU_gpioToggle.out gen/PRU_gpioToggle
.object -mgen/PRU_gpioToggle.map ./AM335x_PRU.cmd --library=libc.a --library=..
//lib/rpmsg/lib.lib
<Linking>
Finished building target: gen/PRU_gpioToggle.out

Output files can be found in the "gen" directory

Finished building project: PRU_gpioToggle
*****

-Placing the firmware
-Configuring pinmux
P8_45 Mode: pruout
-Rebooting
Rebooting pru-core 1
Done. Blinky must be up on pin P8_45
root@beaglebone:/home/debian/pru/BeagleScope/examples/firmware_exmples/pru_blink
y#
```

Step 35: Copy the following highlighted lines including the empty line:

```
nano PRU_gpioToggle/PRU_gpioToggle.c
```

Then Paste to the putty command prompt by right clicking at the location of the cursor.

Step 37: Scroll down to the end of the file and change Line 57 [before the last 2 lines in the file] from

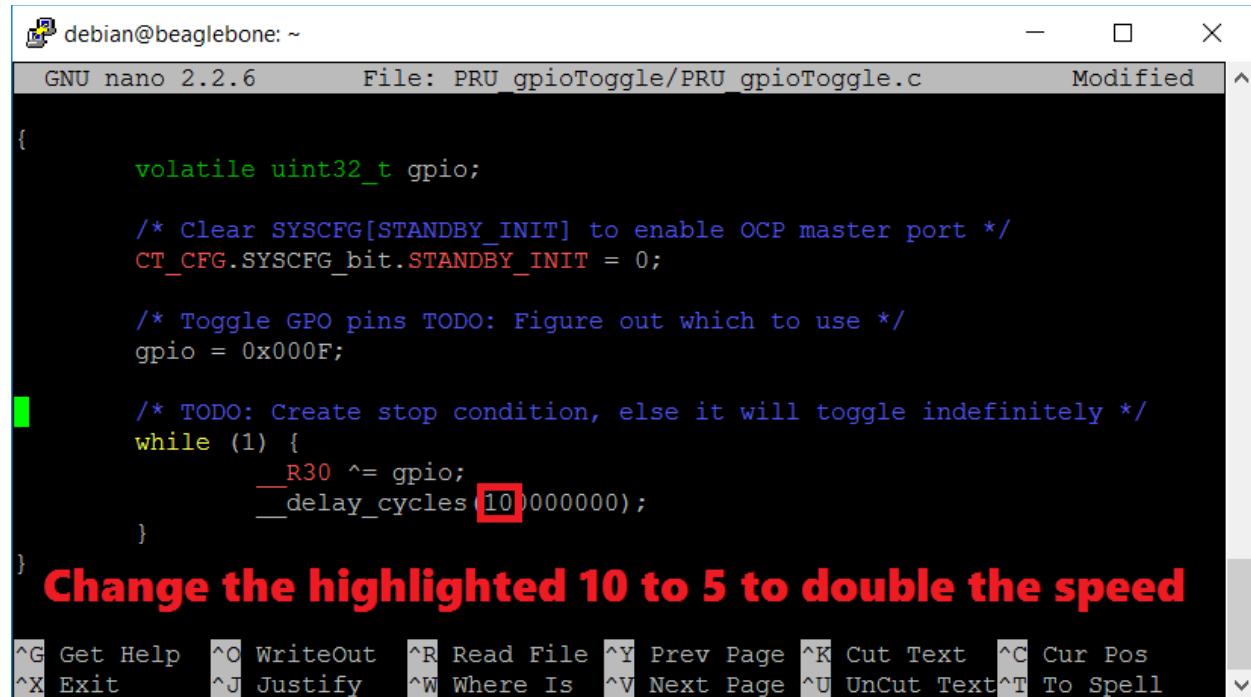
__delay_cycles(100000000);

TO

__delay_cycles(50000000);

By changing **10** at the beginning of the line to **5**.

This will double the speed of blinking. You may increase or decrease the number of cycles to slow down or speed the blinking time!



```
debian@beaglebone: ~
GNU nano 2.2.6      File: PRU_gpioToggle/PRU_gpioToggle.c      Modified
{
    volatile uint32_t gpio;

    /* Clear SYSCFG[STANDBY_INIT] to enable OCP master port */
    CT_CFG.SYSCFG_bit.STANDBY_INIT = 0;

    /* Toggle GPO pins TODO: Figure out which to use */
    gpio = 0x000F;

    /* TODO: Create stop condition, else it will toggle indefinitely */
    while (1) {
        __R30 ^= gpio;
        __delay_cycles(10000000);
    }
}
```

Change the highlighted 10 to 5 to double the speed

^G Get Help ^O WriteOut ^R Read File ^Y Prev Page ^K Cut Text ^C Cur Pos
^X Exit ^J Justify ^W Where Is ^V Next Page ^U UnCut Text ^T To Spell

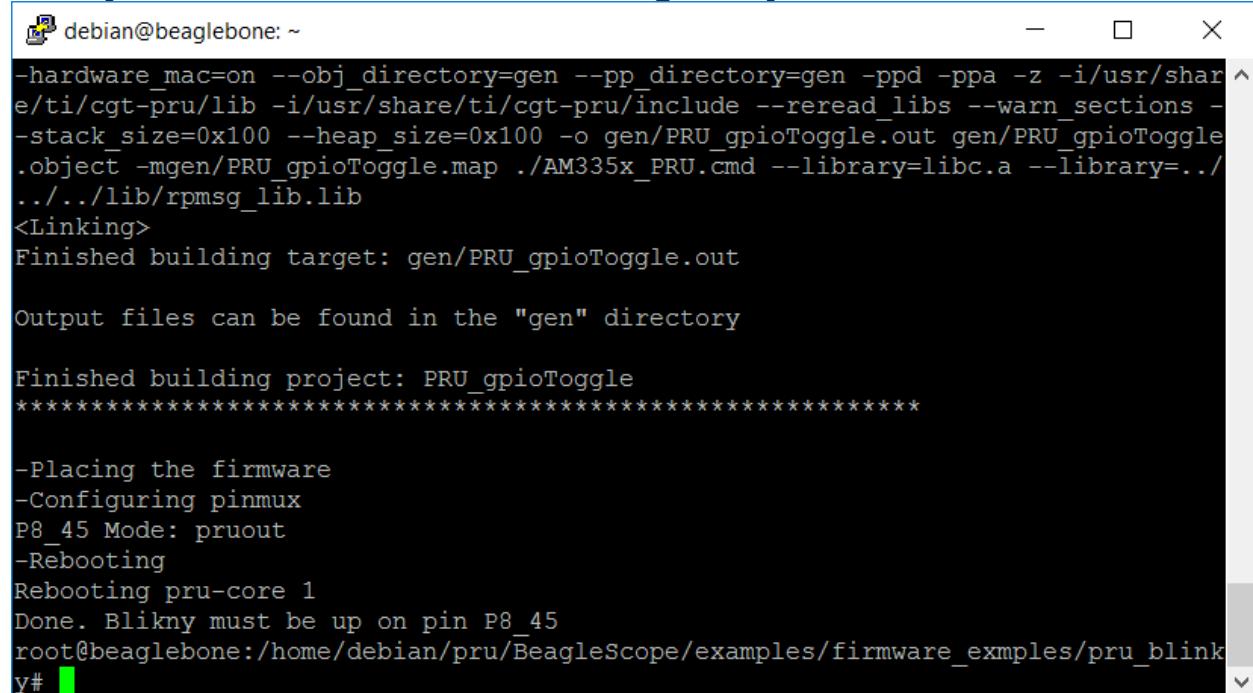
Step 38: Press “Ctrl+X”, then press “Y” for yes, then press “Enter” to exit the file.

Step 39: Copy the following highlighted lines including the empty line:

```
./deploy.sh
```

Then Paste to the putty command prompt by right clicking at the location of the cursor.

Step 40: Press “Enter” to continue. If you don’t see any errors, then you should see the LED blinking every 0.5 second.



```
debian@beaglebone: ~
-hardware_mac=on --obj_directory=gen --pp_directory=gen -ppd -ppa -z -i/usr/share/ti/cgt-pru/lib -i/usr/share/ti/cgt-pru/include --reread_libs --warn_sections --stack_size=0x100 --heap_size=0x100 -o gen/PRU_gpioToggle.out gen/PRU_gpioToggle.object -mgen/PRU_gpioToggle.map ./AM335x_PRU.cmd --library=libc.a --library=.../.../lib/rpmmsg_lib.lib
<Linking>
Finished building target: gen/PRU_gpioToggle.out

Output files can be found in the "gen" directory

Finished building project: PRU_gpioToggle
*****
-Placing the firmware
-Configuring pinmux
P8_45 Mode: pruout
-Rebooting
Rebooting pru-core 1
Done. Blikny must be up on pin P8_45
root@beaglebone:/home/debian/pru/BeagleScope/examples/firmware_exmples/pru_blink#
```

Final Step: Show your TA the blinking light to receive credit