Problem 3

Lab policy agreement:

By entering my full name and ID below, I certify that I have read and agree to the above guidelines, and I will observe all of the Department Lab policies during the entirety of my time at the University. I understand that I can lose my access to the ECEE Labs if I fail to follow these guidelines or otherwise misuse my lab privileges.

Your full name *	
(First name and last name)	
Steve Antony Xavier Kennedy	
CU Student ID *	
9 numbers	
107165904	
Last 7 digits of your BuffOneCard Number for access to lab doors *	
The last 7 digits of the 16-digit number on the front of your BuffOne Card st	arting with 601423500xxxxxxxx
5875854	

Problem 6:

#!/bin/bash

```
# get user information
echo -e "User information : $(whoami)" >> output.log

# get Operating System Type/Brand
echo -e "\nOperating System Type/Brand : $(uname -o)" >> output.log

# get OS Distribution
echo -e "\nOS Distribution : $(lsb_release -id)" >> output.log

# get OS Version
echo -e "\nOS Version : $(lsb_release -r)" >> output.log

# get Kernel Version
echo -e "\nKernel Version : $(uname --kernel-release)" >> output.log

# get Kernel gcc version build
echo -e "\nKernel gcc version build : $(cat /proc/version)" >> output.log
```

```
# get Kernel build time
echo -e "\nKernel build time : $(uname -v)" >> output.log
# get System Architecture information
echo -e "\nSystem Architecture information : $(lscpu)" >> output.log
# get Information on File System Memory
echo -e "\nInformation on File System Memory : $(df -h)" >> output.log
Output File:
 User
 information
 : steve
               Operating System Type/Brand : GNU/Linux
               OS Distribution : Distributor ID:
                                                   Ubuntu
               Description: Ubuntu 17.10
               OS Version : Release: 17.10
               Kernel Version : 4.13.0-46-generic
               Kernel gcc version build : Linux version 4.13.0-46-generic
               (buildd@lcy01-amd64-002) (gcc version 7.2.0 (Ubuntu 7.2.0-
               8ubuntu3.2)) #51-Ubuntu SMP Tue Jun 12 12:36:29 UTC 2018
               Kernel build time: #51-Ubuntu SMP Tue Jun 12 12:36:29 UTC
               2018
               System Architecture information : Architecture:
               x86_64
               CPU op-mode(s):
                                    32-bit, 64-bit
                                    Little Endian
               Byte Order:
               CPU(s):
               On-line CPU(s) list: 0-7
               Thread(s) per core: 2
               Core(s) per socket: 4
               Socket(s):
                                    1
               NUMA node(s):
               Vendor ID:
                                    GenuineIntel
```

CPU family: 6
Model: 142

Model name: Intel(R) Core(TM) i7-8550U CPU @

1.80GHz

i386/22

Stepping: 10

CPU MHz: 3204.975 CPU max MHz: 4000.0000 CPU min MHz: 400.0000 BogoMIPS: 3984.00 VT-x Virtualization: L1d cache: 32K L1i cache: 32K L2 cache: 256K L3 cache: 8192K NUMA node0 CPU(s): 0-7

Flags: fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid aperfmperf tsc_known_freq pni pclmulqdq dtes64 monitor ds_cpl vmx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb invpcid_single pti retpoline intel_pt rsb_ctxsw spec_ctrl tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 avx2 smep bmi2 erms invpcid mpx rdseed adx smap clflushopt xsaveopt xsavec xgetbv1 xsaves dtherm ida arat pln pts hwp hwp_notify hwp_act_window hwp_epp

Information on File System Memory : Filesystem Size Used Avail Use% Mounted on

udev	7.8G	0	7.8G	0%	/dev
tmpfs	1.6G	11M	1.6G	1%	/run
/dev/sda6	39G	27G	11G	72%	/
tmpfs	7.8G	15M	7.8G	1%	/dev/shm
tmpfs	5.0M	4.0K	5.0M	1%	/run/lock
tmpfs	7.8G	0	7.8G	0%	/sys/fs/cgroup
/dev/loop0	238M	238M	0	100%	/snap/wine-platform-
i386/25					
/dev/loop2	228M	228M	0	100%	/snap/wine-platform-

/dev/loop1	4.8M	4.8M	0	100%	/snap/notepad-plus-
plus/173					
/dev/loop3	89M	89M	0	100%	/snap/core/5897
/dev/loop5	90M	90M	0	100%	/snap/core/6130
/dev/loop4	3.8M	3.8M	0	100%	/snap/notepad-plus-
plus/167					
/dev/loop7	90M	90M	0	100%	/snap/core/6034
/dev/loop6	228M	228M	0	100%	/snap/wine-platform-
i386/23					
/dev/loop8	4.8M	4.8M	0	100%	/snap/notepad-plus-
plus/171					
/dev/sda1	256M	29M	228M	12%	/boot/efi
tmpfs	1.6G	20K	1.6G	1%	/run/user/121
tmpfs	1.6G	4.2M	1.6G	1%	/run/user/1000

Problem 7: Native build

./Hello-arm-static



./hello-arm-shared



• the difference in the size each

```
steveantonys@ubuntu:-/Documents/APES/MELP-Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02-arm/MELP/Chapter02
```

Static Library

Readelf grep "Shared library", Readelf grep "program interpreter"

```
steveantonySqubuntu:-/Documents/APES/MELP-Chapter02-arr/MELP/Chapter02-arr/lbrary/hello-arm5 readelf -a hello-arm-static |grep "program interpreter" readel? istrings: 3]: inth field (s) should index a syntab section.
steveantonySqubuntu:-/Documents/APES/MELP-Chapter02-arr/MELP/Chapter02-arr/lbrary/hello-arm5 readelf -a hello-arm-static |grep "Shared library" readelf: Warning: [3]: Link field (s) should index a syntab section.
steveantonySqubuntu:-/Documents/APES/MELP-Chapter02-arm/MELP/Chapter02-arm/library/hello-arm5
steveantonySqubuntu:-/Documents/APES/MELP-Chapter02-arm/MELP/Chapter02-arm/library/hello-arm5
```

Shared Library

Readelf grep "Shared library"

Readelf grep "program interpreter"

```
steveantonySqubuntu:-/Documents/APES/MELP-Chapter02-arn/MELP/Chapter02-arn/Library/hello-arn/s readelf -a "hello-arn-shared" |grep "program interpreter"
[Requesting program interpreter: /tlb64/ld-linux-x86-64.so.2]
steveantonySqubuntu:-/Documents/APES/MELP-Chapter02-arn/MELP/Chapter02-arn/library/hello-arn/s
| SteveantonySqubuntu:-/Documents/APES/MELP-Chapter02-arn/MELP/Chapter02-arn/library/hello-arn/s
```

Problem 8

<u>Screenshots of arm-cortex_a8 cross-tool chain Beagle bone Black: the version and configuration of "arm-cortex_a8-linux-gnueabihf" gcc compiler</u>



screenshot of sysroot



• the size of each executable

```
steveantonySgubuntu:-/Documents/APES/MELP-Chapter02-arn/MELP/Chapter02-arn/lbrary/hello-arn5 ls -l hello-arn-s*
-rwxrwxr-x l steveantonyS steveantonyS 12048 2na 24 21:46 hello-arn-shared
-rwxrwxr-x l steveantonyS steveantonyS 4124745 lna 12 42:146 hello-arn-startc
steveantonySgubuntu:-/Documents/APES/MELP-Chapter02-arn/NELP/Chapter02-arn/lbrary/hello-arn5
```

• the shared library use of each executable

Static library

steveantonySqubuntu:-/Documents/APES/MELP-Chapter02-arm/MELP/Chapter02-arm/library/hello-arm\$ readelf -a hello-arm-static |grep "Shared library"
steveantonySqubuntu:-/Documents/APES/MELP-Chapter02-arm/MELP/Chapter02-arm/lelbrary/hello-arm\$ readelf -a hello-arm-static |grep "program interpreter"
steveantonySqubuntu:-/Documents/APES/MELP-Chapter02-arm/MELP/Chapter02-arm/library/hello-arm\$

Shared Library grep "Shared library", Grep "program interpreter"



the crosstool-NG chain for the QEMU emulator

Screenshots of arm-cortex_a8 cross-tool chain: the version and configuration of "arm-unkown-linux-gnueabihf" gcc compiler

```
isteveantonySqubuntu:-/crosstool-ng$ arm-unknown-linux-gnueabl-gcc -v

Eng but the the control of the control o
```

```
steveantonyS@ubuntu:-/crosstool-ng$ ./ct-ng show-config
[[..] arm-unknown-linux-gnueabi
Languages : C,c+
05 : linux-4.19.1
Binutls : binutlis-2.31.1
Complier : gcc-8.2.0
Debug row : gcc-8.2.3
Gonpanton libs : expat-2.2.5 gettext-8.19.8.1 gmp-6.1.2 isl-8.20 libelf-8.8.13 libiconv-1.15 mpc-1.1.0 mpfr-4.8.1 ncurses-6.1
Companton tools : autoconf-2.69 automake-1.16.1
steveantonyS@ubuntu:-/crosstool-ngS
```

Sysroot

```
steveantonyS@ubuntu:-/crosstool-ng$ arm-unknown-linux-gnueabi-gcc -print-sysroot
/home/steveantonyS/x-tools/arm-unknown-linux-gnueabi/arm-unknown-linux-gnueabi/sysroot
steveantonyS@ubuntu:-/crosstool-ng$
```

the size of each executable

```
steveantonySQubuntu:-/Oocuments/APES/MELP/chapter02/library/hello-armS ls -l hello-arm-s*
-rwsrxxr x 1 steveantony5 steveantony5 11992 Jan 24 21:37 hello-arm-shared
-rwsrxxx x 1 steveantony5 memory for the steveantony5 steveantony5 memory for the steveantony5
```

• the shared library use of each executable

Static Library

```
steveantonyS@ubuntu:-/Documents/APES/MELP-Chapter02-arm/MELP/Chapter02-arm/lbrary/hello-armS readelf -a hello-arm-static |grep "Shared library"
steveantonyS@ubuntu:-/Documents/APES/MELP-Chapter02-arm/MELP/Chapter02-arm/lbrary/hello-armS readelf -a hello-arm-static |grep "program interpreter"
steveantonyS@ubuntu:-/Documents/APES/MELP-Chapter02-arm/MELP/Chapter02-arm/lbrary/hello-armS
```

Shared library grep "Shared library", Grep "program interpreter"

```
| steventonyS@ubuntu:-/Documents/APES/MELP/Chapter02/library/hello-arm steventonyS@ubuntu:-/Documents/APES/MELP/Chapter02/library/hello-arm 204x47

steventonyS@ubuntu:-/Documents/APES/MELP/Chapter02/library/hello-arm steventonyS@ubuntu:-/Documents/APES/MELP/Chapter02/library/hello-arm 204x47

shared library: [libc.so.6]

shared library: [libc.so.6]

steventonyS@ubuntu:-/Documents/APES/MELP/Chapter02/library/hello-arms
```

```
steveantomySqbbuntu:-/Documents/APES/MELP/chapter02/library/hello-armS readelf -a hello-arm-shared | grep "program interpreter"
(Requesting program interpreter: /llb/ld-linux.so.3)
steveantomySqbbuntu:-/Documents/APES/MELP/Chapter02/library/hello-armS |
steveantomySqbbuntu:-/Documents/APES/MELP/Chapter02/library/hello-armS |
```