22M0761 - ABHISHEK DIXIT
Lab: Introduction to Linux Tools
Exercise Solution Report

1.(a) The command "more /proc/cpuinfo" displays information about the CPU including processor (numbered 0,1,2,3), BogoMIPS as 48.00 telling about frequency of CPU, Features which includes many acronyms and other details like CPU implementer, architecture, variant, part, revision for every processor.
Cores = Tells about the true number of separate hardware computing units.
Processors = Tells about number of threads in the CPU - which are virtual and not hardware based, so if 2 threads per core, number of processors = 2*(number of cores)

"lscpu" used for (b) to (e) , "top" used for (f) and (g)

1.(b) "Core(s) per socket: 4
Socket(s): 1" - means total number of cores is 4 = 4*1 (assigned to VM)

1.(c) "Thread(s) per core: 1" - means 1 thread/processor per core, so total number of processors = 4*1 = 4

1.(d) "BogoMIPS: 48.00" - As displayed by the "lscpu" command, it tells about frequency of CPU (exact frequency not displayed since Virtual Machine)

1.(e) "Architecture: aarch64" - As displayed by the "lscpu" command, it implies 64bit architecture of the CPU

1.(f) "MiB Mem : 1964.2 total" - represents 1964.2 mebibytes, that is (1964.2)*(2^20) bytes Physical memory (RAM) - obtained by using "top" command

1.(g) "88.9 free" - represents 88.9 mebibytes free physical memory, that is (88.9)*(2^20) bytes

1(h) "processes 4437" - represents number of process created using forks (found using "more /proc/stat")
"ctxt 1966051" - represents number of context switches

2.(a) "5424" - PID of "cpu" command process

2.(b) "100.0" - %CPU usage - since infinite loop is present.
"0.0" - %MEM - represents Memory usage

2.(c) "R" - means Running, the "S" column shows the status of the process.

3.(a) "7843" - is the "PID" of the "./cpu_print" process - using "ps -e"

3.(b) (using "ps -e -f")
"6017" - is the PPID (parent PID) of the "./cpu_print" (7843) process - that is, ancestor of 7843 has PID = "6017" and UID = "bash"
"3352" - is the PPID of "bash" (6017) process - that is, ancestor of 6017 has PID = "3352" and UID = "/usr/libexec/gnome-terminal-se"
"1398" - is the PPID of (3352) process - that is, ancestor of 3352 has PID = "1398" and UID = "/lib/systemd/systemd --user"
"1" - is the PPID of (1398) process - that is, ancestor of 1398 has PID = "1" and UID = "/sbin/init"

3.(c) (using "ls -l /proc/5371/fd") (where PID = 5371)
total 0
lrwx------ 1 abhishekdixit abhishekdixit 64 Aug 8 20:14 0 -> /dev/pts/0
l-wx------ 1 abhishekdixit abhishekdixit 64 Aug 8 20:14 1 -> /tmp/tmp.txt
lrwx------ 1 abhishekdixit abhishekdixit 64 Aug 8 20:14 2 -> /dev/pts/0

0 represents input, so input directory is "/dev/pts/0" which is default
1 represents output, so output storage directory is "/tmp/tmp.txt" - that is, output is being stored in the given "tmp.txt" file in "tmp" folder
2 represents error, so error directory is "/dev/pts/0" which is default
If input was taken from some file, it would be shown in "0" file descriptor.

3.(d) (using "ls -l /proc/4074/fd") (where PID = 4074)
total 0
lr-x------ 1 abhishekdixit abhishekdixit 64 Aug 9 13:43 0 -> 'pipe:[42075]'
lrwx------ 1 abhishekdixit abhishekdixit 64 Aug 9 13:43 1 -> /dev/pts/0

lrwx------ 1 abhishekdixit abhishekdixit 64 Aug 9 13:43 2 -> /dev/pts/0

In this case the input file descriptor(0) is showing directory as "pipe:[42075]" - so, by functioning of pipe, the output of program "./cpu-print" is being feed as input to "hello", that is, the output is being redirected to "hello".

3.(e) using command "help", all the bash builtin commands are displayed, so in the given commands, only "cd" and "history" are in the list
"cd" = it is a command builtin inside the bash
"ls" = it is run as an executable
"history" = it is a command builtin inside the bash
"ps" = it is run as an executable

---

4. Using command "ps -au"
Both processes have the same VSZ (virtual memory) but the RSS (physical memory) varies between them.This is because, the physical memory is given as per being currently used by the program, while the same initial amount of virtual memory is provided to all the programs.

abhishe+ 10720 0.0 0.0 5972 1132 pts/0   S+   15:01   0:00 ./memory1
abhishe+ 10722 0.0 0.1 5976 3420 pts/2   S+   15:01   0:00 ./memory2

---

5. (a) disk file) While running "./disk" and monitoring using "iostat", following output was received (relevant parts shown below) -
Conclusion - Since a large number of pdf files are being read, and RAM space is not enough, hence disk has to be continuously read to bring relevant files to memory, therefore the disk usage is high continuously until the program is killed, but the disk usage gets lower with time since some files are in memory.

“avg-cpu: %user   %nice %system %iowait %steal   %idle
          4.26   0.00   1.00   0.25   0.00   94.49

Device   tps   kB_read/s   kB_wrtn/s   kB_dscd/s   kB_read
kB_wrtn   kB_dscd
dm-0   3.00   0.00   16.00   0.00   0   16
          0

```
loop0             0.00         0.00         0.00         0.00         0         0         0
loop1             0.00         0.00         0.00         0.00         0         0         0
loop2             0.00         0.00         0.00         0.00         0         0         0
loop3             0.00         0.00         0.00         0.00         0         0         0
loop4             0.00         0.00         0.00         0.00         0         0         0
loop5             0.00         0.00         0.00         0.00         0         0         0
loop6             0.00         0.00         0.00         0.00         0         0         0
loop7             0.00         0.00         0.00         0.00         0         0         0
loop8             0.00         0.00         0.00         0.00         0         0         0
loop9             0.00         0.00         0.00         0.00         0         0         0
sr0               0.00         0.00         0.00         0.00         0         0         0
vda               4.00         0.00        40.00         0.00         0        40
          0

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           7.96   0.00   8.71   4.98   0.00   78.36

Device             tps    kB_read/s    kB_wrtn/s    kB_dscd/s    kB_read
kB_wrtn    kB_dscd
dm-0          13559.00    262572.00     41680.00         0.00    262572
41680          0
loop0             0.00         0.00         0.00         0.00         0         0         0
loop1             0.00         0.00         0.00         0.00         0         0         0
loop2             0.00         0.00         0.00         0.00         0         0         0
loop3             0.00         0.00         0.00         0.00         0         0         0
loop4             0.00         0.00         0.00         0.00         0         0         0
loop5             0.00         0.00         0.00         0.00         0         0         0
loop6             0.00         0.00         0.00         0.00         0         0         0
loop7             0.00         0.00         0.00         0.00         0         0         0
loop8             0.00         0.00         0.00         0.00         0         0         0
loop9             0.00         0.00         0.00         0.00         0         0         0
sr0               0.00         0.00         0.00         0.00         0         0         0
vda            3627.00    262572.00     41680.00         0.00    262572
41680          0

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           2.74   0.00  13.68  14.68       0.00   68.91
```

Device	tps	kB_read/s	kB_wrtn/s	kB_dscd/s	kB_read		
kB_wrtn	kB_dscd						
dm-0	20414.00	469604.00	59172.00	0.00	469604		
59172	0						
loop0	0.00	0.00	0.00	0.00	0	0	0
loop1	0.00	0.00	0.00	0.00	0	0	0
loop2	0.00	0.00	0.00	0.00	0	0	0
loop3	0.00	0.00	0.00	0.00	0	0	0
loop4	0.00	0.00	0.00	0.00	0	0	0
loop5	0.00	0.00	0.00	0.00	0	0	0
loop6	0.00	0.00	0.00	0.00	0	0	0
loop7	0.00	0.00	0.00	0.00	0	0	0
loop8	0.00	0.00	0.00	0.00	0	0	0
loop9	0.00	0.00	0.00	0.00	0	0	0
sr0	0.00	0.00	0.00	0.00	0	0	0
vda	7094.00	469456.00	59172.00	0.00	469456		
59172	0						

avg-cpu:	%user	%nice	%system	%iowait	%steal	%idle
	2.00	0.00	15.50	12.25	0.00	70.25

Device	tps	kB_read/s	kB_wrtn/s	kB_dscd/s	kB_read		
kB_wrtn	kB_dscd						
dm-0	18648.00	379632.00	53568.00	0.00	379632		
53568	0						
loop0	0.00	0.00	0.00	0.00	0	0	0
loop1	0.00	0.00	0.00	0.00	0	0	0
loop2	0.00	0.00	0.00	0.00	0	0	0
loop3	0.00	0.00	0.00	0.00	0	0	0
loop4	0.00	0.00	0.00	0.00	0	0	0
loop5	0.00	0.00	0.00	0.00	0	0	0
loop6	0.00	0.00	0.00	0.00	0	0	0
loop7	0.00	0.00	0.00	0.00	0	0	0
loop8	0.00	0.00	0.00	0.00	0	0	0
loop9	0.00	0.00	0.00	0.00	0	0	0
sr0	0.00	0.00	0.00	0.00	0	0	0
vda	6853.00	379780.00	53568.00	0.00	379780		
53568	0						

avg-cpu: %user %nice %system %iowait %steal %idle
4.01 0.00 16.54 12.28 0.00 67.17

Device	tps	kB_read/s	kB_wrtn/s	kB_dscd/s	kB_read	kB_wrtn	kB_dscd
dm-0	15847.00	294464.00	46452.00	0.00	294464	46452	0
loop0	0.00	0.00	0.00	0.00	0	0	0
loop1	0.00	0.00	0.00	0.00	0	0	0
loop2	0.00	0.00	0.00	0.00	0	0	0
loop3	0.00	0.00	0.00	0.00	0	0	0
loop4	0.00	0.00	0.00	0.00	0	0	0
loop5	0.00	0.00	0.00	0.00	0	0	0
loop6	0.00	0.00	0.00	0.00	0	0	0
loop7	0.00	0.00	0.00	0.00	0	0	0
loop8	0.00	0.00	0.00	0.00	0	0	0
loop9	0.00	0.00	0.00	0.00	0	0	0
sr0	0.00	0.00	0.00	0.00	0	0	0
vda	5990.00	294272.00	46168.00	0.00	294272	46168	0”

---

5. (b) disk1 file) While running "./disk1" and monitoring usage using "iostat", the following output is generated (given below) -
Conclusion - Only a small amount of disk read is detected because only 1 file is being read by the "./disk1" program continuously, and it is being cached in the RAM and hence, multiple disk reads are not necessary, hence after some disk read, 0 disk read is being done.

“avg-cpu: %user %nice %system %iowait %steal %idle
8.77 0.00 4.51 0.25 0.00 86.47

Device	tps	kB_read/s	kB_wrtn/s	kB_dscd/s	kB_read	kB_wrtn	kB_dscd
dm-0	121.00	1448.00	24.00	0.00	1448	24	0
loop0	0.00	0.00	0.00	0.00	0	0	0
loop1	0.00	0.00	0.00	0.00	0	0	0

```
loop2             0.00         0.00         0.00         0.00       0       0       0
loop3             0.00         0.00         0.00         0.00       0       0       0
loop4             0.00         0.00         0.00         0.00       0       0       0
loop5             0.00         0.00         0.00         0.00       0       0       0
loop6             0.00         0.00         0.00         0.00       0       0       0
loop7             0.00         0.00         0.00         0.00       0       0       0
loop8             0.00         0.00         0.00         0.00       0       0       0
loop9             0.00         0.00         0.00         0.00       0       0       0
sr0               0.00         0.00         0.00         0.00       0       0       0
vda              28.00      1448.00        24.00         0.00    1448              24
          0

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           9.95    0.00   17.91    0.00    0.00   72.14

Device             tps    kB_read/s    kB_wrtn/s    kB_dscd/s    kB_read
kB_wrtn      kB_dscd
dm-0             41.00       556.00         0.00         0.00        556              0
          0
loop0             0.00         0.00         0.00         0.00       0       0       0
loop1             0.00         0.00         0.00         0.00       0       0       0
loop2             0.00         0.00         0.00         0.00       0       0       0
loop3             0.00         0.00         0.00         0.00       0       0       0
loop4             0.00         0.00         0.00         0.00       0       0       0
loop5             0.00         0.00         0.00         0.00       0       0       0
loop6             0.00         0.00         0.00         0.00       0       0       0
loop7             0.00         0.00         0.00         0.00       0       0       0
loop8             0.00         0.00         0.00         0.00       0       0       0
loop9             0.00         0.00         0.00         0.00       0       0       0
sr0               0.00         0.00         0.00         0.00       0       0       0
vda              15.00       556.00         0.00         0.00        556              0
          0

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
          18.00    0.00   17.25    0.00    0.00   64.75

Device             tps    kB_read/s    kB_wrtn/s    kB_dscd/s    kB_read
kB_wrtn      kB_dscd
```

```
dm-0              38.00       152.00         0.00         0.00       152         0
          0
loop0              0.00         0.00         0.00         0.00         0         0         0
loop1              0.00         0.00         0.00         0.00         0         0         0
loop2              0.00         0.00         0.00         0.00         0         0         0
loop3              0.00         0.00         0.00         0.00         0         0         0
loop4              0.00         0.00         0.00         0.00         0         0         0
loop5              0.00         0.00         0.00         0.00         0         0         0
loop6              0.00         0.00         0.00         0.00         0         0         0
loop7              0.00         0.00         0.00         0.00         0         0         0
loop8              0.00         0.00         0.00         0.00         0         0         0
loop9              0.00         0.00         0.00         0.00         0         0         0
sr0                0.00         0.00         0.00         0.00         0         0         0
vda                6.00       152.00         0.00         0.00       152         0
          0

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
          15.84 0.00   19.31 0.00   0.00   64.85

Device             tps    kB_read/s    kB_wrtn/s    kB_dscd/s    kB_read
kB_wrtn      kB_dscd
dm-0              0.00         0.00         0.00         0.00         0         0         0
loop0             0.00         0.00         0.00         0.00         0         0         0
loop1             0.00         0.00         0.00         0.00         0         0         0
loop2             0.00         0.00         0.00         0.00         0         0         0
loop3             0.00         0.00         0.00         0.00         0         0         0
loop4             0.00         0.00         0.00         0.00         0         0         0
loop5             0.00         0.00         0.00         0.00         0         0         0
loop6             0.00         0.00         0.00         0.00         0         0         0
loop7             0.00         0.00         0.00         0.00         0         0         0
loop8             0.00         0.00         0.00         0.00         0         0         0
loop9             0.00         0.00         0.00         0.00         0         0         0
sr0               0.00         0.00         0.00         0.00         0         0         0
vda               0.00         0.00         0.00         0.00         0         0         0”
```
