1.
   a) x86_64,Little Endian, 36 bits physical, 48 bits virtual (command: lscpu)
   b) 1, 4, 4 (command: lscpu)
   c) 128 KiB + 128 KiB, 1 MiB, 6 MiB (command: lscpu)
   d) Main memory : Total=8GB Free=1.8GB
   e) 248, 1, 247, 0, 0 (command: top)
   f) 3rd figure

```
labuser@sl2-25:~$ lscpu
Architecture:                  x86_64
CPU op-mode(s):                32-bit, 64-bit
Byte Order:                    Little Endian
Address sizes:                 36 bits physical, 48 bits virtual
CPU(s):                        4
On-line CPU(s) list:           0-3
Thread(s) per core:            1
Core(s) per socket:            4
Socket(s):                     1
NUMA node(s):                  1
Vendor ID:                     GenuineIntel
CPU family:                    6
Model:                         58
Model name:                    Intel(R) Core(TM) i5-3330 CPU @ 3.00GHz
Stepping:                      9
CPU MHz:                       1596.576
CPU max MHz:                   3200.0000
CPU min MHz:                   1600.0000
BogoMIPS:                      5986.68
Virtualization:                VT-x
L1d cache:                     128 KiB
L1i cache:                     128 KiB
L2 cache:                      1 MiB
L3 cache:                      6 MiB
```

```
labuser@sl2-25:~$ \cd /proc/
labuser@sl2-25:/proc$ cat meminfo
MemTotal:        8046636 kB
MemFree:         1816516 kB
MemAvailable:    6076072 kB
Buffers:          337172 kB
Cached:          4290396 kB
SwapCached:            0 kB
Active:          3151212 kB
Inactive:        2142700 kB
Active(anon):    1027880 kB
```

```
top - 15:49:33 up 24 days, 32 min,  1 user,  load average: 0.10, 0.23, 0.31
Tasks: 248 total,   1 running, 247 sleeping,   0 stopped,   0 zombie
%Cpu(s):  1.2 us,  0.3 sy,  0.0 ni, 98.5 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
MiB Mem :   7858.0 total,   1708.1 free,   1280.7 used,   4869.2 buff/cache
MiB Swap:   4096.0 total,   4096.0 free,      0.0 used.   5868.2 avail Mem
```

```
labuser@sl2-25:~$ df -h
Filesystem                           Size  Used Avail Use% Mounted on
udev                                 3.8G     0  3.8G   0% /dev
tmpfs                                786M  1.7M  785M   1% /run
/dev/mapper/ubuntu--vg-ubuntu--lv     58G   11G   44G  20% /
tmpfs                                3.9G   20M  3.9G   1% /dev/shm
tmpfs                                5.0M  4.0K  5.0M   1% /run/lock
tmpfs                                3.9G     0  3.9G   0% /sys/fs/cgroup
/dev/sda2                            976M  217M  693M  24% /boot
/dev/loop0                            56M   56M     0 100% /snap/core18/1944
/dev/loop1                            70M   70M     0 100% /snap/lxd/19188
freenas.cse.iitb.ac.in:/users         13T  4.0T  8.5T  32% /users
tmpfs                                786M   60K  786M   1% /run/user/1001
/dev/loop3                            56M   56M     0 100% /snap/core18/2538
/dev/loop4                            47M   47M     0 100% /snap/snapd/16292
/dev/loop5                            62M   62M     0 100% /snap/core20/1587
/dev/loop6                            68M   68M     0 100% /snap/lxd/22753
labuser@sl2-25:~$ █
```

2.

   (command: cat /proc/__PID__/status)

   Memory_1.c : VmSize: 6280 kB
               VmRSS: 5004 kB
   Memory_2.c : VmSize: 10184 kB
               VmRSS: 8452 kB
   Memory_3.c : VmSize: 6276 kB
               VmRSS: 4896 kB
   Memory_4.c : VmSize: 6272 kB
               VmRSS: 4904 kB

3.

   Number of subprocess = 4
   Command : ps -a

```
anand@Aspire:~/Downloads/lab1/object$ ps -a
   PID TTY          TIME CMD
  1354 tty2     00:28:16 Xorg
  1365 tty2     00:00:00 xf86-video-inte
  1491 tty2     00:00:00 gnome-session-b
 24629 pts/2    00:00:00 subprocesses
 24630 pts/2    00:00:00 subprocesses
 24631 pts/2    00:00:00 subprocesses
 24632 pts/2    00:00:00 subprocesses
 24638 pts/1    00:00:00 ps
```

4.

   Strace shows system calls and signals involved in a process
   ./empty

execve(), brk(), arch_prctl(), mmap(), access(), openat(), newfstatat(), close(),
read(), pread64(), WRITE(), set_tid_address(), set_robust_list(), rseq(), mprotect(), prlimit64(),
munmap(), exit_group()

./ hello
execve(), brk(), arch_prctl(), mmap(), access(), openat(), newfstatat(), close(), read(), pread64(),
WRITE(), read(), set_tid_address(), set_robust_list(), rseq(), mprotect(), prlimit64(), munmap(),
exit_group()

5.

```
labuser@sl2-25:~/Downloads/lab1/files$ lsof | grep openfiles
chmod\x20 92572                      labuser  txt      REG              253,0      8760
   3542007 /home/labuser/Downloads/lab1/files/openfiles
openfiles 92613                      labuser  cwd      DIR              253,0      4096
   3541977 /home/labuser/Downloads/lab1/files
openfiles 92613                      labuser  rtd      DIR              253,0      4096
        2 /
openfiles 92613                      labuser  txt      REG              253,0      8760
   3542007 /home/labuser/Downloads/lab1/files/openfiles
openfiles 92613                      labuser  mem      REG              253,0   2029592
   1059240 /usr/lib/x86_64-linux-gnu/libc-2.31.so
openfiles 92613                      labuser  mem      REG              253,0    191504
   1054528 /usr/lib/x86_64-linux-gnu/ld-2.31.so
openfiles 92613                      labuser    0u     CHR              136,7       0t0
       10 /dev/pts/7
openfiles 92613                      labuser    1u     CHR              136,7       0t0
       10 /dev/pts/7
openfiles 92613                      labuser    2u     CHR              136,7       0t0
       10 /dev/pts/7
openfiles 92613                      labuser    3w     REG              253,0         0
   1716537 /tmp/welocme to OS
openfiles 92613                      labuser    4w     REG              253,0         0
   1716556 /tmp/CS333
openfiles 92613                      labuser    5w     REG              253,0         0
   1716560 /tmp/CS347
labuser@sl2-25:~/Downloads/lab1/files$
```


6.

```
anand@Asptre:~/Downloads/lab1/strace$ df -al
df: /run/user/1000/doc: Operation not permitted
Filesystem     Type          1K-blocks      Used Available Use% Mounted on
sysfs          sysfs                 0         0         0    - /sys
proc           proc                  0         0         0    - /proc
udev           devtmpfs        3952064         0   3952064   0% /dev
devpts         devpts                0         0         0    - /dev/pts
tmpfs          tmpfs            797352      3896    793456   1% /run
/dev/nvme0n1p8 ext4           71277712  60803580   6807700  90% /
securityfs     securityfs            0         0         0    - /sys/kernel/security
tmpfs          tmpfs           3986752    155940   3830812   4% /dev/shm
tmpfs          tmpfs              5120         4      5116   1% /run/lock
cgroup2        cgroup2               0         0         0    - /sys/fs/cgroup
pstore         pstore                0         0         0    - /sys/fs/pstore
efivarfs       efivarfs              0         0         0    - /sys/firmware/efi/efivars
bpf            bpf                   0         0         0    - /sys/fs/bpf
systemd-1      -                     -         -         -    - /proc/sys/fs/binfmt_misc
mqueue         mqueue                0         0         0    - /dev/mqueue
hugetlbfs      hugetlbfs             0         0         0    - /dev/hugepages
debugfs        debugfs               0         0         0    - /sys/kernel/debug
tracefs        tracefs               0         0         0    - /sys/kernel/tracing
fusectl        fusectl               0         0         0    - /sys/fs/fuse/connections
configfs       configfs              0         0         0    - /sys/kernel/config
none           ramfs                 0         0         0    - /run/credentials/systemd-sysusers.service
/dev/loop1     squashfs           9216      9216         0 100% /snap/canonical-livepatch/146
/dev/loop2     squashfs            128       128         0 100% /snap/bare/5
/dev/loop0     squashfs           9216      9216         0 100% /snap/canonical-livepatch/138
/dev/loop3     squashfs         116736    116736         0 100% /snap/core/13308
/dev/loop4     squashfs         116736    116736         0 100% /snap/core/13425
/dev/loop5     squashfs          56960     56960         0 100% /snap/core18/2409
/dev/loop6     squashfs          56960     56960         0 100% /snap/core18/2538
/dev/loop7     squashfs          63488     63488         0 100% /snap/core20/1587
/dev/loop8     squashfs          63488     63488         0 100% /snap/core20/1581
/dev/loop10    squashfs         167296    167296         0 100% /snap/firefox/1589
/dev/loop11    squashfs          33024     33024         0 100% /snap/fwupd/4247
/dev/loop12    squashfs          33024     33024         0 100% /snap/fwupd/4284
/dev/loop13    squashfs         168832    168832         0 100% /snap/gnome-3-28-1804/161
/dev/loop14    squashfs         224256    224256         0 100% /snap/gnome-3-34-1804/72
/dev/loop15    squashfs         224256    224256         0 100% /snap/gnome-3-34-1804/77
/dev/loop17    squashfs         410496    410496         0 100% /snap/gnome-3-38-2004/112
/dev/loop16    squashfs         260224    260224         0 100% /snap/gnome-3-38-2004/106
/dev/loop18    squashfs           1408      1408         0 100% /snap/gnome-chess/76
/dev/loop19    squashfs           1280      1280         0 100% /snap/gnome-chess/78
/dev/loop20    squashfs          83328     83328         0 100% /snap/gtk-common-themes/1534
/dev/loop21    squashfs          93952     93952         0 100% /snap/gtk-common-themes/1535
/dev/loop22    squashfs          11520     11520         0 100% /snap/hw-probe/1377
/dev/loop23    squashfs         434432    434432         0 100% /snap/kde-frameworks-5-91-qt-5-15-3-core20/1
/dev/loop24    squashfs         100480    100480         0 100% /snap/pyqt5-runtime-lite/4
/dev/loop25    squashfs           5120      5120         0 100% /snap/remote-touchpad/272
/dev/loop26    squashfs           5120      5120         0 100% /snap/remote-touchpad/273
```

7.
 objdump -s password.out
It shows all the contents where we can easily find "Password123".

PART 2.

In boot_sector1.bin , there is not any magic number whereas it is available in
boot_sector2.bin so BIOS does get to know that it is in boot sector.