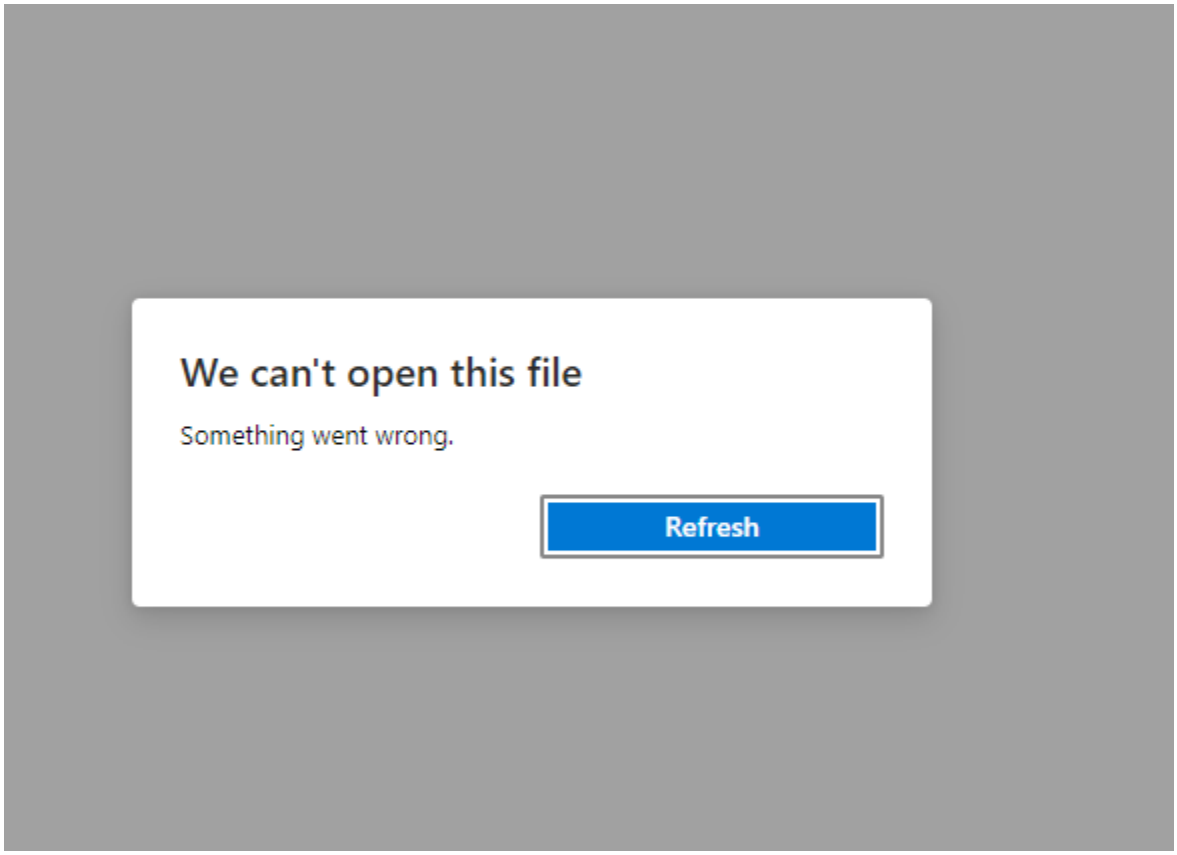
Homework #5 RE

Name: Gilbert Garczynski
UID: 115308718

Honor Pledge: I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination.

1.

This pdf, from just downloading it, cannot be opened. The following is the error that is given.



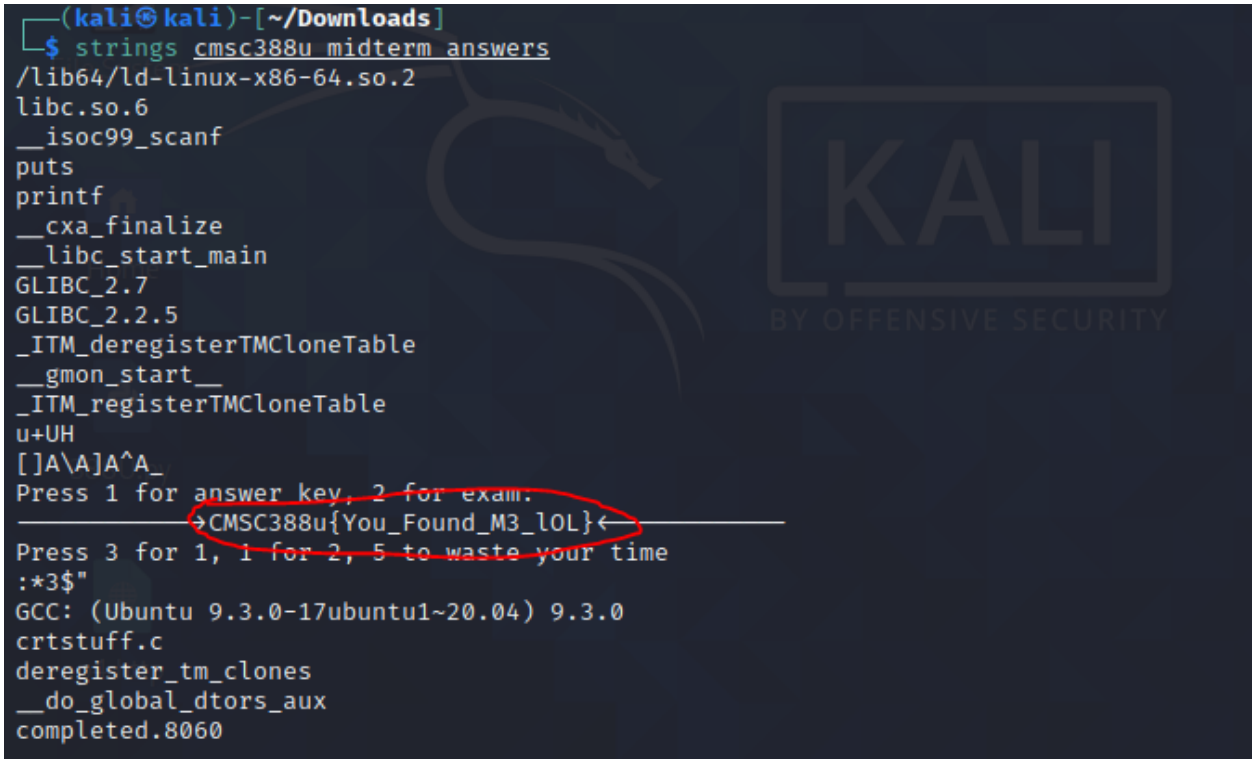
To find more information on the file, I can run '`file supersecret.pdf`' in the terminal

```
┌──(kali㉿kali)-[~/Downloads]
└─$ file supersecret.pdf
supersecret.pdf: ISO Media, MP4 Base Media v
1 [ISO 14496-12:2003]
```

This shows that the file is a ISO Media, MP4 Base file, so it is a video file
I discovered what the file actually is, but I told the file "Never going to give you up".

2.

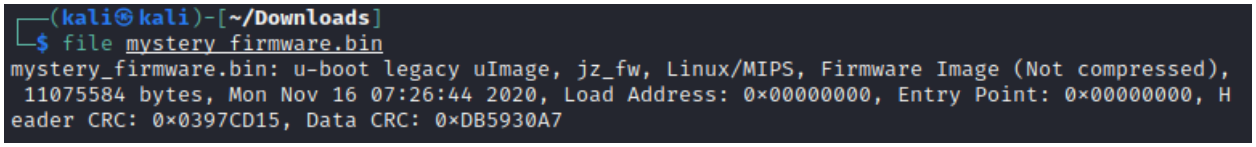
The flag is “CMSC388u{You_Found_M3_lOL}”
I first downloaded the file from http://supersecure.store:7070/cmsc388u_midterm_answers
Then ran “`strings cmsc388u_midterm_answers`” in the terminal



The flag has been circled.

3.1

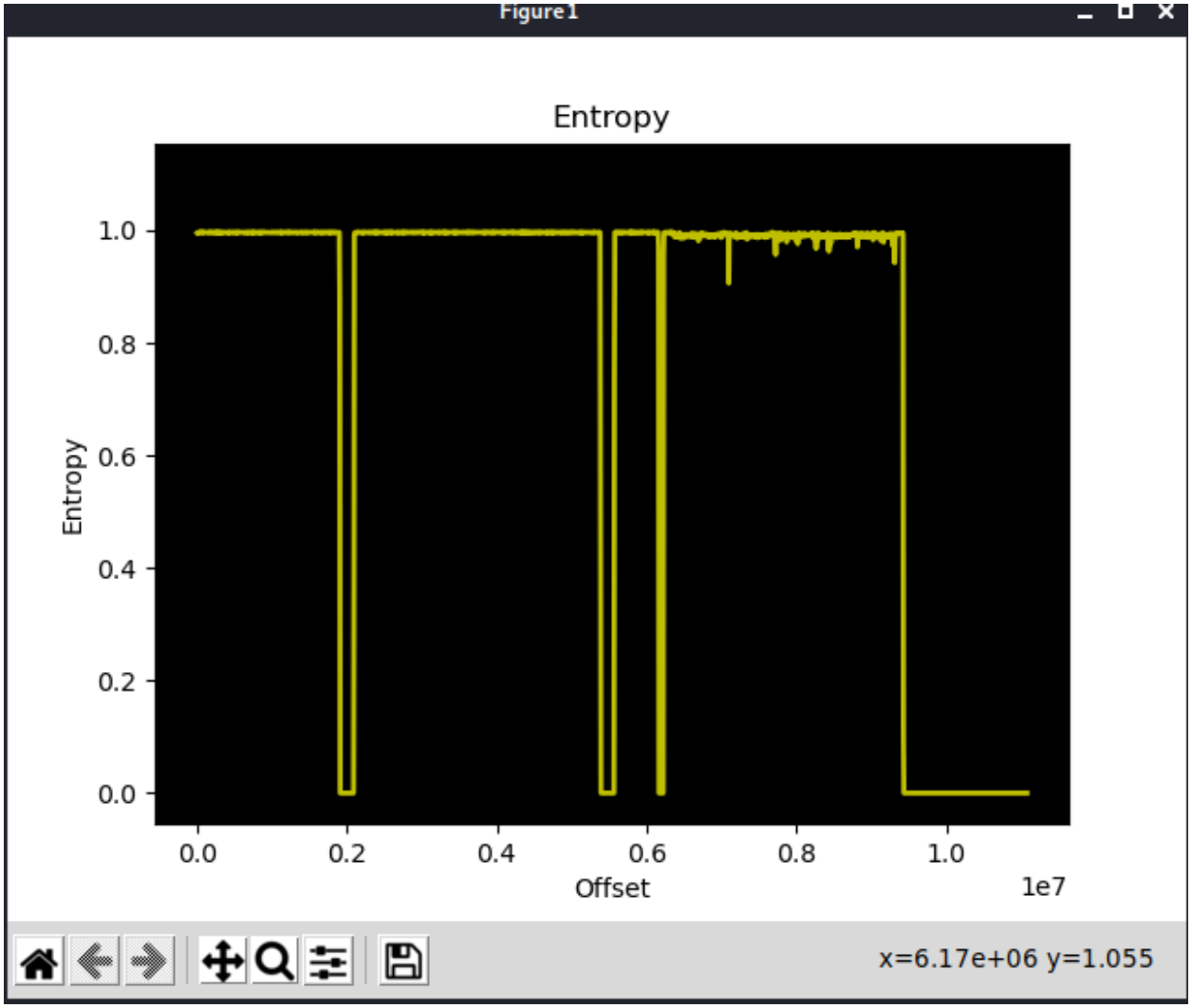
The output of the command ‘file mystery_firmware.bin’



As you can see, it appears that this file is some sort of Linux/MIPS Firmware Image ie you could run code on it and it may even be a mini OS???

3.2

Running ‘`binwalk -E myster_firmware.bin`’:



DECIMAL	HEXADECIMAL	ENTROPY
0	0×0	Rising entropy edge (0.995367)
1908736	0×1D2000	Falling entropy edge (0.000000)
2097152	0×200000	Rising entropy edge (0.991855)
5384192	0×522800	Falling entropy edge (0.585710)
5574656	0×551000	Rising entropy edge (0.996314)
6164480	0×5E1000	Falling entropy edge (0.000000)
6225920	0×5F0000	Rising entropy edge (0.955090)
7102464	0×6C6000	Rising entropy edge (0.992726)
9316352	0×8E2800	Rising entropy edge (0.982819)
9426944	0×8FD800	Falling entropy edge (0.099588)

The entropy file is the randomness of information associated with a file. It is often used to determine if a file is compressed or encrypted. Files that have these characteristics have a high entropy. source

3.3

Running ‘`binwalk myster_firmware.bin`’

```
┌──(kali㉿kali)-[~/Downloads]
└─$ binwalk mystery_firmware.bin

DECIMAL       HEXADECIMAL     DESCRIPTION
--------------------------------------------------------------------------------
0             0×0             uImage header, header size: 64 bytes, header CRC: 0×397CD15, crea
ted: 2020-11-16 07:26:44, image size: 11075584 bytes, Data Address: 0×0, Entry Point: 0×0, data
 CRC: 0×DB5930A7, OS: Linux, CPU: MIPS, image type: Firmware Image, compression type: none, ima
ge name: "jz_fw"
64            0×40            uImage header, header size: 64 bytes, header CRC: 0×6F5948F4, cre
ated: 2020-05-26 05:03:55, image size: 1907357 bytes, Data Address: 0×80010000, Entry Point: 0x
80421870, data CRC: 0×D8FCDDFA, OS: Linux, CPU: MIPS, image type: OS Kernel Image, compression
type: lzma, image name: "Linux-3.10.14"
128           0×80            LZMA compressed data, properties: 0×5D, dictionary size: 33554432
 bytes, uncompressed size: -1 bytes
2097216       0×200040        Squashfs filesystem, little endian, version 4.0, compression:xz,
size: 3289920 bytes, 414 inodes, blocksize: 131072 bytes, created: 2020-11-16 07:26:39
5570624       0×550040        Squashfs filesystem, little endian, version 4.0, compression:xz,
size: 593566 bytes, 13 inodes, blocksize: 131072 bytes, created: 2020-11-16 07:26:40
6225984       0×5F0040        JFFS2 filesystem, little endian
```

This was hard to read, so I copied it and placed it into a text file

*Untitled - Notepad

File Edit Format View Help

```
DECIMAL       HEXADECIMAL     DESCRIPTION
--------------------------------------------------------------------------------
0             0x0             uImage header, header size: 64 bytes, header CRC: 0x397CD15, created: 2020-11-16 07:26:44,
                                image size: 11075584 bytes, Data Address: 0x0, Entry Point: 0x0, data CRC: 0xDB5930A7,
                                OS: Linux, CPU: MIPS, image type: Firmware Image, compression type: none, image name: "jz_fw"
64            0x40            uImage header, header size: 64 bytes, header CRC: 0x6F5948F4, created: 2020-05-26 05:03:55,
                                image size: 1907357 bytes, Data Address: 0x80010000, Entry Point: 0x80421870, data CRC:
                                0xD8FCDDFA, OS: Linux, CPU: MIPS, image type: OS Kernel Image, compression type: lzma,
                                image name: "Linux-3.10.14"
128           0x80            LZMA compressed data, properties: 0x5D, dictionary size: 33554432 bytes, uncompressed size:
                                -1 bytes
2097216       0x200040        Squashfs filesystem, little endian, version 4.0, compression:xz, size: 3289920 bytes, 414
                                inodes, blocksize: 131072 bytes, created: 2020-11-16 07:26:39
5570624       0x550040        Squashfs filesystem, little endian, version 4.0, compression:xz, size: 593566 bytes, 13
                                inodes, blocksize: 131072 bytes, created: 2020-11-16 07:26:40
6225984       0x5F0040        JFFS2 filesystem, little endian
```

It appears that there are 6 files present inside of this file.

3.4.1

Ran the command ‘`binwalk --extract mystery_firmware.bin`’

```
┌──(kali㉿kali)-[~/Downloads]
└─$ binwalk --extract mystery_firmware.bin

DECIMAL       HEXADECIMAL     DESCRIPTION
--------------------------------------------------------------------------------
0             0x0             uImage header, header size: 64 bytes, header CRC: 0x397CD15, crea
ted: 2020-11-16 07:26:44, image size: 11075584 bytes, Data Address: 0x0, Entry Point: 0x0, data
 CRC: 0xDB5930A7, OS: Linux, CPU: MIPS, image type: Firmware Image, compression type: none, ima
ge name: "jz_fw"
64            0x40            uImage header, header size: 64 bytes, header CRC: 0x6F5948F4, cre
ated: 2020-05-26 05:03:55, image size: 1907357 bytes, Data Address: 0x80010000, Entry Point: 0x
80421870, data CRC: 0xD8FCDDFA, OS: Linux, CPU: MIPS, image type: OS Kernel Image, compression
type: lzma, image name: "Linux-3.10.14"
128           0x80            LZMA compressed data, properties: 0x5D, dictionary size: 33554432
 bytes, uncompressed size: -1 bytes
2097216       0x200040        Squashfs filesystem, little endian, version 4.0, compression:xz,
size: 3289920 bytes, 414 inodes, blocksize: 131072 bytes, created: 2020-11-16 07:26:39
5570624       0x550040        Squashfs filesystem, little endian, version 4.0, compression:xz,
size: 593566 bytes, 13 inodes, blocksize: 131072 bytes, created: 2020-11-16 07:26:40

WARNING: Extractor.execute failed to run external extractor 'jefferson -d 'jffs2-root' '%e'': [
Errno 2] No such file or directory: 'jefferson', 'jefferson -d 'jffs2-root' '%e'' might not be
installed correctly
6225984       0x5F0040        JFFS2 filesystem, little endian
```

Cleaned up output:

*Untitled - Notepad

File Edit Format View Help

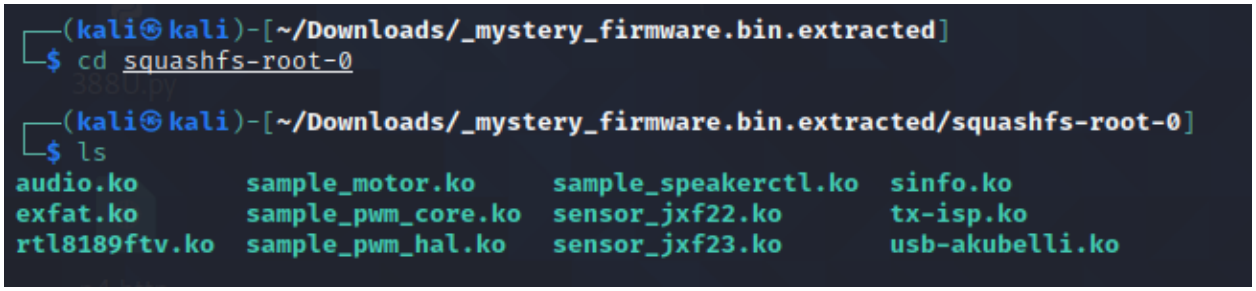
```
DECIMAL       HEXADECIMAL     DESCRIPTION
--------------------------------------------------------------------------------
0             0x0             uImage header, header size: 64 bytes, header CRC: 0x397CD15, created: 2020-11-16 07:26:44,
                                image size: 11075584 bytes, Data Address: 0x0, Entry Point: 0x0, data CRC: 0xDB5930A7,
                                OS: Linux, CPU: MIPS, image type: Firmware Image, compression type: none, image name: "jz_fw"
64            0x40            uImage header, header size: 64 bytes, header CRC: 0x6F5948F4, created: 2020-05-26 05:03:55,
                                image size: 1907357 bytes, Data Address: 0x80010000, Entry Point: 0x80421870, data CRC:
                                0xD8FCDDFA, OS: Linux, CPU: MIPS, image type: OS Kernel Image, compression type: lzma,
                                image name: "Linux-3.10.14"
128           0x80            LZMA compressed data, properties: 0x5D, dictionary size: 33554432 bytes, uncompressed
                                size: -1 bytes
2097216       0x200040        Squashfs filesystem, little endian, version 4.0, compression:xz, size: 3289920 bytes,
                                414 inodes, blocksize: 131072 bytes, created: 2020-11-16 07:26:39
5570624       0x550040        Squashfs filesystem, little endian, version 4.0, compression:xz, size: 593566 bytes,
                                13 inodes, blocksize: 131072 bytes, created: 2020-11-16 07:26:40

WARNING: Extractor.execute failed to run external extractor 'jefferson -d 'jffs2-root' '%e'': [Errno 2] No such file
        or directory: 'jefferson', 'jefferson -d 'jffs2-root' '%e'' might not be installed correctly
6225984       0x5F0040        JFFS2 filesystem, little endian
```

After running this, i did ‘ls’ and it showed:

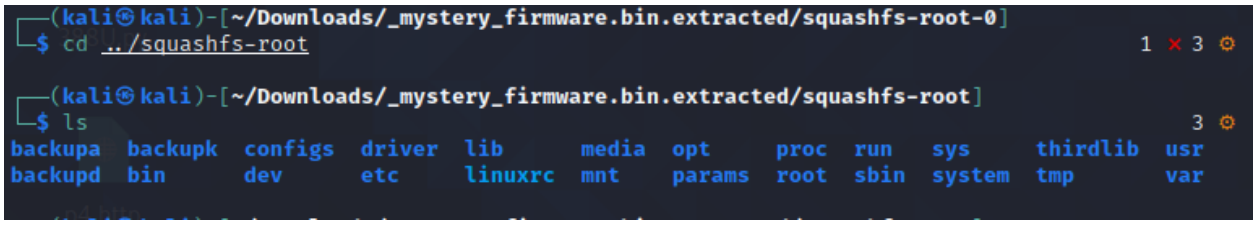
```
┌──(kali㉿kali)-[~/Downloads]
└─$ ls
cmsc388u_midterm_answers  mystery_firmware.bin              supersecret.pdf
Image.lzma                _mystery_firmware.bin.extracted  uImage
```

I then cd into _mystery_firmware.bin.extracted and here are the contents

There is little of interest in 'squashfs-root-0'



However, in 'squashfs-root' we see that there appears to be something with a similar architecture to an OS.



Therefore, the root file system is located at _myster_firmware.bin.extracted/squashfs-root

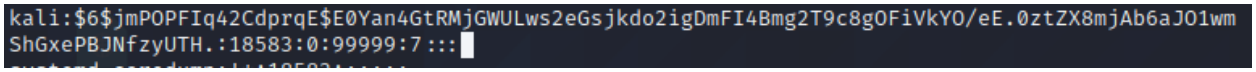
3.4.2

First, I run '`cd /usr/bin/etc/`'. Then I run '`cat passwd`' with the points of interest being the lines

```
root:x:0:0:root:/root:/usr/bin/zsh
kali:x:1000:1000:Kali,,,:/home/kali:/usr/bin/zsh
```

and '`sudo cat shadow`' with the points of interest being the lines

```
root:!:18583:0:99999:7:::
```



The password hasf for the device was located at the path _myster_firmware.bin.extracted/squashfs-root/etc/shadow.
The password hash is:
`$6$jmPOPFIq42CdprqE$E0Yan4GtRMjGWULws2eGsjkdo2igDmFI4Bmg2T9c8gOFiVkYO/eE.0ztZX8mjAb6aJO1wmShGxePBJNfzyUTH.`