

National Institute of Technology Karnataka Surathkal,
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DEPARTMENT OF INFORMATION TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

LAB ASSIGNMENT 2

Submitted for Parallel Computing (IT301) By

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To

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[Code link](#)
[github](#)

Problem - 1

To get CPU information using cat command

```
$ cat /proc/cpuinfo
```

```
gko@root:/mnt/d/practice/cpp$ cat /proc/cpuinfo
processor       : 0
vendor_id     : GenuineIntel
cpu family    : 6
model         : 142
model name    : Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz
stepping      : 10
microcode    : 0xffffffff
cpu MHz       : 1799.999
cache size    : 6144 KB
physical id   : 0
siblings      : 8
core id       : 0
cpu cores     : 4
apicid        : 0
initial apicid : 0
fpu           : yes
fpu_exception : yes
cpuid level   : 21
wp            : yes
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 1
m constant_tsc rep_good nopl xtopology cpuid pni pclmulqdq ssse3 fma cx16 pcid sse4_1 sse4_2 movbe popcnt aes xsave avx f16c rdrand hypervisor lahf_1
m abm 3dnowprefetch invpcid_single pti ssbd ibrs ibpb stibp fsgsbase bmi1 avx2 smep bmi2 erms invpcid rdseed adx smap clflushopt xsaveopt xsavec xget
bv1 xsave flush_l1d arch_capabilities
bugs          : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swapgs itlb_multihit srbds
bogomips      : 3599.99
clflush size   : 64
cache_alignment : 64
address sizes  : 39 bits physical, 48 bits virtual
power management:
```

```
processor       : 1
vendor_id     : GenuineIntel
cpu family    : 6
model         : 142
model name    : Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz
stepping      : 10
microcode    : 0xffffffff
cpu MHz       : 1799.999
cache size    : 6144 KB
physical id   : 0
siblings      : 8
core id       : 0
cpu cores     : 4
apicid        : 1
initial apicid : 1
fpu           : yes
fpu_exception : yes
cpuid level   : 21
wp            : yes
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 1
m constant_tsc rep_good nopl xtopology cpuid pni pclmulqdq ssse3 fma cx16 pcid sse4_1 sse4_2 movbe popcnt aes xsave avx f16c rdrand hypervisor lahf_1
m abm 3dnowprefetch invpcid_single pti ssbd ibrs ibpb stibp fsgsbase bmi1 avx2 smep bmi2 erms invpcid rdseed adx smap clflushopt xsaveopt xsavec xget
bv1 xsave flush_l1d arch_capabilities
bugs          : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swapgs itlb_multihit srbds
bogomips      : 3599.99
clflush size   : 64
cache_alignment : 64
address sizes  : 39 bits physical, 48 bits virtual
power management:
```

```
processor       : 2
vendor_id     : GenuineIntel
cpu family    : 6
model         : 142
model name    : Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz
stepping      : 10
microcode    : 0xffffffff
cpu MHz       : 1799.999
cache size    : 6144 KB
physical id   : 0
siblings      : 8
core id       : 1
cpu cores     : 4
apicid        : 2
initial apicid : 2
fpu           : yes
fpu_exception : yes
cpuid level   : 21
wp            : yes
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 1
m constant_tsc rep_good nopl xtopology cpuid pni pclmulqdq ssse3 fma cx16 pcid sse4_1 sse4_2 movbe popcnt aes xsave avx f16c rdrand hypervisor lahf_1
m abm 3dnowprefetch invpcid_single pti ssbd ibrs ibpb stibp fsgsbase bmi1 avx2 smep bmi2 erms invpcid rdseed adx smap clflushopt xsaveopt xsavec xget
bv1 xsave flush_l1d arch_capabilities
bugs          : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swapgs itlb_multihit srbds
bogomips      : 3599.99
clflush size   : 64
cache_alignment : 64
address sizes  : 39 bits physical, 48 bits virtual
power management:
```

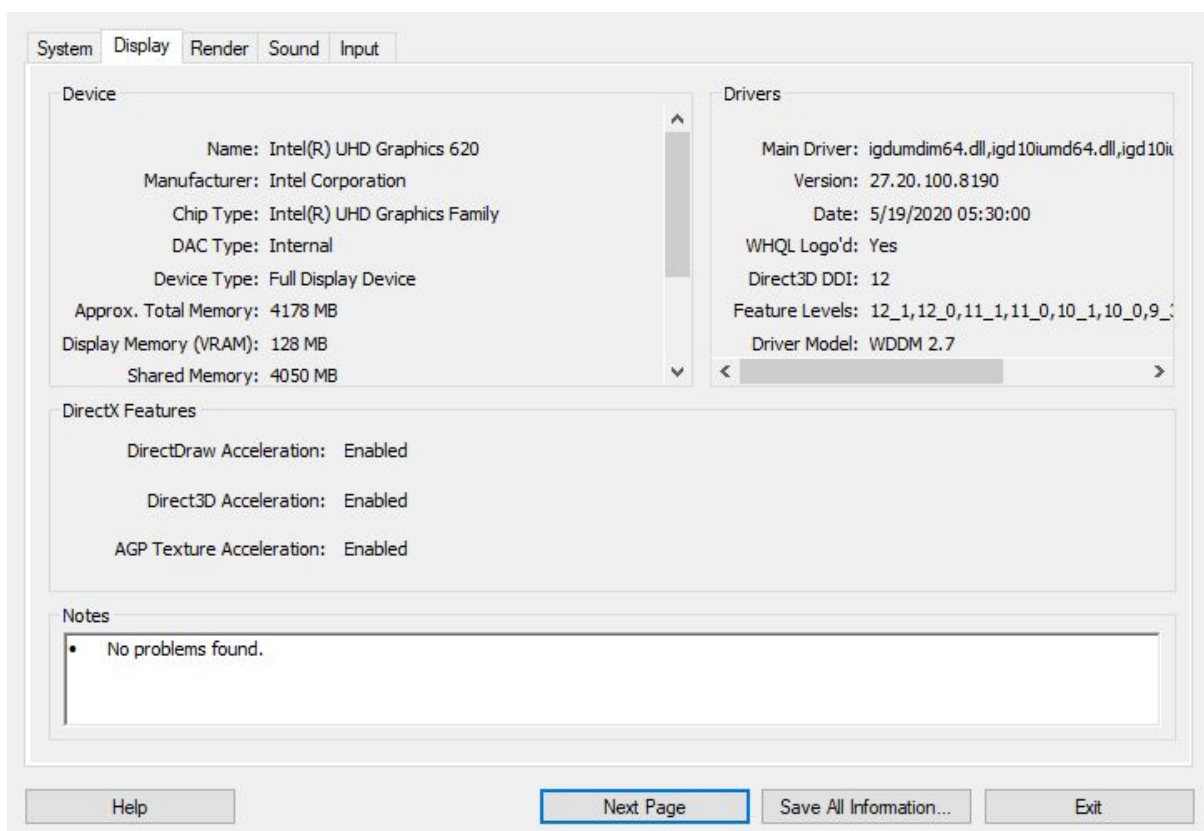
question) How many processors are there in your system?

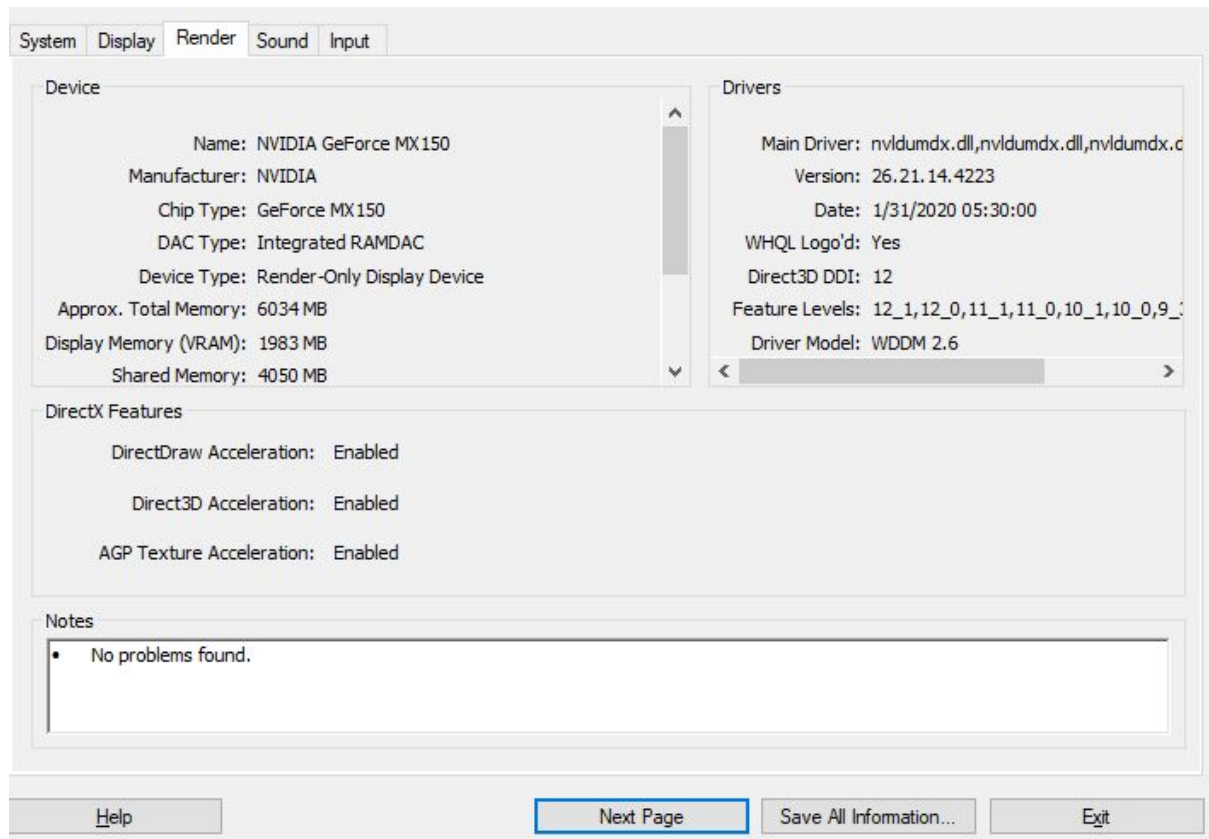
answer) there are total of **8 processors** in my system

```
processor       : 7
vendor_id      : GenuineIntel
cpu family     : 6
model          : 142
model name     : Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz
stepping       : 10
microcode      : 0xffffffff
cpu MHz        : 1799.999
cache size     : 6144 KB
physical id    : 0
siblings       : 8
core id        : 3
cpu cores      : 4
apicid         : 7
initial apicid : 7
fpu            : yes
fpu_exception  : yes
cpuid level    : 21
wp             : yes
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 1
m constant_tsc rep_good nopl xtopology cpuid pni pclmulqdq ssse3 fma cx16 pcid sse4_1 sse4_2 movbe popcnt aes xsave avx f16c rdrand hypervisor lahf_1
m abm 3dnowprefetch invpcid_single pti ssbd ibrs ibpb stibp fsgsbase bmi1 avx2 smep bmi2 erms invpcid rdseed adx smap clflushopt xsaveopt xsavec xget
bv1 xsave flush_l1d arch_capabilities
bugs           : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swapgs itlb_multihit srbds
bogomips       : 3599.99
clflush size   : 64
cache_alignment : 64
address sizes   : 39 bits physical, 48 bits virtual
power management:
```

question) Whether any graphics card is available in your system?

answer) **yes**





question) Write following information with respect to each processor in your system.

answer)

Processor Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz, 1800 Mhz, 4 Core(s), 8 Logical Pr...

model name : Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz

Processor	Process or id	Speed of processor (MHz)	Model name	Cache size
1	0	1799.999	Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz	6144KB
2	1	1799.999	Intel(R) Core(TM)	6144KB

			i5-8250U CPU @ 1.60GHz	
3	2	1799.999	Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz	6144KB
4	3	1799.999	Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz	6144KB
5	4	1799.999	Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz	6144KB
6	5	1799.999	Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz	6144KB
7	6	1799.999	Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz	6144KB
8	7	1799.999	Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz	6144KB

question) to view vendor name

answer) **GenuineIntel**

```
$ cat /proc/cpuinfo | grep 'vendor' | uniq
```

```
# view vendor name with above command
```

```
gkc@root:/mnt/d/practice/cpp$ cat /proc/cpuinfo | grep 'vendor' | uniq
vendor_id      : GenuineIntel
gkc@root:/mnt/d/practice/cpp$ |
```

question) To display model name

answer)

```
$ cat /proc/cpuinfo | grep 'model name' | uniq
```

```
# view model name with above command
```

```
gkc@root:/mnt/d/practice/cpp$ cat /proc/cpuinfo | grep 'model name' | uniq
model name      : Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz
gkc@root:/mnt/d/practice/cpp$ |
```

question) Count the number of processing elements

answer)

```
$ cat /proc/cpuinfo | grep processor | wc -l
```

```
# Count the number of processing elements with above command
```

```
gkc@root:/mnt/d/practice/cpp$ cat /proc/cpuinfo | grep processor | wc -l
8
gkc@root:/mnt/d/practice/cpp$ |
```

question) Show individual cores

answer)

```
$ cat /proc/cpuinfo | grep 'code id'
```

```
# Show individual cores with above command
```

It doesn't show any info

```
gkc@root:/mnt/d/practice/cpp$ cat /proc/cpuinfo | grep 'code id'
gkc@root:/mnt/d/practice/cpp$ cat /proc/cpuinfo | grep 'code id'
gkc@root:/mnt/d/practice/cpp$ |
```

```
$ grep 'cpu cores' /proc/cpuinfo | uniq
```

```
gkc@root:/mnt/d/practice/cpp$ grep 'cpu cores' /proc/cpuinfo | uniq
cpu cores       : 4
gkc@root:/mnt/d/practice/cpp$ |
```


question) The command `lscpu` prints CPU architecture information from `sysfs` and `/proc/cpuinfo` as shown below:

answer)

```
$ lscpu
```

```
gkc@root:/mnt/d/practice/cpp$ lscpu
Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Byte Order:             Little Endian
Address sizes:          39 bits physical, 48 bits virtual
CPU(s):                 8
On-line CPU(s) list:    0-7
Thread(s) per core:     2
Core(s) per socket:     4
Socket(s):              1
Vendor ID:              GenuineIntel
CPU family:             6
Model:                  142
Model name:             Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz
Stepping:                10
CPU MHz:                1799.999
BogoMIPS:               3599.99
Hypervisor vendor:      Microsoft
Virtualization type:     full
L1d cache:              128 KiB
L1i cache:              128 KiB
L2 cache:               1 MiB
L3 cache:               6 MiB
Vulnerability Itlb multihit: KVM: Vulnerable
Vulnerability L1tf:        Mitigation; PTE Inversion
Vulnerability Mds:         Vulnerable; Clear CPU buffers attempted, no microcode; SMT Host state unknown
Vulnerability Meltdown:    Mitigation; PTI
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1:  Mitigation; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2:  Mitigation; Full generic retpoline, IBPB conditional, IBRS_FW, STIBP conditional, RSB filling
Vulnerability Srbds:       Unknown: Dependent on hypervisor status
Vulnerability Tsx async abort: Not affected
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 lm constant_tsc rep_good nopl xtopology cpuid pni pclmulqdq ssse3 fma cx16 pcid sse4_1 sse4_2 movbe po
pnt aes xsave avx f16c rdrand hypervisor lahf_lm abm 3dnowprefetch invpcid_single pti ssbd ibrs ibpb stibp fsgsbase
bmi1 avx2 smep bmi2 erms invpcid rdseed adx smap clflushopt xsaveopt xsavec xgetbv1 xsaves flush_l1d arch_capabilities
ies
gkc@root:/mnt/d/practice/cpp$ |
```

Architecture:	x86_64
CPU op-mode(s):	32-bit, 64-bit
Byte Order:	Little Endian
Address sizes:	39 bits physical, 48 bits virtual
CPU(s):	8
On-line CPU(s) list:	0-7
Thread(s) per core:	2
Core(s) per socket:	4
Socket(s):	1
Vendor ID:	GenuineIntel
CPU family:	6
Model:	142
Model name:	Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz
Stepping:	10
CPU MHz:	1799.999
BogoMIPS:	3599.99
Hypervisor vendor:	Microsoft

Virtualization type: full
L1d cache: 128 KiB
L1i cache: 128 KiB
L2 cache: 1 MiB
L3 cache: 6 MiB

architecture :	x86_64	
byte order :	Little Endian	
number of CPU :	8	
types of cache :	L1d cache L1i cache L2 cache L3 cache	
cache size :	L1d cache: 128 KiB L1i cache: 128 KiB L2 cache: 1 MiB L3 cache: 6 MiB	

The command `cpuid` dumps complete information about the CPU(s) collected from the CPUID instruction, and also discover the exact model of x86 CPU(s) from that information.

```
$ cpuid
```

```
gkc@root:/mnt/d/practice/cpp$ cpuid
Command 'cpuid' not found, but can be installed with:

sudo apt install cpuid

gkc@root:/mnt/d/practice/cpp$ sudo apt install cpuid
[sudo] password for gkc:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  cpuid
0 upgraded, 1 newly installed, 0 to remove and 136 not upgraded.
Need to get 86.0 kB of archives.
After this operation, 369 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu focal/universe amd64 cpuid amd64 20200211-1 [86.0 kB]
Fetched 86.0 kB in 3s (33.5 kB/s)
Selecting previously unselected package cpuid.
(Reading database ... 47583 files and directories currently installed.)
Preparing to unpack .../cpuid_20200211-1_amd64.deb ...
Unpacking cpuid (20200211-1) ...
Setting up cpuid (20200211-1) ...
Processing triggers for man-db (2.9.1-1) ...
gkc@root:/mnt/d/practice/cpp$ cpuid
CPU 0:
  vendor_id = "GenuineIntel"
  version information (1/eax):
    processor type = primary processor (0)
    family = 0x6 (6)
    model = 0xe (14)
    stepping id = 0xa (10)
    extended family = 0x0 (0)
    extended model = 0x8 (8)
    (family synth) = 0x6 (6)
    (model synth) = 0x8e (142)
    (simple synth) = Intel Core (unknown type) (Kaby Lake / Amber Lake-Y / Whiskey Lake-U / Comet Lake-U) [Kaby Lake] {Skylake}, 14nm
  miscellaneous (1/ebx):
    process local APIC physical ID = 0x0 (0)
    cpu count = 0x8 (8)
    CLFLUSH line size = 0x8 (8)
    brand index = 0x0 (0)
  brand id = 0x00 (0): unknown
  feature information (1/edx):
    x87 FPU on chip = true
    VME: virtual-8086 mode enhancement = true
    DE: debugging extensions = true
    PSE: page size extensions = true
    TSC: time stamp counter = true
    RDMSR and WRMSR support = true
    PAE: physical address extensions = true
    MCE: machine check exception = true
    CMPXCHG8B inst. = true
    APIC on chip = true
    SYSENTER and SYSEXIT = true
    MTRR: memory type range registers = true
    PTE global bit = true
    MCA: machine check architecture = true
    CMOV: conditional move/compare instr = true
```

question) Write /highlight the information about Translation Lookaside Buffer (TLB).

answer)

```
$ cpuid
```

```

79      F16C half-precision convert instruction = true
80      RDRAND instruction                      = true
81      hypervisor guest status                 = true
82  ✓    cache and TLB information (2):
83  ✓    0x63: data TLB: 2M/4M pages, 4-way, 32 entries
84      0x63: data TLB: 1G pages, 4-way, 4 entries
85      0x03: data TLB: 4K pages, 4-way, 64 entries
86      0x76: instruction TLB: 2M/4M pages, fully, 8 entries
87      0xff: cache data is in CPUID leaf 4
88      0xb5: instruction TLB: 4K, 8-way, 64 entries
89      0xf0: 64 byte prefetching
90      0xc3: L2 TLB: 4K/2M pages, 6-way, 1536 entries
91      processor serial number = 0008-06EA-0000-0000-0000-0000
92  ✓    deterministic cache parameters (4):
93      --- cache 0 ---
94      cache type                = data cache (1)
95      cache level               = 0x1 (1)
96      self-initializing cache level = true
97      fully associative cache    = false
98      extra threads sharing this cache = 0x1 (1)

```

```

667      hypervisor guest status                = true
668      cache and TLB information (2):
669      0x63: data TLB: 2M/4M pages, 4-way, 32 entries
670      0x63: data TLB: 1G pages, 4-way, 4 entries
671      0x03: data TLB: 4K pages, 4-way, 64 entries
672      0x76: instruction TLB: 2M/4M pages, fully, 8 entries
673      0xff: cache data is in CPUID leaf 4
674      0xb5: instruction TLB: 4K, 8-way, 64 entries
675      0xf0: 64 byte prefetching
676      0xc3: L2 TLB: 4K/2M pages, 6-way, 1536 entries
677      processor serial number = 0008-06EA-0000-0000-0000-0000
678      deterministic cache parameters (4):
679      --- cache 0 ---
680      cache type                = data cache (1)

```

question) To find the number of processes present in a system use nproc command.

answer) 8

```
$ nproc
```

```
gkc@root:/mnt/d/SEM/SEM 06/IT301-Parallel Computing/IT301-LAB/LAB-2/docs$ nproc
8
gkc@root:/mnt/d/SEM/SEM 06/IT301-Parallel Computing/IT301-LAB/LAB-2/docs$ |
```