Name: Mosab Fathy Ramadan Mohamed
Group: B20-SD-01
Lab 2: OS main components

Environment Preparation:

- Ensure that you enable the EFI standard of booting. How did you check this
  - It is enabled
  - I checked it by finding /sys/firmware/efi

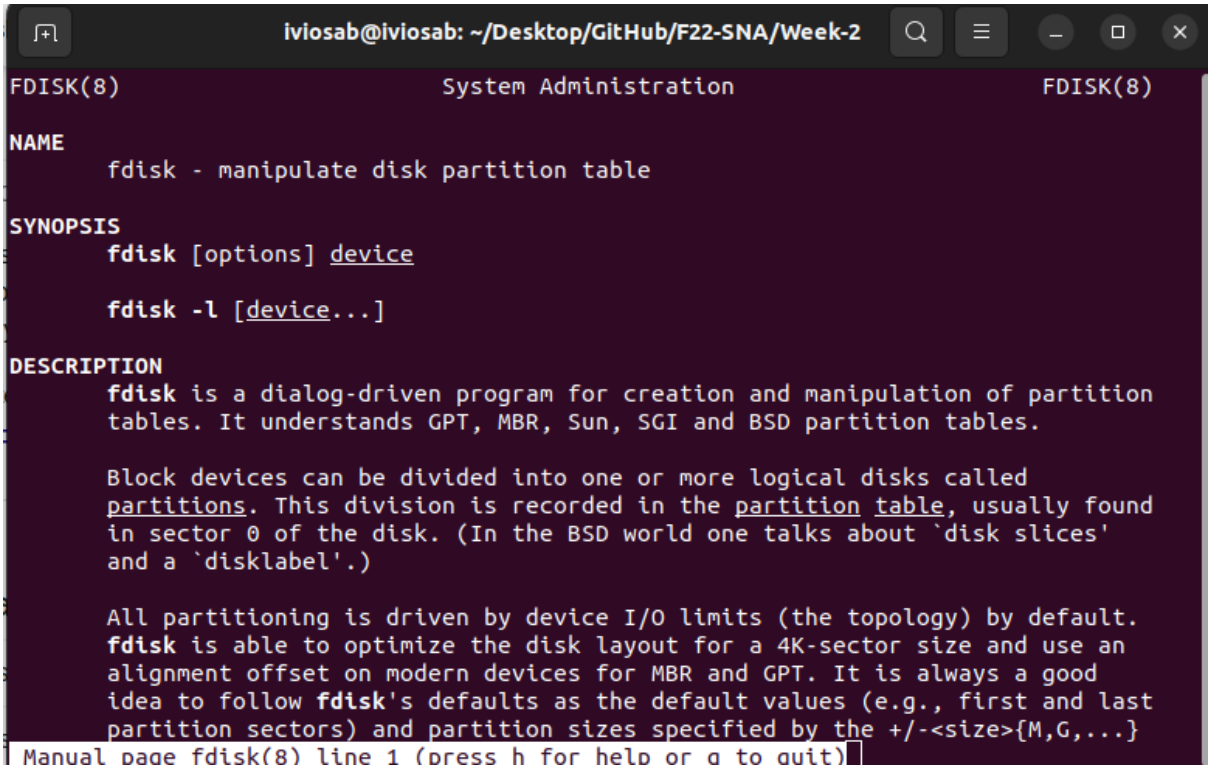
Exercise 1: GPT partition

Questions to answer:

Q1: What is fdisk utility used for?

Answer:

Fdisk is used to manipulate disk partition tables
It is a dialog-driven program for creation and manipulation of partition tables



Q2: Show the bootable device(s) on your machine, and identify which partition(s) are bootable.

Answer:
We can find the bootable devices and partitions using the command : (lsblk)

```
iviosab@iviosab:~/Desktop/GitHub/F22-SNA/Week-2$ lsblk
NAME         MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
loop0          7:0    0     4K  1 loop /snap/bare/5
loop1          7:1    0 908,1M  1 loop /snap/clion/203
loop2          7:2    0 909,4M  1 loop /snap/clion/204
loop3          7:3    0  55,6M  1 loop /snap/core18/2538
loop4          7:4    0  55,6M  1 loop /snap/core18/2560
loop5          7:5    0 164,8M  1 loop /snap/gnome-3-28-1804/161
loop6          7:6    0    62M  1 loop /snap/core20/1611
loop7          7:7    0  70,4M  1 loop /snap/core22/188
loop8          7:8    0 400,8M  1 loop /snap/gnome-3-38-2004/112
loop9          7:9    0 346,3M  1 loop /snap/gnome-3-38-2004/115
loop10         7:10   0  81,3M  1 loop /snap/gtk-common-themes/1534
loop11         7:11   0  91,7M  1 loop /snap/gtk-common-themes/1535
loop12         7:12   0  45,9M  1 loop /snap/snap-store/575
loop13         7:13   0  45,9M  1 loop /snap/snap-store/582
loop14         7:14   0    47M  1 loop /snap/snapd/16010
loop15         7:15   0    47M  1 loop /snap/snapd/16292
loop16         7:16   0   284K  1 loop /snap/snapd-desktop-integration/10
loop17         7:17   0   284K  1 loop /snap/snapd-desktop-integration/14
loop18         7:18   0   345M  1 loop /snap/telegram-desktop/4095
loop19         7:19   0   345M  1 loop /snap/telegram-desktop/4116
loop20         7:20   0 230,2M  1 loop /snap/racket/2
loop21         7:21   0 414,3M  1 loop /snap/gnome-42-2204/29
loop22         7:22   0  63,2M  1 loop /snap/core20/1623
loop23         7:23   0 169,4M  1 loop /snap/spotify/60
sda            8:0    0 931,5G  0 disk
├─sda1         8:1    0   999M  0 part
└─sda2         8:2    0 930,5G  0 part
nvme0n1      259:0    0 238,5G  0 disk
├─nvme0n1p1 259:1    0   450M  0 part
├─nvme0n1p2 259:2    0   100M  0 part /boot/efi
├─nvme0n1p3 259:3    0    16M  0 part
├─nvme0n1p4 259:4    0 130,9G  0 part
├─nvme0n1p5 259:5    0   777M  0 part
└─nvme0n1p6 259:6    0 106,3G  0 part /
iviosab@iviosab:~/Desktop/GitHub/F22-SNA/Week-2$
```

We can see that the only bootable deceive is nvme0n1
And bootable partition in that device is the second one (nvme0n1p2)

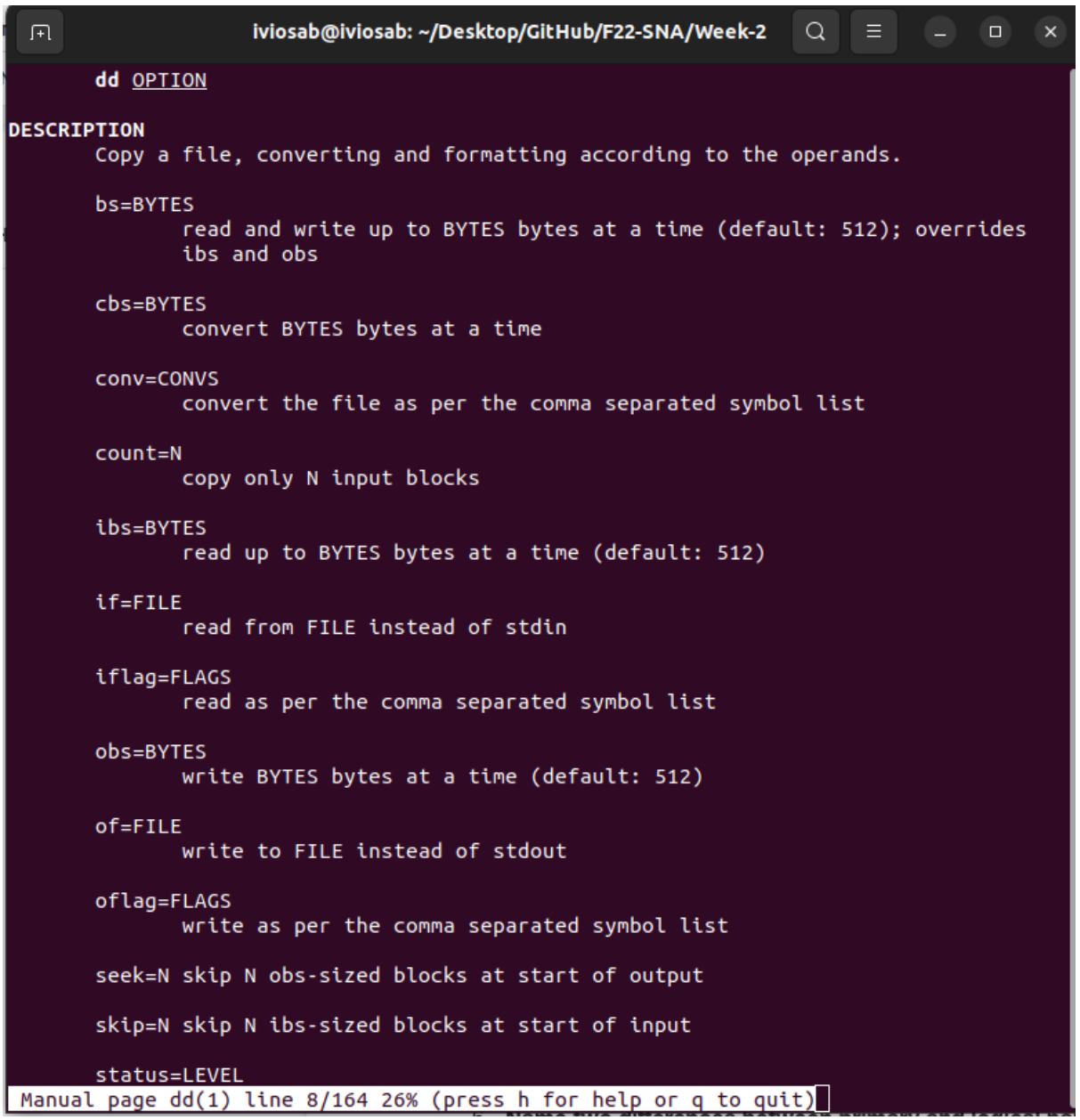
Q3: What is logical block address?

Answer:
Logical block addressing (LBA) is a common scheme used for specifying the location of blocks of data stored on computer storage devices, generally secondary storage systems such as hard disk drives. LBA is a particularly simple linear addressing scheme; blocks are located by an integer index, with the first block being LBA 0, the second LBA 1, and so on.

Q4: Why did we specify the count, the bs, and the skip options when using dd?

Answer:

“bs” means the number of bytes to read or write at a time
“count“ means the number of input blocks you want to copy
“skip” means the number of blocks we want to skip before copying
So basically we indicate how much we read or write each time, then indicate the number of times we want to read, then indicate where we want to start copying



Q5: Why does a GPT formatted disk have the MBR?

Answer:
The main purpose of inserting the MBR at the start of disk is strictly for protection. MBR-oriented disk utilities have the possibility of not recognizing or even writing over top of the GPT disks. To prevent this, the entire GPT disk is labeled as one partition. The System ID of this partitoin is established as 0xEE, indicating the implementation of the GPT.

Q6: Name two differences between primary and logical partitions in an MBR partitioning scheme

Answer:

Primary partition is a bootable partition and it contains the operating system/s of the computer, while logical partition is a partition that is not bootable.
Logical partitions are similar to primary partitions. However, while only four primary partitions can exist on a single disk, the number of logical partitions that can exist on a disk is unlimited. A logical partition can be formatted and assigned a drive letter.

Exercise 2 - UEFI Booting

Questions to answer

Q1: Why is Shim used to load the GRUB bootloader?

Answer:

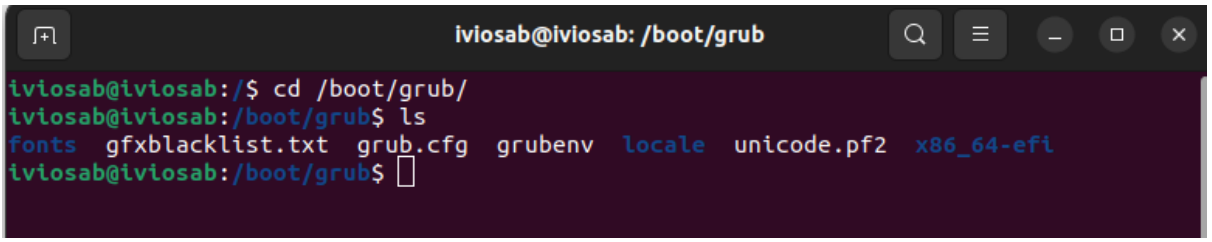
Shim acts as a pre-bootloader where it mounts all the efi drivers in the boot directory in ubuntu, so that the real bootloader GRUB loads utilizing the drivers the shim has written in the file system.

Q2: Can you locate your grub configuration file? Show the path.

Answer:

Yes we can, by using “cd /boot/grub”

So the path will be “/boot/grub/grub.cfg”



Q3: According to the boot order, what is the third boot device on your computer? How did you check this?

Answer:

The third boot device is EFI USB Device RC

I checked this by opening the “efibootmgr -v” and checking the bootOrder, then locating the id of the third device which was 2001, then locating the information about that device.

```
iviosab@iviosab:/boot/grub$ efibootmgr -v
BootCurrent: 0000
Timeout: 0 seconds
BootOrder: 0000,0004,2001,2002,2003
Boot0000* ubuntu        HD(2,GPT,7d202dd1-57c6-42ae-abff-ff88e849804a,0xe1800,0x32000
)/File(\EFI\ubuntu\shimx64.efi)
Boot0002* EFI PXE 0 for IPv4 (00-2B-67-F1-63-5C)        PciRoot(0x0)/Pci(0x1d,0x6)/Pc
i(0x0,0x0)/MAC(002b67f1635c,0)/IPv4(0.0.0.00.0.0.0,0,0)RC
Boot0003* EFI PXE 0 for IPv6 (00-2B-67-F1-63-5C)        PciRoot(0x0)/Pci(0x1d,0x6)/Pc
i(0x0,0x0)/MAC(002b67f1635c,0)/IPv6([::]:<->[::]:,0,0)RC
Boot0004* Windows Boot Manager  HD(2,GPT,7d202dd1-57c6-42ae-abff-ff88e849804a,0xe1800
,0x32000)/File(\EFI\Microsoft\Boot\bootmgfw.efi)WINDOWS.........x...B.C.D.O.B.J.E.C.T
.=.{.9.d.e.a.8.6.2.c.-.5.c.d.d.-.4.e.7.0.-.a.c.c.1.-.f.3.2.b.3.4.4.d.4.7.9.5.}...M...
............
Boot2001* EFI USB Device        RC
Boot2002* EFI DVD/CDROM RC
Boot2003* EFI Network   RC
iviosab@iviosab:/boot/grub$
```

Exercise 3: Filesystem

Questions to answer

Q1: How many inodes are in use on your system?

Answer:

I have 559180 inode in use

```
bash: /: is a directory
iviosab@iviosab:/$ df -i
Filesystem      Inodes  IUsed   IFree IUse% Mounted on
tmpfs          2036168   1426 2034742    1% /run
/dev/nvme0n1p6 6971392 557152 6414240    8% /
tmpfs          2036168    409 2035759    1% /dev/shm
tmpfs          2036168      3 2036165    1% /run/lock
/dev/nvme0n1p2       0      0       0     - /boot/efi
tmpfs           407233    190  407043    1% /run/user/1000
iviosab@iviosab:/$
```

Q2: What is the filesystem type of the EFI partition?

Answer:

FAT32
Using “lsblk -r” command

```
nvme0n1
│
├─nvme0n1p1
│    ntfs         Recovery
│                      BA1C8E0B1C8DC33D
├─nvme0n1p2
│    vfat   FAT32       248F-14E7                            65,8M    31% /boot/efi
├─nvme0n1p3
│
├─nvme0n1p4
│    ntfs               01D88E5CAFF9D1B0
├─nvme0n1p5
│    ntfs               AA8AB64C8AB614B3
└─nvme0n1p6
     ext4   1.0         ad47611f-ca53-4a26-9508-28ee50c32a40   58,5G    39% /
iviosab@iviosab:/$
```

Q3: What device is mounted at your root / directory? Show proof.

Answer:

nvme0n1 is the device mounted at my root directory
Specifically nvme0n1p6 partition

```
nvme0n1
│
├─nvme0n1p1
│    ntfs         Recovery
│                      BA1C8E0B1C8DC33D
├─nvme0n1p2
│    vfat   FAT32       248F-14E7                              65,8M    31% /boot/efi
├─nvme0n1p3
│
├─nvme0n1p4
│    ntfs               01D88E5CAFF9D1B0
├─nvme0n1p5
│    ntfs               AA8AB64C8AB614B3
└─nvme0n1p6
     ext4   1.0         ad47611f-ca53-4a26-9508-28ee50c32a40   58,5G    39% /
iviosab@iviosab:/$ mount /
mount: /: must be superuser to use mount.
iviosab@iviosab:/$ sudo mount /
mount: /: /dev/nvme0n1p6 already mounted on /.
iviosab@iviosab:/$
```

Q4: What is your partition UUID?

Answer:

UUID="ad47611f-ca53-4a26-9508-28ee50c32a40"

```
iviosab@iviosab:/$ sudo blkid | grep UUID=
/dev/nvme0n1p6: UUID="ad47611f-ca53-4a26-9508-28ee50c32a40" BLOCK_SIZE="4096" TYPE="e
xt4" PARTUUID="ed142395-9c13-44a4-83a7-059fd48656af"
/dev/nvme0n1p5: BLOCK_SIZE="512" UUID="AA8AB64C8AB614B3" TYPE="ntfs" PARTUUID="d1995c
63-6fb8-430b-8918-1aaba8a5e6f0"
/dev/nvme0n1p1: LABEL="Recovery" BLOCK_SIZE="512" UUID="BA1C8E0B1C8DC33D" TYPE="ntfs"
 PARTLABEL="Basic data partition" PARTUUID="35488e0e-8f39-4313-9531-ac2c7162f322"
/dev/nvme0n1p4: BLOCK_SIZE="512" UUID="01D88E5CAFF9D1B0" TYPE="ntfs" PARTLABEL="Basic
 data partition" PARTUUID="35e0822d-e769-46ba-af27-a2f660c683f0"
/dev/nvme0n1p2: UUID="248F-14E7" BLOCK_SIZE="512" TYPE="vfat" PARTLABEL="EFI system p
artition" PARTUUID="7d202dd1-57c6-42ae-abff-ff88e849804a"
/dev/sda2: LABEL="New Volume" BLOCK_SIZE="512" UUID="B69448D794489C2D" TYPE="ntfs"
/dev/sda1: UUID="EE5C-6E50" BLOCK_SIZE="512" TYPE="vfat"
/dev/nvme0n1p3: PARTLABEL="Microsoft reserved partition" PARTUUID="7af755cb-c080-4331
-a191-b3bcb3a07e6c"
iviosab@iviosab:/$
```

Q5: Show at least two methods of viewing the UUID of a block device.

Answer:

1) “blkid”

```
iviosab@iviosab:/$ sudo blkid | grep UUID=
/dev/nvme0n1p6: UUID="ad47611f-ca53-4a26-9508-28ee50c32a40" BLOCK_SIZE="4096" TYPE="e
xt4" PARTUUID="ed142395-9c13-44a4-83a7-059fd48656af"
/dev/nvme0n1p5: BLOCK_SIZE="512" UUID="AA8AB64C8AB614B3" TYPE="ntfs" PARTUUID="d1995c
63-6fb8-430b-8918-1aaba8a5e6f0"
/dev/nvme0n1p1: LABEL="Recovery" BLOCK_SIZE="512" UUID="BA1C8E0B1C8DC33D" TYPE="ntfs"
 PARTLABEL="Basic data partition" PARTUUID="35488e0e-8f39-4313-9531-ac2c7162f322"
/dev/nvme0n1p4: BLOCK_SIZE="512" UUID="01D88E5CAFF9D1B0" TYPE="ntfs" PARTLABEL="Basic
 data partition" PARTUUID="35e0822d-e769-46ba-af27-a2f660c683f0"
/dev/nvme0n1p2: UUID="248F-14E7" BLOCK_SIZE="512" TYPE="vfat" PARTLABEL="EFI system p
artition" PARTUUID="7d202dd1-57c6-42ae-abff-ff88e849804a"
/dev/sda2: LABEL="New Volume" BLOCK_SIZE="512" UUID="B69448D794489C2D" TYPE="ntfs"
/dev/sda1: UUID="EE5C-6E50" BLOCK_SIZE="512" TYPE="vfat"
/dev/nvme0n1p3: PARTLABEL="Microsoft reserved partition" PARTUUID="7af755cb-c080-4331
-a191-b3bcb3a07e6c"
iviosab@iviosab:/$
```

2) “lsblk -f”

```
iviosab@iviosab:/$ lsblk -f | grep -v loop
NAME        FSTYPE   FSVER LABEL      UUID                                 FSAVAIL FS
USE% MOUNTPOINTS
sda

├─sda1      vfat     FAT32            EE5C-6E50

└─sda2      ntfs           New Volume B69448D794489C2D

nvme0n1

├─nvme0n1p1 ntfs           Recovery   BA1C8E0B1C8DC33D

├─nvme0n1p2 vfat     FAT32            248F-14E7                              65,8M
 31% /boot/efi
├─nvme0n1p3

├─nvme0n1p4 ntfs                      01D88E5CAFF9D1B0

├─nvme0n1p5 ntfs                      AA8AB64C8AB614B3

└─nvme0n1p6 ext4     1.0              ad47611f-ca53-4a26-9508-28ee50c32a40   58,5G
 39% /
iviosab@iviosab:/$
```

Q6: What is the function of /dev/zero?

Answer:

/dev/zero is a special file in Unix-like operating systems that provides as many null characters (ASCII NUL, 0x00) as are read from it. One of the typical uses is to provide a character stream for initializing data storage.