HPC ASSIGNMENT 13

lshw:

Display detailed hardware component information.

Input: - sudo lshw

Output: -

[sudo] password for user:

laptop-6in5e1d3

  description: Computer

  width: 64 bits

  capabilities: smp vsyscall32

 *-core

    description: Motherboard

    physical id: 0

  *-memory

      description: System memory

      physical id: 0

      size: 8GiB

  *-cpu

      product: Intel(R) Core(TM) i7-10750H CPU @ 2.60GHz

      vendor: Intel Corp.

      physical id: 1

      bus info: cpu@0

      version: 6.165.2

      width: 64 bits

capabilities: fpu fpu_exception wp vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse sse2 ss ht syscall nx pdpe1gb rdtscp x86-64 constant_tsc arch_perfmon rep_good nopl xtopology cpuid pni pclmulqdq vmx ssse3 fma cx16 pdcm pcid sse4_1 sse4_2 x2apic movbe popcnt aes xsave avx f16c rdrand hypervisor lahf_lm abm 3dnowprefetch invpcid_single ssbd ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi ept vpid ept_ad fsgsbase bmi1 avx2 smep bmi2 erms invpcid rdseed adx smap clflushopt xsaveopt xsavec xgetbv1 xsaves flush_l1d arch_capabilities

configuration: microcode=4294967295

  *-display:0

    description: 3D controller

    product: Microsoft Corporation

    vendor: Microsoft Corporation

    physical id: 2

    bus info: pci@6274:00:00.0

    version: 00

    width: 32 bits

    clock: 33MHz

    capabilities: bus_master cap_list

    configuration: driver=dxgkrnl latency=0

    resources: irq:0

  *-generic

    description: System peripheral

    product: Virtio file system

    vendor: Red Hat, Inc.

    physical id: 3

    bus info: pci@673b:00:00.0

    version: 01

width: 64 bits

clock: 33MHz

capabilities: msix bus_master cap_list

configuration: driver=virtio-pci latency=64

resources: iomemory:e0-df iomemory:e0-df iomemory:c0-bf irq:0 memory:e00000000-e00000fff memory:e00001000-e00001fff memory:c00000000-dfffffffff

 *-virtio1 UNCLAIMED

   description: Virtual I/O device

   physical id: 0

   bus info: virtio@1

   configuration: driver=virtiofs

*-display:1

   description: 3D controller

   product: Microsoft Corporation

   vendor: Microsoft Corporation

   physical id: 4

   bus info: pci@971b:00:00.0

   version: 00

   width: 32 bits

   clock: 33MHz

   capabilities: bus_master cap_list

   configuration: driver=dxgkrnl latency=0

   resources: irq:0

*-scsi:0

   description: SCSI storage controller

   product: Virtio console

vendor: Red Hat, Inc.

physical id: 5

bus info: pci@9def:00:00.0

version: 01

width: 64 bits

clock: 33MHz

capabilities: scsi msix bus_master cap_list

configuration: driver=virtio-pci latency=64

resources: iomemory:90-8f iomemory:90-8f iomemory:90-8f irq:0
memory:9ffe00000-9ffe00fff memory:9ffe01000-9ffe01fff
memory:9ffe02000-9ffe02fff

*-virtio0 UNCLAIMED

description: Virtual I/O device

physical id: 0

bus info: virtio@0

configuration: driver=virtio_console

*-pnp00:00

product: PnP device PNP0b00

physical id: 6

capabilities: pnp

configuration: driver=rtc_cmos

*-scsi:1

physical id: 7

logical name: scsi0

*-disk:0

description: SCSI Disk

product: Virtual Disk

vendor: Linux

physical id: 0.0.0

bus info: scsi@0:0.0.0

logical name: /dev/sda

version: 1.0

size: 388MiB

capabilities: extended_attributes large_files huge_files extents ext2 initialized

configuration: ansiversion=5 filesystem=ext2 logicalsectorsize=512 sectorsize=512 state=clean

   *-disk:1

description: Linux swap volume

product: Virtual Disk

vendor: Msft

physical id: 0.0.1

bus info: scsi@0:0.0.1

logical name: /dev/sdb

version: 1

serial: f9b3fa53-afbd-4af6-99b9-b7ce3182ac64

size: 2GiB

capacity: 2GiB

capabilities: swap initialized

configuration: ansiversion=5 filesystem=swap logicalsectorsize=512 pagesize=4096 sectorsize=4096

   *-disk:2

description: EXT4 volume

product: Virtual Disk

vendor: Linux

physical id: 0.0.2

bus info: scsi@0:0.0.2

logical name: /dev/sdc

logical name: /

logical name: /mnt/wslg/distro

logical name: /snap

version: 1.0

serial: dca79db0-6b6e-4726-8879-ad73e977ae75

size: 1TiB

capabilities: journaled extended_attributes large_files huge_files dir_nlink recover 64bit extents ext4 ext2 initialized

configuration: ansiversion=5 created=2024-03-13 09:26:36 filesystem=ext4 lastmountpoint=/distro logicalsectorsize=512 modified=2024-03-13 21:03:01 mount.fstype=ext4 mount.options=rw,relatime,discard,errors=remount-ro,data=ordered mounted=2024-03-13 21:03:01 sectorsize=4096 state=mounted

*-usbhost:0

product: USB/IP Virtual Host Controller

vendor: Linux 5.15.146.1-microsoft-standard-WSL2 vhci_hcd

physical id: 1

bus info: usb@1

logical name: usb1

version: 5.15

capabilities: usb-2.00

configuration: driver=hub slots=8 speed=480Mbit/s

*-usbhost:1

product: USB/IP Virtual Host Controller

vendor: Linux 5.15.146.1-microsoft-standard-WSL2 vhci_hcd

physical id: 2

bus info: usb@2

logical name: usb2

version: 5.15

capabilities: usb-3.00

configuration: driver=hub slots=8 speed=5000Mbit/s

*-network

description: Ethernet interface

physical id: 3

logical name: eth0

serial: 00:15:5d:25:86:ef

size: 10Gbit/s

capabilities: ethernet physical

configuration: autonegotiation=off broadcast=yes driver=hv_netvsc driverversion=5.15.146.1-microsoft-standard-W duplex=full firmware=N/A ip=172.27.192.178 link=yes multicast=yes speed=10Gbit/s

lsusb:

List connected USB devices.

Input: -lsusb

Output: -
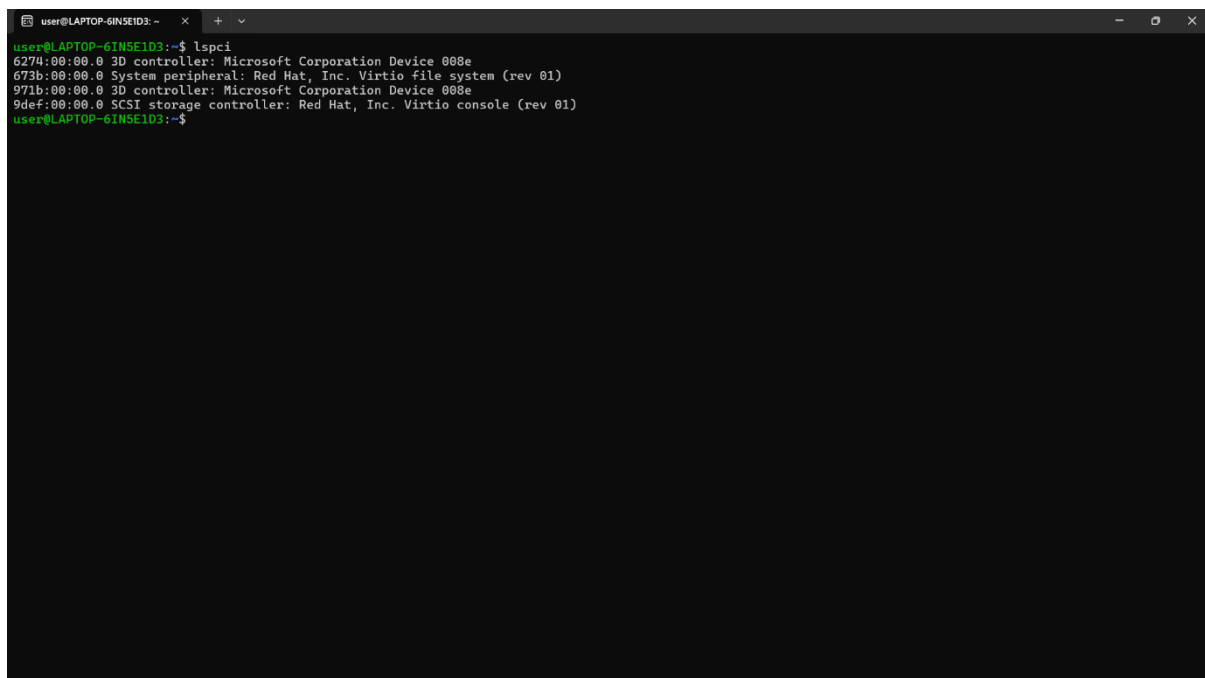
```
user@LAPTOP-6IN5E1D3:~$ lsusb
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
user@LAPTOP-6IN5E1D3:~$
```

lspci:

List installed PCI devices.

Input: - lspci

Output: -

```
user@LAPTOP-6IN5E1D3:~$ lspci
6274:00:00.0 3D controller: Microsoft Corporation Device 008e
673b:00:00.0 System peripheral: Red Hat, Inc. Virtio file system (rev 01)
971b:00:00.0 3D controller: Microsoft Corporation Device 008e
9def:00:00.0 SCSI storage controller: Red Hat, Inc. Virtio console (rev 01)
user@LAPTOP-6IN5E1D3:~$
```

lsblk:

 List block devices and their attributes.

Input: - lsblk

Output: -

```
user@LAPTOP-6IN5E1D3:~$ lsblk
NAME MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
sda    8:0    0 388.5M  1 disk
sdb    8:16   0     2G  0 disk [SWAP]
sdc    8:32   0     1T  0 disk /snap
                                /mnt/wslg/distro
                                /

user@LAPTOP-6IN5E1D3:~$
```

lscpu:

 Output CPU architecture and characteristics.

Input: - lscpu

Output: -

```
user@LAPTOP-6IN5E1D3:~$ lscpu
Architecture:          x86_64
  CPU op-mode(s):      32-bit, 64-bit
  Address sizes:       39 bits physical, 48 bits virtual
  Byte Order:          Little Endian
CPU(s):                12
  On-line CPU(s) list: 0-11
Vendor ID:             GenuineIntel
  Model name:          Intel(R) Core(TM) i7-10750H CPU @ 2.60GHz
    CPU family:        6
    Model:             165
    Thread(s) per core: 2
    Core(s) per socket: 6
    Socket(s):         1
    Stepping:          2
    BogoMIPS:          5184.01
    Flags:             fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse sse2 ss ht syscall nx pdpe1gb rdtscp l
                       m constant_tsc arch_perfmon rep_good nopl xtopology cpuid pni pclmulqdq vmx ssse3 fma cx16 pdcm pcid sse4_1 sse4_2 x2apic movbe pop
                       cnt aes xsave avx f16c rdrand hypervisor lahf_lm abm 3dnowprefetch invpcid_single ssbd ibrs ibpb stibp ibrs_enhanced tpr_shadow vnm
                       i ept vpid ept_ad fsgsbase bmi1 avx2 smep bmi2 erms invpcid rdseed adx smap clflushopt xsaveopt xsavec xgetbv1 xsaves flush_l1d arc
                       h_capabilities
Virtualization features:
  Virtualization:      VT-x
  Hypervisor vendor:   Microsoft
  Virtualization type: full
Caches (sum of all):
  L1d:                 192 KiB (6 instances)
  L1i:                 192 KiB (6 instances)
  L2:                  1.5 MiB (6 instances)
  L3:                  12 MiB (1 instance)
Vulnerabilities:
  Gather data sampling: Unknown: Dependent on hypervisor status
  Itlb multihit:       KVM: Mitigation: VMX disabled
  L1tf:                Not affected
  Mds:                 Not affected
  Meltdown:            Not affected
  Mmio stale data:     Vulnerable: Clear CPU buffers attempted, no microcode; SMT Host state unknown
  Retbleed:            Mitigation; Enhanced IBRS
  Spec rstack overflow: Not affected
  Spec store bypass:   Mitigation; Speculative Store Bypass disabled via prctl and seccomp
  Spectre v1:          Mitigation; usercopy/swapgs barriers and __user pointer sanitization
  Spectre v2:          Mitigation; Enhanced IBRS, IBPB conditional, RSB filling, PBRSB-eIBRS SW sequence
  Srbds:               Unknown: Dependent on hypervisor status
  Tsx async abort:     Not affected
```

df:

Show disk space usage and availability.

Input: -df

Output: -

```
user@LAPTOP-6IN5E1D3:~$ df
Filesystem       1K-blocks       Used  Available Use% Mounted on
none               4008568          4    4008564   1% /mnt/wsl
none             322598024  249724504   72873520  78% /usr/lib/wsl/drivers
none               4008568          0    4008568   0% /usr/lib/modules
none               4008568          0    4008568   0% /usr/lib/modules/5.15.146.1-microsoft-standard-WSL2
/dev/sdc         1055762868    1561820 1000497576   1% /
none               4008568         84    4008484   1% /mnt/wslg
none               4008568          0    4008568   0% /usr/lib/wsl/lib
rootfs             4005312       1884    4003428   1% /init
none               4008568        804    4007764   1% /run
none               4008568          0    4008568   0% /run/lock
none               4008568          0    4008568   0% /run/shm
tmpfs                 4096          0       4096   0% /sys/fs/cgroup
none               4008568         76    4008492   1% /mnt/wslg/versions.txt
none               4008568         76    4008492   1% /mnt/wslg/doc
C:\              322598024  249724504   72873520  78% /mnt/c
D:\              675838972  321099964  354739008  48% /mnt/d
G:\               15728640    1199208   14529432   8% /mnt/g
snapfuse               128        128          0 100% /snap/bare/5
snapfuse             75776      75776          0 100% /snap/core22/864
snapfuse             93952      93952          0 100% /snap/gtk-common-themes/1535
snapfuse             41856      41856          0 100% /snap/snapd/20290
snapfuse             40064      40064          0 100% /snap/snapd/21184
snapfuse            134272     134272          0 100% /snap/ubuntu-desktop-installer/1276
snapfuse            134912     134912          0 100% /snap/ubuntu-desktop-installer/1286
user@LAPTOP-6IN5E1D3:~$
```

dmidecode:

Decode and display DMI table information.

Input: - dmidecode

Output: -

```
user@LAPTOP-6IN5E1D3:~$ dmidecode
# dmidecode 3.3
Scanning /dev/mem for entry point.
/dev/mem: Permission denied
user@LAPTOP-6IN5E1D3:~$ sudo dmidecode
[sudo] password for user:
# dmidecode 3.3
Scanning /dev/mem for entry point.
# No SMBIOS nor DMI entry point found, sorry.
user@LAPTOP-6IN5E1D3:~$ |
```

ip a:

Show IP addresses and network information for all interfaces.

Input: - ip a

Output: -

```
user@LAPTOP-6IN5E1D3:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group default qlen 1000
    link/ether 00:15:5d:25:86:ef brd ff:ff:ff:ff:ff:ff
    inet 172.27.192.178/20 brd 172.27.207.255 scope global eth0
       valid_lft forever preferred_lft forever
    inet6 fe80::215:5dff:fe25:86ef/64 scope link
       valid_lft forever preferred_lft forever
user@LAPTOP-6IN5E1D3:~$
```

top:

Display real-time system resource usage.

Input: -top

Output: -

```
user@LAPTOP-6IN5E1D3:~$ top
top - 21:12:15 up 9 min,  1 user,  load average: 0.08, 0.04, 0.01
Tasks:  33 total,   1 running,  32 sleeping,   0 stopped,   0 zombie
%Cpu(s):  0.2 us,  0.1 sy,  0.0 ni, 99.7 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
MiB Mem :   7829.2 total,   6943.5 free,    505.5 used,    380.3 buff/cache
MiB Swap:   2048.0 total,   2048.0 free,      0.0 used.   7095.3 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
    1 root      20   0  165976  11108   8112 S   1.7   0.1   0:06.39 systemd
  416 root      20   0   44224  37964  10040 S   0.3   0.5   0:04.16 python3
    2 root      20   0    2280   1304   1188 S   0.0   0.0   0:00.00 init-systemd(Ub
    8 root      20   0    2280      4      0 S   0.0   0.0   0:00.00 init
   37 root      19  -1   47740  14920  13916 S   0.0   0.2   0:00.15 systemd-journal
   61 root      20   0   21976   5844   4492 S   0.0   0.1   0:00.24 systemd-udevd
   69 root      20   0    4496    144      0 S   0.0   0.0   0:00.00 snapfuse
   70 root      20   0    4764   1780   1244 S   0.0   0.0   0:01.14 snapfuse
   74 root      20   0    4628    196     48 S   0.0   0.0   0:00.00 snapfuse
   81 root      20   0    4496    160     12 S   0.0   0.0   0:00.00 snapfuse
   84 root      20   0    4744   1800   1284 S   0.0   0.0   0:03.52 snapfuse
   88 root      20   0    4496    184     36 S   0.0   0.0   0:00.00 snapfuse
   89 root      20   0    4744   1808   1312 S   0.0   0.0   0:01.68 snapfuse
   96 systemd+  20   0   25540  12676   8480 S   0.0   0.2   0:00.20 systemd-resolve
  113 root      20   0    4308   2744   2512 S   0.0   0.0   0:00.00 cron
  114 message+  20   0    8588   4632   4092 S   0.0   0.1   0:00.04 dbus-daemon
  137 root      20   0   30100  19064  10284 S   0.0   0.2   0:00.14 networkd-dispat
  138 syslog    20   0  222404   6956   4404 S   0.0   0.1   0:00.02 rsyslogd
  139 root      20   0 1911120  42456  17988 S   0.0   0.5   0:00.52 snapd
  143 root      20   0   15332   7364   6420 S   0.0   0.1   0:00.13 systemd-logind
  197 root      20   0    4784   3188   2936 S   0.0   0.0   0:00.10 subiquity-serve
  207 root      20   0    3240   1052    964 S   0.0   0.0   0:00.00 agetty
  214 root      20   0    3196   1064    976 S   0.0   0.0   0:00.00 agetty
  215 root      20   0  107224  21256  13144 S   0.0   0.3   0:00.10 unattended-upgr
  328 root      20   0  154620  70824  17960 S   0.0   0.9   0:03.92 python3.10
  364 root      20   0    7528   4924   4000 S   0.0   0.1   0:00.01 login
  398 user      20   0   16916   8908   7452 S   0.0   0.1   0:00.07 systemd
  399 user      20   0  168900   3504     16 S   0.0   0.0   0:00.00 (sd-pam)
  404 user      20   0    6124   4916   3320 S   0.0   0.1   0:00.01 bash
 1548 root      20   0    2296    120      0 S   0.0   0.0   0:00.00 SessionLeader
 1549 root      20   0    2296    128      0 S   0.0   0.0   0:00.01 Relay(1555)
 1555 user      20   0    6212   5136   3412 S   0.0   0.1   0:00.07 bash
 2597 user      20   0    7792   3720   3120 R   0.0   0.0   0:00.00 top
```

htop:

Interactive version of top with enhanced visualization.

Input: -htop

Output: -

nvidia-smi:

Provide management for NVIDIA GPU devices.

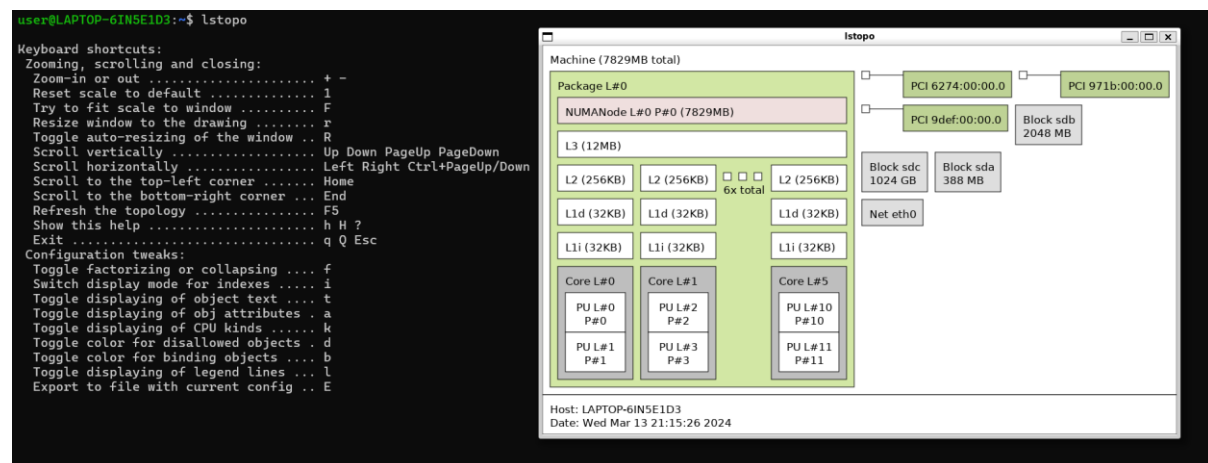Input: - nvidia-smi

Output: -

lstopo:

Generate graphical system topology representation.

Input: -lstopo

Output: -

perf:

Collect and analyze performance data.

Input: -perf

Output: -

numactl:

Control and monitor NUMA policy on NUMA systems.

Input: - numactl

Output: -

```
user@LAPTOP-6IN5E1D3:~$ numactl
usage: numactl [--all | -a] [--interleave= | -i <nodes>] [--preferred= | -p <node>]
               [--physcpubind= | -C <cpus>] [--cpunodebind= | -N <nodes>]
               [--membind= | -m <nodes>] [--localalloc | -l] command args ...
       numactl [--show | -s]
       numactl [--hardware | -H]
       numactl [--length | -l <length>] [--offset | -o <offset>] [--shmmode | -M <shmmode>]
               [--strict | -t]
               [--shmid | -I <id>] --shm | -S <shmkeyfile>
               [--shmid | -I <id>] --file | -f <tmpfsfile>
               [--huge | -u] [--touch | -T]
               memory policy | --dump | -d | --dump-nodes | -D

memory policy is --interleave | -i, --preferred | -p, --membind | -m, --localalloc | -l
<nodes> is a comma delimited list of node numbers or A-B ranges or all.
Instead of a number a node can also be:
  netdev:DEV the node connected to network device DEV
  file:PATH  the node the block device of path is connected to
  ip:HOST    the node of the network device host routes through
  block:PATH the node of block device path
  pci:[seg:]bus:dev[:func] The node of a PCI device
<cpus> is a comma delimited list of cpu numbers or A-B ranges or all
all ranges can be inverted with !
all numbers and ranges can be made cpuset-relative with +
the old --cpubind argument is deprecated.
use --cpunodebind or --physcpubind instead
<length> can have g (GB), m (MB) or k (KB) suffixes
user@LAPTOP-6IN5E1D3:~$
```

sar:

Collect and analyze system activity data over time.

Input: - sar -u 1 10

Output: -

```
user@LAPTOP-6IN5E1D3:~$ sar -u 1 10
Linux 5.15.146.1-microsoft-standard-WSL2 (LAPTOP-6IN5E1D3)      03/13/24       _x86_64_        (12 CPU)

22:06:39        CPU      %user     %nice   %system   %iowait    %steal     %idle
22:06:40        all       0.08      0.00      0.17      0.00      0.00     99.75
22:06:41        all       0.08      0.00      0.08      0.00      0.00     99.83
22:06:42        all       0.00      0.00      0.17      0.00      0.00     99.83
22:06:43        all       0.08      0.00      0.00      0.00      0.00     99.92
22:06:44        all       0.17      0.00      0.00      0.00      0.00     99.83
22:06:45        all       0.00      0.00      0.00      0.00      0.00    100.00
22:06:46        all       0.00      0.00      0.00      0.00      0.00    100.00
22:06:47        all       0.08      0.00      0.00      0.00      0.00     99.92
22:06:48        all       0.08      0.00      0.17      0.00      0.00     99.75
22:06:49        all       0.08      0.00      0.00      0.00      0.00     99.92
Average:        all       0.07      0.00      0.06      0.00      0.00     99.88
user@LAPTOP-6IN5E1D3:~$
```

Input: - sar -r 60 5

Output: -

```
user@LAPTOP-6IN5E1D3:~$ sar -r 60 5
Linux 5.15.146.1-microsoft-standard-WSL2 (LAPTOP-6IN5E1D3)      03/13/24     _x86_64_      (12 CPU)

22:29:00    kbmemfree   kbavail kbmemused  %memused kbbuffers  kbcached  kbcommit   %commit kbactive   kbinact   kbdirty
22:30:00      7070956   7236824    492196      6.14     13732    355448    844528      8.35    99232    512988         0
22:31:00      7070264   7236132    492856      6.15     13732    355448    845600      8.36    99240    513400         0
22:32:00      7073932   7239812    489144      6.10     13740    355448    842768      8.33    99244    511808         0
22:33:00      7074040   7239920    489008      6.10     13740    355448    841828      8.32    99236    511404         0
22:34:00      7079396   7245228    483644      6.03     13740    355448    838996      8.30    99188    509576         0
Average:      7073718   7239583    489370      6.10     13737    355448    842744      8.33    99228    511835         0
user@LAPTOP-6IN5E1D3:~$
```

Input: - sar -d 5 30

Output: -

```
user@LAPTOP-6IN5E1D3:~$ sar -d 5 30
Linux 5.15.146.1-microsoft-standard-WSL2 (LAPTOP-6IN5E1D3)      03/13/24        _x86_64_        (12 CPU)

22:32:23        DEV        tps       rkB/s       wkB/s       dkB/s      areq-sz     aqu-sz      await       %util
22:32:28        sda        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00
22:32:28        sdb        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00
22:32:28        sdc        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00

22:32:28        DEV        tps       rkB/s       wkB/s       dkB/s      areq-sz     aqu-sz      await       %util
22:32:33        sda        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00
22:32:33        sdb        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00
22:32:33        sdc        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00

22:32:33        DEV        tps       rkB/s       wkB/s       dkB/s      areq-sz     aqu-sz      await       %util
22:32:38        sda        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00
22:32:38        sdb        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00
22:32:38        sdc        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00

22:32:38        DEV        tps       rkB/s       wkB/s       dkB/s      areq-sz     aqu-sz      await       %util
22:32:43        sda        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00
22:32:43        sdb        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00
22:32:43        sdc        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00
^C

Average:        DEV        tps       rkB/s       wkB/s       dkB/s      areq-sz     aqu-sz      await       %util
Average:        sda        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00
Average:        sdb        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00
Average:        sdc        0.00       0.00        0.00        0.00        0.00       0.00        0.00        0.00
user@LAPTOP-6IN5E1D3:~$
```