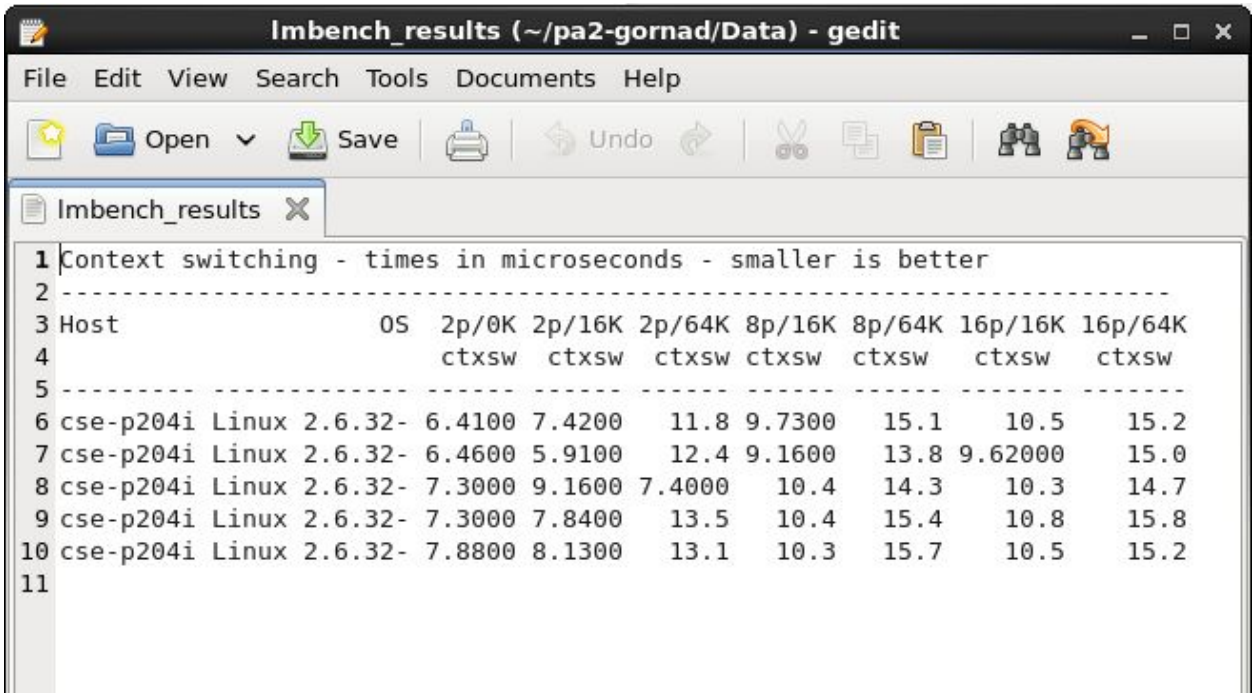
3.2.1)




```
Context switching - times in microseconds - smaller is better
-------------------------------------------------------------------------
Host                 OS  2p/0K 2p/16K 2p/64K 8p/16K 8p/64K 16p/16K 16p/64K
                         ctxsw  ctxsw  ctxsw ctxsw  ctxsw   ctxsw   ctxsw
--------- ------------- ------ ------ ------ ------ ------ ------- -------
cse-p204i Linux 2.6.32- 6.4100 7.4200   11.8 9.7300   15.1    10.5    15.2
cse-p204i Linux 2.6.32- 6.4600 5.9100   12.4 9.1600   13.8 9.62000    15.0
cse-p204i Linux 2.6.32- 7.3000 9.1600 7.4000   10.4   14.3    10.3    14.7
cse-p204i Linux 2.6.32- 7.3000 7.8400   13.5   10.4   15.4    10.8    15.8
cse-p204i Linux 2.6.32- 7.8800 8.1300   13.1   10.3   15.7    10.5    15.2
```

Empirical average and variance of kernel threads performance:
Average = (6.4100+6.4600+7.3000+7.3000+7.8800)/5 = 7.07 µs
Variance = 0.3924 (using excel)

The number of context switches so far is: 1
The time taken by the context switch is: 2025 = 2.025 µs
The number of context switches so far is: 2
The time taken by the context switch is: 2095 = 2.095 µs
The number of context switches so far is: 3
The time taken by the context switch is: 1886 = 1.886 µs
The number of context switches so far is: 4
The time taken by the context switch is: 2374 = 2.374 µs
The number of context switches so far is: 5
The time taken by the context switch is: 2095 = 2.095 µs
The number of context switches so far is: 6
The time taken by the context switch is: 2165 = 2.165 µs
The number of context switches so far is: 7
The time taken by the context switch is: 1886 = 1.886 µs
The number of context switches so far is: 8
The time taken by the context switch is: 2025 = 2.025 µs
The number of context switches so far is: 9
The time taken by the context switch is: 1816 = 1.816 µs
The number of context switches so far is: 10
The time taken by the context switch is: 2025 = 2.025 µs

The number of context switches so far is: 11
The time taken by the context switch is: 1257 = 1.257 μs
Empirical average and variance:
Average = (2025 + 2095 + 1886 + 2374 + 2095 + 2165 + 1886 + 2025 + 1816 + 2025 + 1257)/11 = 1968 ns = 1.968 μs
Variance = 78772.29 (using excel)

3.2.2)

Kernel Threads Sleeping()	User Threads Sleeping()
17463847	17632545
16270248	19306493
17177640	22372854
17669386	28898776
17209392	43898551
17069643	72135502

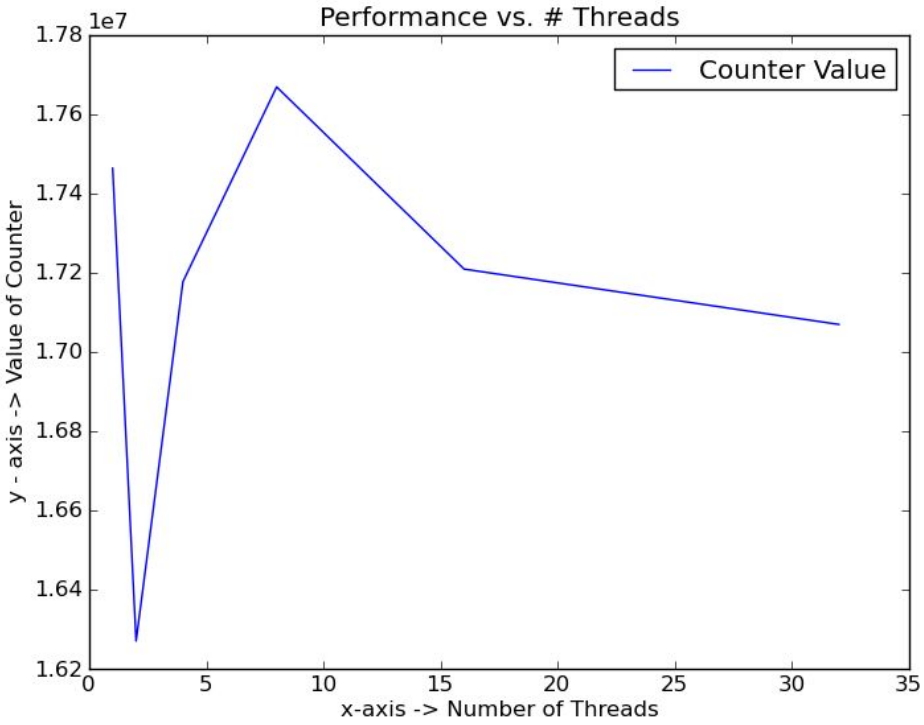


Image 1: Kernel threads sleeping()

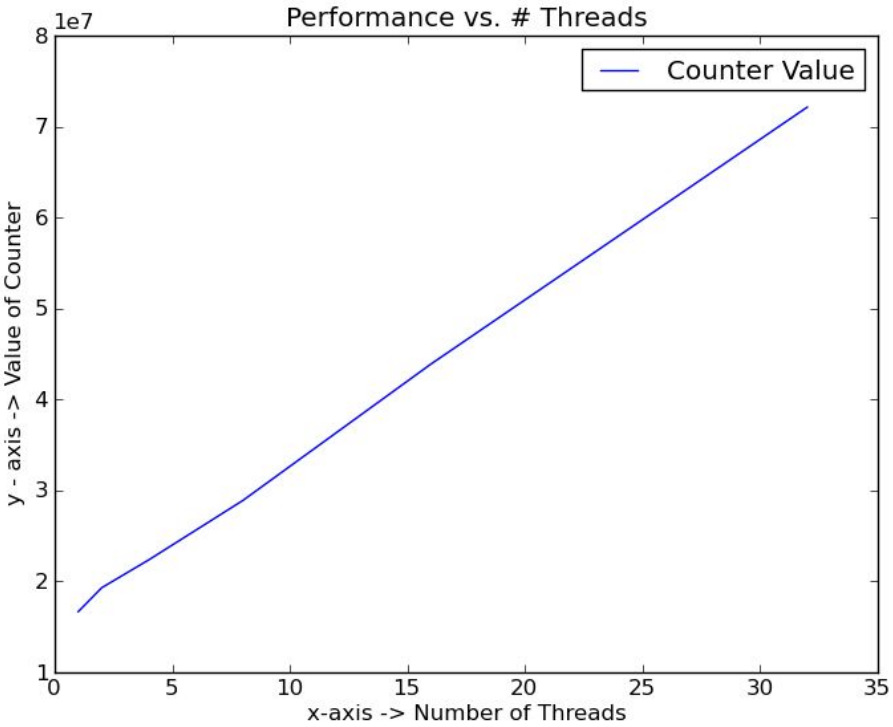


Image 2: User threads sleeping()
Note: Both user and kernel thread tests were tested for an increasing number of threads similar to 3.2.3 to produce more reliable results.

For kernel threads, we notice that performance is extremely unreliable. This is caused by the expensive context switching times coupled with occupied system resources and scheduling. For user level threads, we notice a consistent increase of performance that is due to the relatively inexpensive context switching times of user threads.

3.2.3)

Kernel Threads Counter()	User Threads Counter()
17329426	17656769
18020844	18867391
17065985	22594306
16195997	29240851
16545564	43117937
17784652	71651928

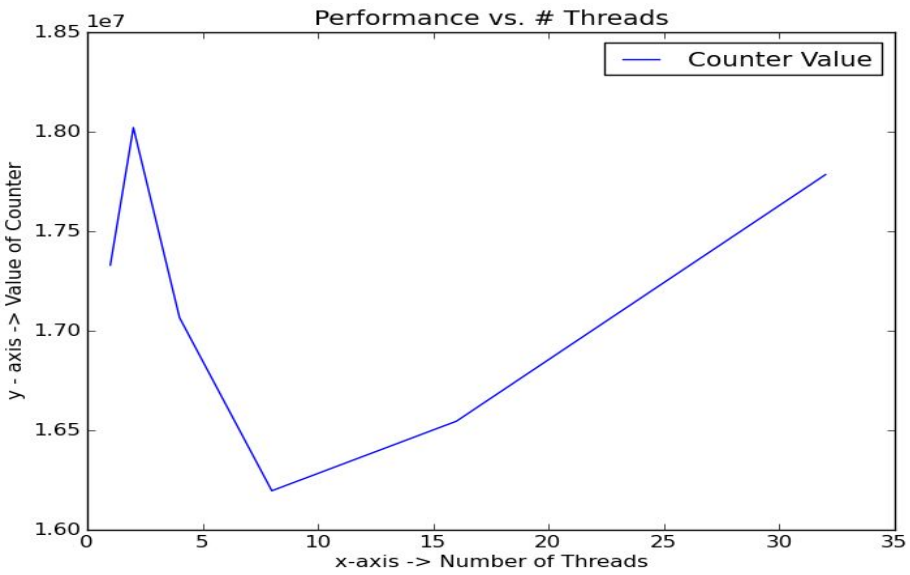


Image 3: Kernel threads counter()

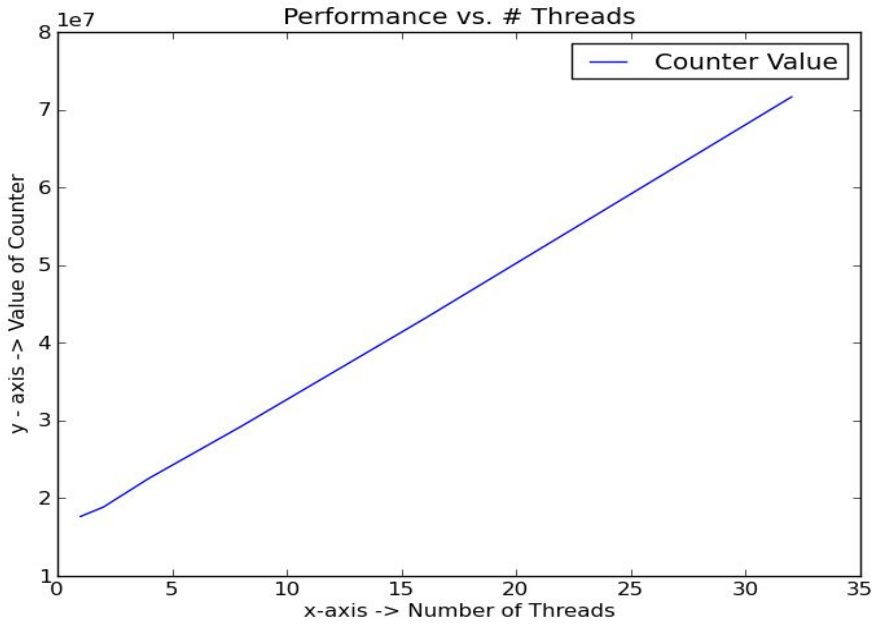


Image 4: User threads counter()

Since the counter() function is less expensive for kernel threads, we do not see as much inconsistency as with the sleeping() function. For both graphs, we notice an increase of work done in relation to the number of threads. There is a correlation between the number of cores in the system and the number of threads. This is explained by parallel processing. More cores mean more threads can be handled efficiently leading to an increased performance.