# NCTU-OS-HW2

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## Task 1

### Mutex

```
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./mutex 2
In main: Creating thread 0
In main: Creating thread 1
200000000
13.576u 10.876s 0:13.90 175.8%  0+0k 24+0io 0pf+0w
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./mutex 4
In main: Creating thread 0
In main: Creating thread 1
In main: Creating thread 2
In main: Creating thread 3
400000000
61.169u 142.563s 0:56.16 362.7% 0+0k 0+0io 0pf+0w
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./mutex 8
In main: Creating thread 0
In main: Creating thread 1
In main: Creating thread 2
In main: Creating thread 3
In main: Creating thread 4
In main: Creating thread 5
In main: Creating thread 6
In main: Creating thread 7
800000000
73.449u 622.959s 1:30.15 772.4% 0+0k 0+0io 0pf+0w
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./mutex 16
In main: Creating thread 0
In main: Creating thread 1
In main: Creating thread 2
In main: Creating thread 3
In main: Creating thread 4
In main: Creating thread 5
In main: Creating thread 6
In main: Creating thread 7
In main: Creating thread 8
In main: Creating thread 9
In main: Creating thread 10
In main: Creating thread 11
In main: Creating thread 12
In main: Creating thread 13
In main: Creating thread 14
In main: Creating thread 15
1600000000
136.193u 2229.789s 2:30.81 1568.8%      0+0k 0+0io 0pf+0w
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- %
```

semaphore

```
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./sem 2
In main: Creating thread 0
In main: Creating thread 1
200000000
29.043u 41.846s 0:43.13 164.3%  0+0k 0+0io 0pf+0w
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./sem 4
In main: Creating thread 0
In main: Creating thread 1
In main: Creating thread 2
In main: Creating thread 3
400000000
82.406u 221.956s 1:25.65 355.3% 0+0k 0+0io 0pf+0w
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./sem 8
In main: Creating thread 0
In main: Creating thread 1
In main: Creating thread 2
In main: Creating thread 3
In main: Creating thread 4
In main: Creating thread 5
In main: Creating thread 6
In main: Creating thread 7
800000000
154.479u 1472.279s 3:32.92 764.0%       0+0k 0+0io 0pf+0w
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./sem 16
In main: Creating thread 0
In main: Creating thread 1
In main: Creating thread 2
In main: Creating thread 3
In main: Creating thread 4
In main: Creating thread 5
In main: Creating thread 6
In main: Creating thread 7
In main: Creating thread 8
In main: Creating thread 9
In main: Creating thread 10
In main: Creating thread 11
In main: Creating thread 12
In main: Creating thread 13
In main: Creating thread 14
In main: Creating thread 15
1600000000
308.363u 7333.042s 8:05.03 1575.4%      0+0k 0+0io 0pf+0w
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % _
```

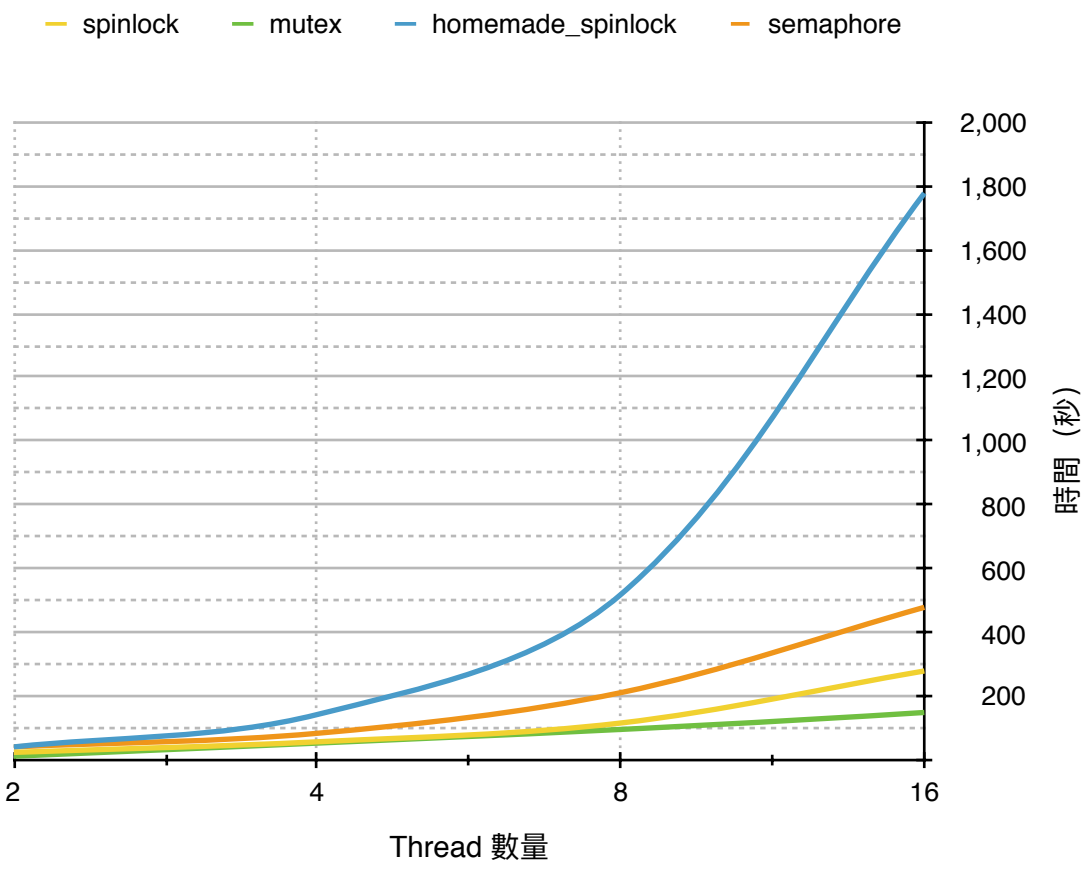
spinlock

```
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./spinlock 2
In main: Creating thread 0
In main: Creating thread 1
200000000
50.783u 0.003s 0:25.89 196.1%   0+0k 0+0io 0pf+0w
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./spinlock 4
In main: Creating thread 0
In main: Creating thread 1
In main: Creating thread 2
In main: Creating thread 3
400000000
232.406u 0.016s 0:58.99 393.9%  0+0k 0+0io 0pf+0w
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./spinlock 8
In main: Creating thread 0
In main: Creating thread 1
In main: Creating thread 2
In main: Creating thread 3
In main: Creating thread 4
In main: Creating thread 5
In main: Creating thread 6
In main: Creating thread 7
800000000
759.053u 0.006s 1:57.82 644.2%  0+0k 0+0io 0pf+0w
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./spinlock 16
In main: Creating thread 0
In main: Creating thread 1
In main: Creating thread 2
In main: Creating thread 3
In main: Creating thread 4
In main: Creating thread 5
In main: Creating thread 6
In main: Creating thread 7
In main: Creating thread 8
In main: Creating thread 9
In main: Creating thread 10
In main: Creating thread 11
In main: Creating thread 12
In main: Creating thread 13
In main: Creating thread 14
In main: Creating thread 15
1600000000
4438.456u 0.109s 4:40.80 1580.6%        0+0k 0+0io 0pf+0w
```

homemade_spinlock

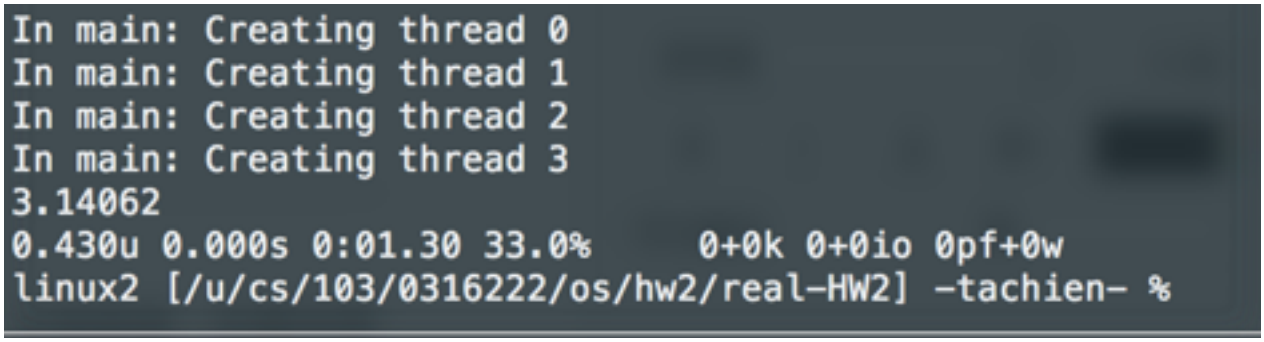
```
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./homemade_spinlock 2
In main: Creating thread 0
In main: Creating thread 1
200000000
85.679u 0.003s 0:43.06 198.9%   0+0k 0+0io 0pf+0w
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./homemade_spinlock 4
In main: Creating thread 0
In main: Creating thread 1
In main: Creating thread 2
In main: Creating thread 3
400000000
611.899u 0.039s 2:44.54 371.8%  0+0k 0+0io 0pf+0w
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./homemade_spinlock 8
In main: Creating thread 0
In main: Creating thread 1
In main: Creating thread 2
In main: Creating thread 3
In main: Creating thread 4
In main: Creating thread 5
In main: Creating thread 6
In main: Creating thread 7
800000000
4292.702u 0.173s 9:10.53 779.7% 0+0k 0+0io 0pf+0w
linux3 [/u/cs/103/0316222/os/hw2/real-HW2] -tachien- % time ./homemade_spinlock 16
In main: Creating thread 0
In main: Creating thread 1
In main: Creating thread 2
In main: Creating thread 3
In main: Creating thread 4
In main: Creating thread 5
In main: Creating thread 6
In main: Creating thread 7
In main: Creating thread 8
In main: Creating thread 9
In main: Creating thread 10
In main: Creating thread 11
In main: Creating thread 12
In main: Creating thread 13
In main: Creating thread 14
In main: Creating thread 15
1600000000
17465.924u 0.156s 29:36.48 983.1%       0+0k 0+0io 0pf+0w
```

Comparison Chart

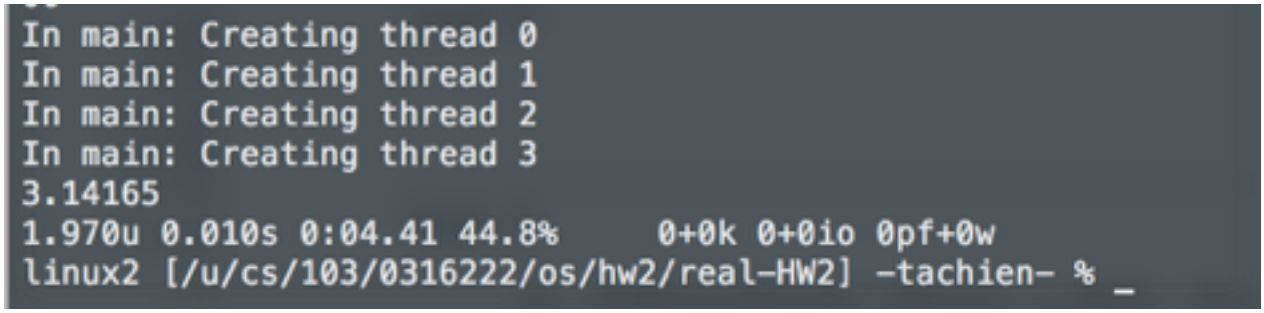


## Task 2

pi_free — 1.3 seconds with 10000000 points generated




pi_lock — 4.41 seconds with 10000000 points generated



## Task 3

用一個陣列紀錄四個人擁有的Lock數量，選定一人（N方向）去做檢查，如果這個人Acquire第二個lock失敗，就會去看是不是每個人都有Lock，是的話就表示Deadlock發生，退出當前Lock並等待需要使用我的人（E方向）成功通過之後再重新取得自己第一個Lock，如果不是的話表示並沒有Deadlock發生，只是有人剛好在你前面，那就重新再嘗試取得一次，持續下去。