

Machine Problem 1

Our Machine Problem uses the OpenMP API to parallelize/multi-thread a program which involves multiple 'for' loops.

The output of '*cat /proc/cpuinfo*' is provided at the end of the report. The environment consists of the following:

- 64 bit Windows 7 host OS with Virtualbox hypervisor
- Intel(R) Core(TM) i7-3770S CPU @ 3.10GHz
 - o 4 cores
 - o hyper-threading turned off in BIOS
- 16 GB DDR3 RAM
- 64 bit Ubuntu 12.04 guest OS

The system time is printed at program initiation and at finish with the following line added to the code:

```
system("date");
```

The number of threads allowed to be executed by our MP1 program is regulated by the following command in the bash cli of the Ubuntu OS:

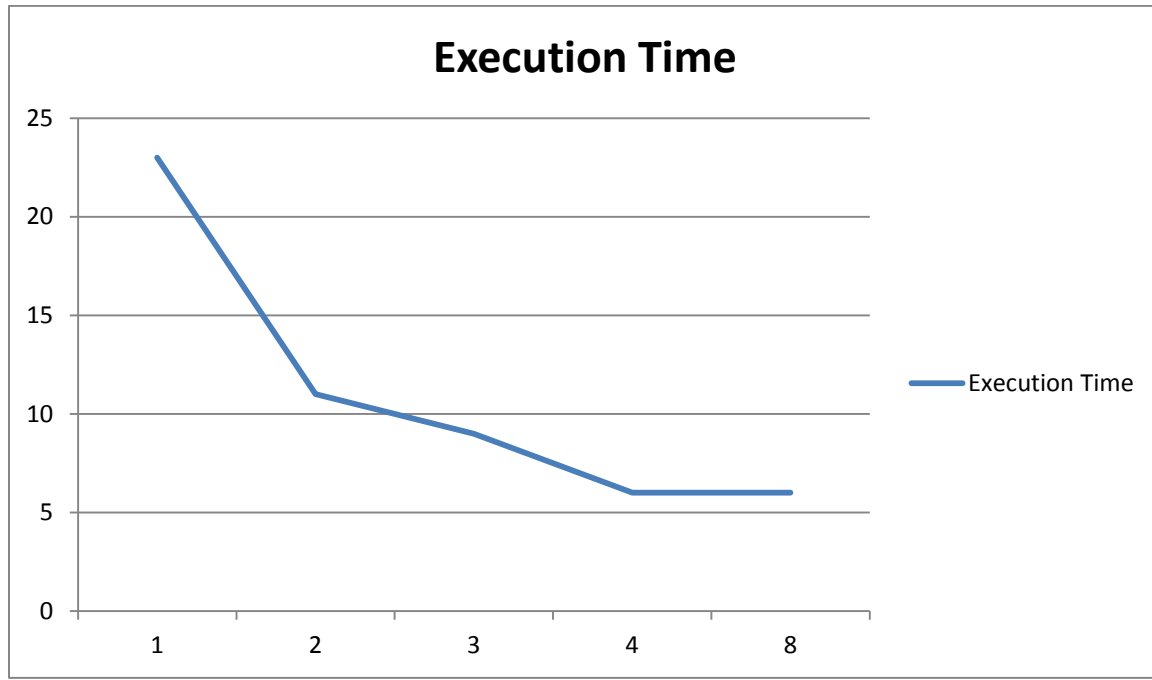
```
export OMP_NUM_THREADS=<max_#_of_threads_allowed>
```

Upon varying the maximum number of threads and executing the program we record the corresponding values.

Number of Threads	Execution Time
1	23
2	11
3	9
4	6
8	6

One can observe that every time the number of threads is doubled the time to execute is halved; however a cap of four cores caps the benefit of multi-threading execution time gains to under 4 threads.

In the following graph we can see that as the number of threads goes to infinity the execution time will remain at 6 seconds.




Host Machine Specifications:

CPU-Z

CPU | Caches | Mainboard | Memory | SPD | Graphics | About

Processor

Name	Intel Core i7 3770S		
Code Name	Ivy Bridge	Max TDP	65 W
Package	Socket 1155 LGA		
Technology	22 nm	Core Voltage	0.808 V



Specification: Intel(R) Core(TM) i7-3770S CPU @ 3.10GHz

Family	6	Model	A	Stepping	9
Ext. Family	6	Ext. Model	3A	Revision	E1/L1

Instructions: MMX, SSE, SSE2, SSE3, SSSE3, SSE4.1, SSE4.2, EM64T, VT-x, AES, AVX

Clocks (Core #0)

Core Speed	1604.69 MHz
Multiplier	x 16.0 (16 - 39)
Bus Speed	100.29 MHz
Rated FSB	

Cache

L1 Data	4 x 32 KBytes	8-way
L1 Inst.	4 x 32 KBytes	8-way
Level 2	4 x 256 KBytes	8-way
Level 3	8 MBytes	16-way

Selection: Processor #1 | Cores: 4 | Threads: 4

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CPU-Z

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L1 D-Cache

Size	32 KBytes	x 4
Descriptor	8-way set associative, 64-byte line size	

L1 I-Cache

Size	32 KBytes	x 4
Descriptor	8-way set associative, 64-byte line size	

L2 Cache

Size	256 KBytes	x 4
Descriptor	8-way set associative, 64-byte line size	

L3 Cache

Size	8 MBytes	
Descriptor	16-way set associative, 64-byte line size	

Size: | |
Descriptor: | |

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Motherboard

Manufacturer	ASUSTeK COMPUTER INC.		
Model	P8Z77-V LK	Rev X.0x	
Chipset	Intel	Ivy Bridge	Rev. 09
Southbridge	Intel	Z77	Rev. 04
LPCIO	Nuvoton	NCT6779	

BIOS

Brand	American Megatrends Inc.
Version	1103
Date	07/16/2013

Graphic Interface

Version			
Transfer Rate		Max. Supported	
Side Band			

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CPU-Z

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General

Type	DDR3	Channel #	Single
Size	16 GBytes	DC Mode	
		NB Frequency	

Timings

DRAM Frequency	668.6 MHz
FSB:DRAM	1:5
CAS# Latency (CL)	9.0 clocks
RAS# to CAS# Delay (tRCD)	9 clocks
RAS# Precharge (tRP)	9 clocks
Cycle Time (tRAS)	24 clocks
Bank Cycle Time (tRC)	
Command Rate (CR)	2T
DRAM Idle Timer	
Total CAS# (tRDRAM)	
Row To Column (tRCD)	

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Guest Machine Specifications:

processor : 0
vendor_id : GenuineIntel
cpu family : 6
model : 58
model name : Intel(R) Core(TM) i7-3770S CPU @ 3.10GHz
stepping : 9
cpu MHz : 2985.104
cache size : 6144 KB
physical id : 0
siblings : 4
core id : 0
cpu cores : 4
apicid : 0
initial apicid : 0
fpu : yes
fpu_exception : yes
cpuid level : 5
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 ht syscall nx rdtscp lm
constant_tsc rep_good nopl pni ssse3 lahf_lm
bogomips : 5970.20
clflush size : 64
cache_alignment : 64
address sizes : 36 bits physical, 48 bits virtual
power management:

processor : 1
vendor_id : GenuineIntel
cpu family : 6
model : 58
model name : Intel(R) Core(TM) i7-3770S CPU @ 3.10GHz
stepping : 9
cpu MHz : 2985.104
cache size : 6144 KB
physical id : 0
siblings : 4
core id : 1
cpu cores : 4
apicid : 1
initial apicid : 1
fpu : yes
fpu_exception : yes
cpuid level : 5
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 ht syscall nx rdtscp lm
constant_tsc rep_good nopl pni ssse3 lahf_lm
bogomips : 5970.20

clflush size : 64
cache_alignment : 64
address sizes : 36 bits physical, 48 bits virtual
power management:

processor : 2
vendor_id : GenuineIntel
cpu family : 6
model : 58
model name : Intel(R) Core(TM) i7-3770S CPU @ 3.10GHz
stepping : 9
cpu MHz : 2985.104
cache size : 6144 KB
physical id : 0
siblings : 4
core id : 2
cpu cores : 4
apicid : 2
initial apicid : 2
fpu : yes
fpu_exception : yes
cpuid level : 5
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 ht syscall nx rdtscp lm
constant_tsc rep_good nopl pni ssse3 lahfm
bogomips : 5970.20
clflush size : 64
cache_alignment : 64
address sizes : 36 bits physical, 48 bits virtual
power management:

processor : 3
vendor_id : GenuineIntel
cpu family : 6
model : 58
model name : Intel(R) Core(TM) i7-3770S CPU @ 3.10GHz
stepping : 9
cpu MHz : 2985.104
cache size : 6144 KB
physical id : 0
siblings : 4
core id : 3
cpu cores : 4
apicid : 3
initial apicid : 3
fpu : yes
fpu_exception : yes
cpuid level : 5
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 ht syscall nx rdtscp lm
constant_tsc rep_good nopl pni ssse3 lahf_lm
bogomips : 5970.20
clflush size : 64
cache_alignment : 64
address sizes : 36 bits physical, 48 bits virtual
power management: