The commands are ran on my local machine, so the answers may be different from the usual.

Exercise 1.

a. CPUs : 4
CPU sockets : 4
Cores per socket: 2, Total : 8

Command used: cat /proc /cpuinfo

b. The frequencies of CPUs are 1225.110 , 998.631, 862.648, 891.174 Mhz.
Command used : cat /proc /cpuinfo

c. Total Memory: 8085936 kB
Command used: cat /proc /meminfo

d. Free memory: 3746972 kB
Avaiable memory: 5276724 kB
Command used: cat /proc /meminfo

Difference:
Free memory is the memory that is currently unused by the system and contains no useful data at all. It is free for use by the system anytime.
Available memory is the memory that contains all the memory that is available for use by the system. It includes both free memory and cached memory.

e. Number of user level processes: 262
Command used: ps -A --no-headers | wc -l

f. Total number of context switches since boot up: 30391189

g. Size of all files are zero.
Despite of storing some information, how come the size is zero?

Exercise 2.

memory_1.c:
VmSize: 8292 kB
VmRSS: 816 kB

memory_2.c
VmSize: 12200 kB
VmRSS: 712 kB

memory_3.c
VmSize: 8296 kB
VmRSS: 3200 kB

memory_4.c
VmSize: 8292 kB
VmRSS: 5308 kB

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Command used: cat /proc /<process ID> /status

VmRSS is a measure of amount of RAM the process is consuming where as VmsSize includes RSS, shared files and memory mapped files.

Exercise 3.

Total number of processes created: 21
Number of child processes created: 20 (as one of them is parent process)

Command used: ps aux| grep “subprocesses”

Exercise 4.

The strace command traces system calls of a process.

Running ‘strace ./empty ‘ command I got the following output:

```
execve("./empty", ["./empty"], 0x7ffda30349d0 /* 52 vars */) = 0
brk(NULL)                               = 0x2181000
access("/etc/ld.so.nohwcap", F_OK)      = -1 ENOENT (No such file or directory)
access("/etc/ld.so.preload", R_OK)      = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=76071, ...}) = 0
mmap(NULL, 76071, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f0ba3efc000
close(3)                                = 0
access("/etc/ld.so.nohwcap", F_OK)      = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\260\34\2\0\0\0\0\0"..., 832) =
832
fstat(3, {st_mode=S_IFREG|0755, st_size=2030544, ...}) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f0ba3efa000
mmap(NULL, 4131552, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_DENYWRITE, 3, 0)
= 0x7f0ba38f7000
mprotect(0x7f0ba3ade000, 2097152, PROT_NONE) = 0
mmap(0x7f0ba3cde000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|
MAP_DENYWRITE, 3, 0x1e7000) = 0x7f0ba3cde000
mmap(0x7f0ba3ce4000, 15072, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|
MAP_ANONYMOUS, -1, 0) = 0x7f0ba3ce4000
close(3)                                = 0
arch_prctl(ARCH_SET_FS, 0x7f0ba3efb4c0) = 0
mprotect(0x7f0ba3cde000, 16384, PROT_READ) = 0
mprotect(0x600000, 4096, PROT_READ)     = 0
mprotect(0x7f0ba3f0f000, 4096, PROT_READ) = 0
munmap(0x7f0ba3efc000, 76071)           = 0
exit_group(0)                           = ?
+++ exited with 0 +++
```

The commands are ran on my local machine, so the answers may be different from the usual.

Runing “strace ./hello” command , and giving 1 as input I got the following output:

```
execve("./hello", ["./hello"], 0x7ffe41c4fdc0 /* 53 vars */) = 0
brk(NULL)                               = 0xf55000
access("/etc/ld.so.nohwcap", F_OK)      = -1 ENOENT (No such file or directory)
access("/etc/ld.so.preload", R_OK)      = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=76071, ...}) = 0
mmap(NULL, 76071, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f910b888000
close(3)                                = 0
access("/etc/ld.so.nohwcap", F_OK)      = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\260\34\2\0\0\0\0\0"..., 832) =
832
fstat(3, {st_mode=S_IFREG|0755, st_size=2030544, ...}) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f910b886000
mmap(NULL, 4131552, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_DENYWRITE, 3, 0)
= 0x7f910b283000
mprotect(0x7f910b46a000, 2097152, PROT_NONE) = 0
mmap(0x7f910b66a000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|
MAP_DENYWRITE, 3, 0x1e7000) = 0x7f910b66a000
mmap(0x7f910b670000, 15072, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|
MAP_ANONYMOUS, -1, 0) = 0x7f910b670000
close(3)                                = 0
arch_prctl(ARCH_SET_FS, 0x7f910b887500) = 0
mprotect(0x7f910b66a000, 16384, PROT_READ) = 0
mprotect(0x600000, 4096, PROT_READ)     = 0
mprotect(0x7f910b89b000, 4096, PROT_READ) = 0
munmap(0x7f910b888000, 76071)           = 0
getpid()                                = 4163
fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(136, 0), ...}) = 0
brk(NULL)                               = 0xf55000
brk(0xf76000)                           = 0xf76000
write(1, "\n", 1
)                 = 1
write(1, "Process ID : 4163 \n", 19Process ID : 4163
)    = 19
write(1, "\n", 1
)                 = 1
fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(136, 0), ...}) = 0
write(1, "Enter your name : ", 18Enter your name : )      = 18
read(0, 1
"1\n", 1024)              = 2
write(1, "\n", 1
)                 = 1
write(1, "Welcome 1\n", 10Welcome 1
)           = 10
lseek(0, -1, SEEK_CUR)                  = -1 ESPIPE (Illegal seek)
exit_group(0)                           = ?
```

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+++ exited with 0 +++

Clearly first part of both outputs are same. Hello as some extra syatem calls of write and read.

Exercise 5.

The files open by openfiles are:

```
COMMAND    PID  USER   FD   TYPE DEVICE SIZE/OFF     NODE NAME
openfiles 4908 panda  cwd    DIR    8,5     4096  2621558
/home/panda/Downloads/lab1/files
openfiles 4908 panda  rtd    DIR    8,5     4096        2 /
openfiles 4908 panda  txt    REG    8,5     8760  2621559
/home/panda/Downloads/lab1/files/openfiles
openfiles 4908 panda  mem    REG    8,5  2030544 21762640 /lib/x86_64-linux-gnu/libc-
2.27.so
openfiles 4908 panda  mem    REG    8,5   170960 21762612 /lib/x86_64-linux-gnu/ld-
2.27.so
openfiles 4908 panda    0u   CHR  136,0      0t0        3 /dev/pts/0
openfiles 4908 panda    1u   CHR  136,0      0t0        3 /dev/pts/0
openfiles 4908 panda    2u   CHR  136,0      0t0        3 /dev/pts/0
openfiles 4908 panda    3w   REG    8,5        0 15467751 /tmp/welocme to OS
openfiles 4908 panda    4w   REG    8,5        0 15467761 /tmp/CS333
openfiles 4908 panda    5w   REG    8,5        0 15467764 /tmp/CS347
```

Command used: ./openfiles
on another terminal: ps aux|grep ‘openfiles’
lsof -p <pid of the process>

Exercise 6.

```
major minor  #blocks  name

   7        0      30196 loop0
   7        1       3796 loop1
   7        2       3332 loop2
   7        3      21488 loop3
   7        4      14840 loop4
   7        5       2376 loop5
   7        6     143400 loop6
   7        7      13300 loop7
   8        0  976762584 sda
   8        1     562176 sda1
   8        2  488634600 sda2
   8        3          1 sda3
   8        5  487563264 sda5
   7        8       1652 loop8
```

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```
   7       9    144260 loop9
   7      10     88632 loop10
   7      11     12504 loop11
   7      12     88964 loop12
```

Command used: cat /proc /partitions