Group Name: META

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Hex Dump of VCB, Free Space, and Root Directory

VCB Dump

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student@student-VirtualBox:~/Documents/CSC415FSProject$ ./Hexdump/hexdump.linux SampleVolume --start 1 --count 1
Dumping file SampleVolume, starting at block 1 for 1 block:

000200: 4D 45 54 41 47 52 50 00  4B 4C 00 00 00 00 00 00 | METAGRP.KL......
000210: 00 02 00 00 00 00 00 00  06 00 00 00 00 00 00 00 | ................
000220: 01 00 00 00 00 00 00 00  49 6E 69 74 69 61 6C 20 | ........Initial
000230: 56 43 42 00 00 00 00 00  00 00 00 00 00 00 00 00 | VCB.............
000240: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000250: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000260: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000270: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000280: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000290: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0002A0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0002B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0002C0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0002D0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0002E0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0002F0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................

000300: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000310: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000320: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000330: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000340: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000350: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000360: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000370: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000380: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000390: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0003A0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0003B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0003C0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0003D0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0003E0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0003F0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................

student@student-VirtualBox:~/Documents/CSC415FSProject$
```

Data from the VCB Dump is stored in little Endian Format:

- From 000200-000207: 8 bytes is the Signature we assigned. The value 0x2050524741544 54D translates to “METAGRP.”
- From 000208-000209: 2 bytes is the unsigned 64-bit integer blocksNeeded. Value: 0x0000000000004C4B converted to decimal is 19531.

- From 000210-000211: 2 byte is the unsigned 64-bit integer blockSize. Value: 0x0000000000000200 converted to decimal is 512.
- From 000218: 1 byte is the unsigned 64-bit integer starting block of the root directory.
- From 000220: 1 byte is the unsigned 64-bit integer starting block of the VCB.
- From 000228-000232: 11 bytes is the character part of the VCB name. This translates to “Initial VCB.“

Free Space Dump

```
student@student-VirtualBox:~/Documents/CSC415FSProject$ ./Hexdump/hexdump.linux SampleVolume --start 2 --count 5
Dumping file SampleVolume, starting at block 2 for 5 blocks:

000400: 00 00 FE FF FF FF FF FF  FF FF FF FF FF FF FF FF | ..◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000410: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000420: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000430: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000440: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000450: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000460: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000470: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000480: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000490: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
0004A0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
0004B0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
0004C0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
0004D0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
0004E0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
0004F0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

000500: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000510: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000520: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000530: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000540: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000550: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000560: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000570: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000580: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000590: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
0005A0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
0005B0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
0005C0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
0005D0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
0005E0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
0005F0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
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000600: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
000610: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
000620: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
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000660: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
000670: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
000680: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
000690: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0006A0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0006B0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0006C0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0006D0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0006E0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0006F0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????

000700: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
000710: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
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000770: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
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0007A0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0007B0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0007C0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0007D0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0007E0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0007F0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
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000800: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
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000890: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0008A0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0008B0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0008C0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0008D0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0008E0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0008F0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????

000900: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
000910: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
000920: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
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0009A0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0009B0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0009C0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0009D0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0009E0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
0009F0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ????????????????
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000A00: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000A10: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000A20: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000A30: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000A40: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000A50: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000A60: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000A70: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000A80: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000A90: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000AA0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000AB0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000AC0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000AD0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000AE0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000AF0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

000B00: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000B10: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000B20: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000B30: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000B40: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000B50: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000B60: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000B70: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000B80: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000B90: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000BA0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000BB0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000BC0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000BD0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000BE0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000BF0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
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000C00: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000C10: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000C20: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000C30: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000C40: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000C50: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000C60: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000C70: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000C80: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000C90: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000CA0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000CB0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000CC0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000CD0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000CE0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000CF0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

000D00: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000D10: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000D20: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000D30: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000D40: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000D50: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000D60: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000D70: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000D80: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000D90: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000DA0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000DB0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000DC0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000DD0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000DE0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
000DF0: FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF | ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

student@student-VirtualBox:~/Documents/CSC415FSProject$
```

- From 400-402: The bitmap marks the first 18 bits as used. Value: 0xFFFFFFFFFFE0000 or in binary: 11111111111111111111111111111111111111111111100000000000000000.
- The rest of the bits are marked as 1 meaning the bit/block is free.

Root Directory

```
student@student-VirtualBox:~/Documents/CSC415FSProject$ ./Hexdump/hexdump.linux SampleVolume --start 7 --count 11
Dumping file SampleVolume, starting at block 7 for 11 blocks:

000E00: 2E 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000E10: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000E20: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000E30: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000E40: 06 00 00 00 00 00 00 00  E0 15 00 00 00 00 00 00 | ........◆.......
000E50: D6 D1 3D 65 00 00 00 00  D6 D1 3D 65 00 00 00 00 | ◆◆=e....◆◆=e....
000E60: D6 D1 3D 65 00 00 00 00  01 00 00 00 00 00 00 00 | ◆◆=e............
000E70: 2E 2E 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000E80: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000E90: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000EA0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000EB0: 06 00 00 00 00 00 00 00  E0 15 00 00 00 00 00 00 | ........◆.......
000EC0: D6 D1 3D 65 00 00 00 00  D6 D1 3D 65 00 00 00 00 | ◆◆=e....◆◆=e....
000ED0: D6 D1 3D 65 00 00 00 00  01 00 00 00 00 00 00 00 | ◆◆=e............
000EE0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000EF0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................

000F00: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000F10: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000F20: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000F30: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000F40: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
000F50: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000F60: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000F70: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000F80: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000F90: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000FA0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000FB0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
000FC0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000FD0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000FE0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
000FF0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
```

- From 000E00: 1 byte that represents the name (‘.’), which is the pointer to the root directory.
- From 000E40: 1 byte that represents the block location of the directory entry. In this case, the root directory is located in block 6.

- From 000E48- 000E49: 2 bytes that represent the size of the directory entry. In this case, the size of the root directory is 5600.
- From 000E50-000E53: 4 bytes that represents the pointer for the date created.
- From 000E58-000E5B: 4 bytes that represents the pointer for the date modified.
- From 000E60-000E63: 4 bytes that represents the pointer for the last accessed.
- From 000E68: 1 byte that represents the value of isDir. Value: 01 means the directory entry is a directory

The next part represents the parent of the directory.

- From 000E70-000E71: 1 byte that represents the name('..'), which is the pointer to the parent of the directory. In this case, the root directory.
- From 000EB0:1 byte that represents the block location of the parent directory entry.
- From 000EB8- 000EB9: 2 bytes that represent the size of the parent directory entry.
- .From 000EC0-000EC3: 4 bytes that represent the date created of the parent directory entry..
- From 000EC8-000ECB: 4 bytes that represent the date modified of the parent directory entry.
- From 000ED0-000ED3: 4 bytes that represent the last accessed of the parent directory entry.
- From 000ED8: 1 byte that represents the value of isDir. Value: 01 means the directory entry is a directory
- From 000F40 and 000FB0: 1 byte that represents the value of isUsed. Value: 01 means the entry is free.

Rest of the Root Directory:

```
001000: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001010: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001020: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001030: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001040: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001050: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001060: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001070: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001080: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001090: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
0010A0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0010B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0010C0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0010D0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0010E0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0010F0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................

001100: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001110: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001120: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001130: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001140: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001150: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001160: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001170: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001180: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001190: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0011A0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0011B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0011C0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0011D0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0011E0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
0011F0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
```

```
001200: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001210: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001220: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001230: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001240: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001250: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001260: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001270: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001280: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001290: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0012A0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0012B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0012C0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
0012D0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0012E0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0012F0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................

001300: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001310: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001320: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001330: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001340: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001350: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001360: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001370: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001380: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001390: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0013A0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
0013B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0013C0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0013D0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0013E0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0013F0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
```

```
001400: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001410: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001420: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001430: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001440: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001450: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001460: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001470: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001480: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001490: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0014A0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0014B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0014C0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0014D0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0014E0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0014F0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................

001500: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001510: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001520: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001530: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001540: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001550: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001560: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001570: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001580: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001590: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0015A0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0015B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0015C0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0015D0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
0015E0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0015F0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
```

```
001600: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001610: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001620: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001630: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001640: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001650: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001660: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001670: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001680: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001690: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0016A0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0016B0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
0016C0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0016D0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0016E0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0016F0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................

001700: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001710: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001720: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001730: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001740: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001750: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001760: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001770: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001780: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001790: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
0017A0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0017B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0017C0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0017D0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0017E0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0017F0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
```

```
001800: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001810: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001820: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001830: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001840: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001850: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001860: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001870: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001880: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001890: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0018A0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0018B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0018C0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0018D0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0018E0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
0018F0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................

001900: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001910: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001920: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001930: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001940: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001950: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001960: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001970: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001980: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001990: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0019A0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0019B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0019C0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
0019D0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0019E0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0019F0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
```

```
001A00: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001A10: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001A20: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001A30: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001A40: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001A50: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001A60: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001A70: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001A80: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001A90: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001AA0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001AB0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001AC0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001AD0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001AE0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001AF0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................

001B00: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001B10: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001B20: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001B30: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001B40: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001B50: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001B60: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001B70: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001B80: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001B90: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001BA0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001BB0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001BC0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001BD0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001BE0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001BF0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
```

```
001C00: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001C10: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001C20: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001C30: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001C40: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001C50: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001C60: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001C70: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001C80: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001C90: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001CA0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001CB0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001CC0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001CD0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001CE0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001CF0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................

001D00: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001D10: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001D20: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001D30: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001D40: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001D50: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001D60: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001D70: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001D80: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001D90: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001DA0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001DB0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001DC0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001DD0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001DE0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001DF0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
```

```
001E00: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001E10: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001E20: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001E30: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001E40: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001E50: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001E60: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001E70: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001E80: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001E90: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001EA0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001EB0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001EC0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001ED0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001EE0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001EF0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................

001F00: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001F10: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001F20: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001F30: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001F40: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001F50: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001F60: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001F70: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001F80: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001F90: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001FA0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001FB0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001FC0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001FD0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
001FE0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
001FF0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
```

```
002000: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002010: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002020: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002030: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002040: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002050: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
002060: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002070: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002080: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002090: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0020A0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0020B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0020C0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
0020D0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0020E0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0020F0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................

002100: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002110: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002120: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002130: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
002140: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002150: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002160: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002170: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002180: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002190: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0021A0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
0021B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0021C0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0021D0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0021E0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0021F0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
```

```
002200: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002210: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
002220: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002230: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002240: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002250: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002260: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002270: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002280: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
002290: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0022A0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0022B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0022C0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0022D0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0022E0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0022F0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................

002300: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002310: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002320: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002330: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002340: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002350: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002360: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
002370: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002380: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
002390: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0023A0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0023B0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0023C0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0023D0: 00 00 00 00 00 00 00 00  00 00 00 00 01 00 00 00 | ................
0023E0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................
0023F0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 | ................

student@student-VirtualBox:~/Documents/CSC415FSProject$
```

VCB Structure Description

- Signature: This signature is used to identify if the volume control block is valid or if the file system is correctly formatted. If a program reads block 0 and finds this signature, it can safely assume that the block contains a valid VCB. The “VCB_SIGNATURE” is used to set and check this value.

- TotalBlocks: This represents the total number of blocks in the file system. It essentially tells you the capacity of the file system in terms of how many blocks it can hold.

- BlockSize: The size of each individual block in bytes. This is crucial for determining how much data can be written to or read from each block.

- RootDirLocation: This indicates the block number where the root directory of the file system starts. The root directory is the top-level directory in the file system, and knowing its location is important for navigation.

- FreeSpaceBitmap: Indicates the block number where the BitMap starts. This can help retrieve the bitmap of the free space management system.

- VCBName: An identifier for the volume control block. The VCB name of the initialized VCB is named “Initial VCB.”

Free Space System Description

For our free space management, we have decided to use a bitmap array of 64-bit unsigned integers. This requires us to allocate memory using malloc() to the array, depending on the amount of blocks we're working with and the amount of bytes per block.

```
uint64_t initBitMap(uint64_t blockCount, uint64_t bytesPerBlock)
{
  bitmap = malloc(bytesPerBlock * (((blockCount/8)/512)+1));
```

Here, we have the bytes per block and block count. In our default case, bytes per block is 512 (BLOCK_SIZE) and the block count is 19,531 blocks/bits. So, it equates to 512 * 5, which is 2560 bytes, but with the use of variables, these values can be changed.

```
memset(bitmap, 0xFF, bytesPerBlock * (((blockCount/8)/512)+1) );
//** set first 6 bits to 0
for (int bitNumber = 0; bitNumber < 6; bitNumber++)
{
  setBitUsed(bitmap, bitNumber);
}
```

Then, we set all bits in the bitmap array to 1. We do this by using the memset() function, passing in the bitmap, 0xFF (which is 255, or 11111111 in binary)and the number of bytes in the bitmap. After that, we need to set the first 6 bits to 0, as per the instructions. For this, I create a helper function to perform a bitwise operation to set individual bits to allocated (0).

```
LBAwrite(bitmap, (((blockCount/8)/512)+1), 1);
return 1;
```

Finally, we call LBAwrite() to write our bitmap to disk. Then, we return 1 because that is the block where our free space management is placed.

The *allocBlocks()* function will allocate blocks by searching for free blocks and contiguously allocate more free blocks until the requested blocks are met. The function will iterate through the bitmap and check each bit to see if it is free or used. If it finds a free bit, it will store the location number and check the other bits. It will iterate for the number of requested blocks. If it finds a bit that is used, it will reset and continue searching until all bits are searched. If it meets the blocks needed, it will set the allocated blocks as used, and return the starting block.

Directory System Description

For the directory system, we made a structure for directory entries:

- Name: This indicates the name of the directory entry. We use this as an identifier to differentiate between directory entries.
- Location: An unsigned 64-bit integer that represents the block location of the directory entry. We are continuously tracking the blocks of the file.
- Size: An unsigned 64-bit integer that represents the size of the directory entry. This is calculated by multiplying the actual number of directory entries times the size of the directory entry structure.
- Date Created: This stores the date and time of directory entry creation.
- Date Modified: This stores the date and time when a directory entry is modified.
- Last Accessed: This stores the date and time when a user last accessed the directory entry.

- IsDir: This indicates if a directory entry is a directory or file. The values stored: 0 (not a directory) and 1 (a directory).
- IsUsed: This indicates if a directory is used or free. The values stored: 0 (Used) and 1 (Free).

For initializing the root Directory, we used the idea Professor Bierman showed in class. We made a function that takes in the initial amount of directory entry (*initDE*) and the parent of the directory entry (*parent*). First, we calculate the bytesNeeded, which is *initDe * 112* (*sizeof(DirectoryEntry)*). Then, we calculate the blocksNeeded using the equation: *(m+(n-1))/n*. Then, we update the *bytesNeeded* by calculating *blocksNeeded * 512(block size)*. Then, we calculate the actual amount of the directory entry we can fit by division, *bytesNeeded/sizeof(DirectoryEntry)*. After calculating, we allocate memory for a pointer to a directory entry (*dir*). We then ask the free space system to allocate blocks using *allocBlocks,* and store the block number where the allocated blocks start. Using a for-loop, we initialize the directory entries and flag each entry as free, by setting the name to null and isUsed to free(1). Then we set up the '.' and '..', in other words, set up the root directory. After setting both up, we write to disk and return the start block.

Work Table

Member	Worked on
Alec Nagal	Initialize the volume control block. Analyzing the dump of VCB, Free Space, and root directory, Debugging
Edward Chen	Allocating Blocks from Free Space (implement *allockBlocks()*), Debugging, Spell Checking (Writeup)
Ivan Ramos	Initializing Free Space management and functions to set bits to free/allocated, Debugging
Karl Xavier Layco	Initializing Root Directory, Allocating Blocks from Free Space (implement *allockBlocks()*), Debugging, Analyzing the dump of VCB, Free Space, and root directory.

Team Meeting

We worked together by dividing the task evenly. If any problems occur, we ask each other for help. We also pass ideas around on how to meet the requirements.

We meet every weekend and some days on weekdays. We schedule discord calls at a specific time and meet for at least 20 minutes.

We divided the work evenly. Alec was assigned to initialize VCB, Ivan and Edward were assigned to work on the free space system, and Karl was assigned to initialize the root directory.

Issues We Faced

- The first issue we faced was figuring out how the bitmap array would work. Setting each entry in the array to 1 (ex. bitmap[0] = 1) would not work, since that would take up way more space than what would be needed, so Ivan did some research on how to change the value of each bit in an entry. He found that using memset() to set each byte in the bitmap to 0xFF (11111111 in binary) did the job. We double-checked to make sure this worked by utilizing the hexdump, and sure enough, it worked since every byte was set to FF.

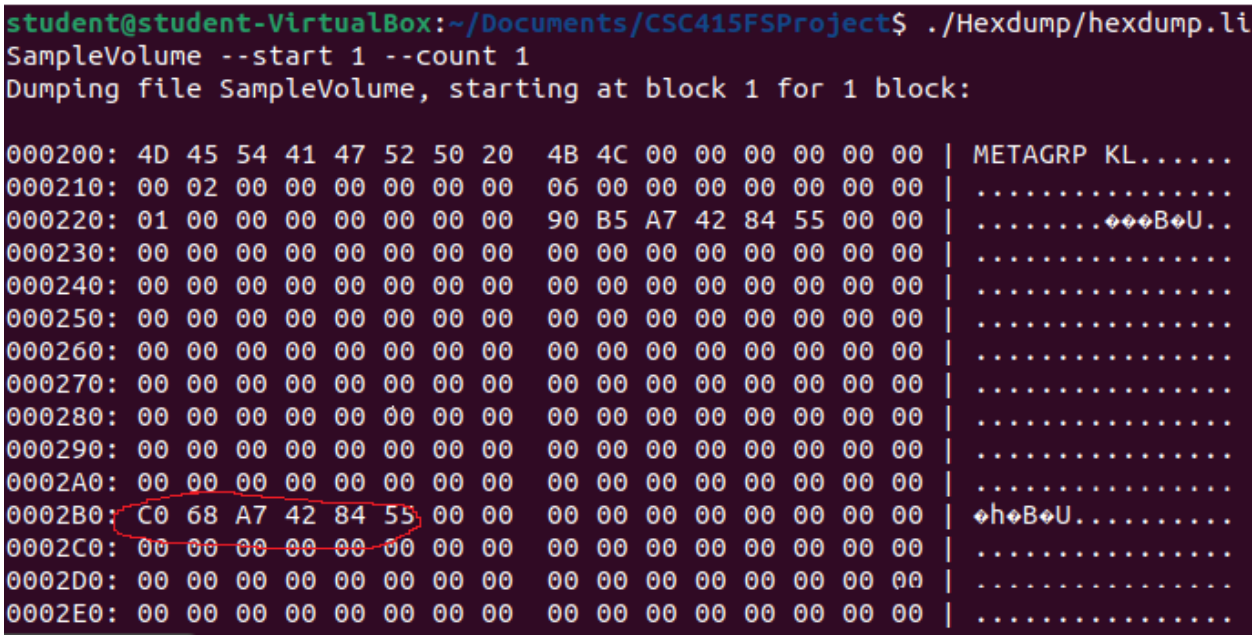
- The second issue we got was allocating blocks from free space. When we were analyzing the dump for freespace, it was not showing that it was contiguously allocated. The dump showed that the function jumps from bit/block 31 to bit/block 64, then from 95 to 128. It was skipping 32 bits. To resolve this, in the *setBitUsed()* and *setBitFree()* functions, we added *ULL* to these:

```
bitmap[bitNumber / 64] &= ~(1ULL << (bitNumber % 64));
```

```
bitmap[bitNumber / 64] |= (1ULL << (bitNumber % 64));
```

  This suffix indicates that the literal should be considered as an unsigned long long integer, which has a size of 64 bits.

- The third issue we got was an unknown pointer was showing up in the dump for VCB.



We could not figure out what this pointer is for, and it shows when we only use *LBAWrite()* in the *initFileSystem*. To fix this issue, we stored the VCB information to a VCB pointer instead of storing it in a VCB variable. This removed unnecessary pointers in the VCB dump.