HW 4: Parallel Programming with MPI – Hypercube Quicksort

UIN: 631000852

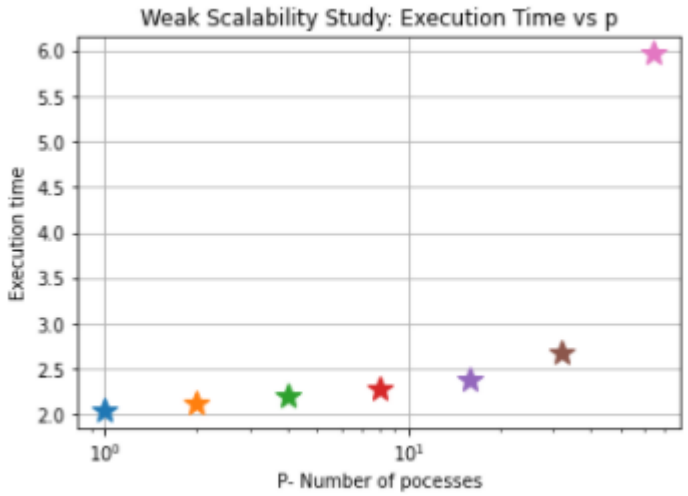
Name: Nimoshika Jayaraman

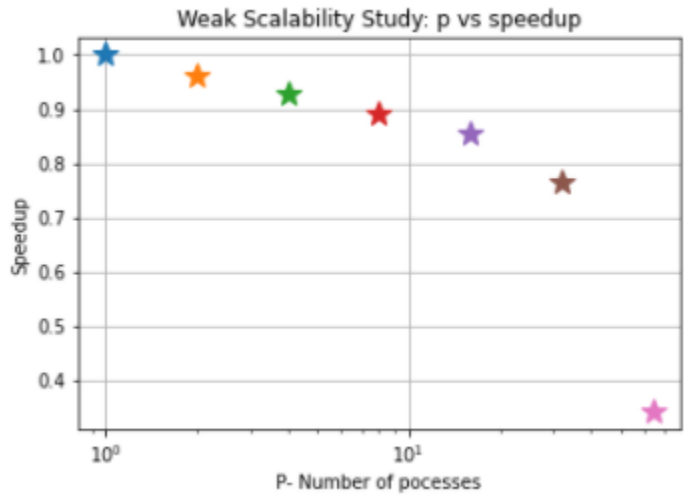
1) Parallel quick sort algorithm for d- dimensional hypercube was implemented. The mentioned commands were executed and compiled successfully, and screen shot attached.
    - Module Load intel
    - mpiicpc -o qsort_hypercube.exe qsort_hypercube.cpp

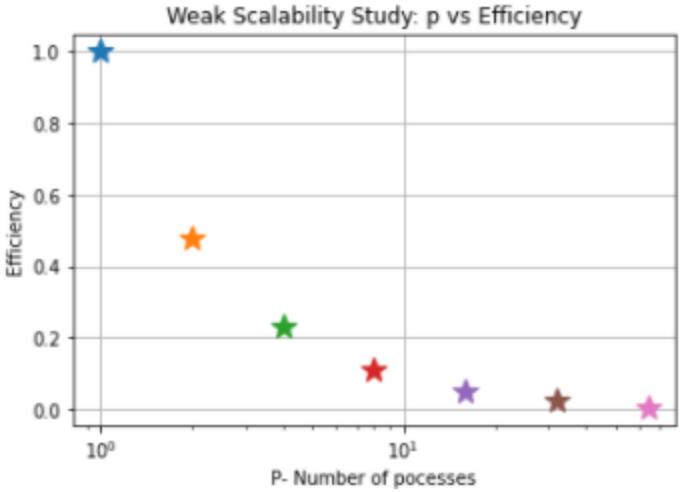
```
nimoshika@grace1 HW4-735]$ mpirun -np 8 ./qsort_hypercube.exe 6000000 0
[Proc: 0] number of processes = 8, initial local list size = 6000000, hypercube qu
icksort time = 0.637203
[Proc: 0] Congratulations. The list has been sorted correctly.
[nimoshika@grace1 HW4-735]$ mpirun -np 2 ./qsort_hypercube.exe 4 -1
[Proc: 0] number of processes = 2, initial local list size = 4, hypercube quicksor
t time = 0.001567
[Proc: 0] Congratulations. The list has been sorted correctly.
[nimoshika@grace1 HW4-735]$ mpirun -np 4 ./qsort_hypercube.exe 4 -2
[Proc: 0] number of processes = 4, initial local list size = 4, hypercube quicksor
t time = 0.002038
[Proc: 0] Congratulations. The list has been sorted correctly.
[nimoshika@grace1 HW4-735]$ mpirun -np 8 ./qsort_hypercube.exe 4 -1
[Proc: 0] number of processes = 8, initial local list size = 4, hypercube quicksor
t time = 0.003433
[Proc: 0] Congratulations. The list has been sorted correctly.
[nimoshika@grace1 HW4-735]$ mpirun -np 16 ./qsort_hypercube.exe 4 0
[Proc: 0] number of processes = 16, initial local list size = 4, hypercube quickso
rt time = 0.006552
[Proc: 0] Congratulations. The list has been sorted correctly.
[nimoshika@grace1 HW4-735]$ mpirun -np 16 ./qsort_hypercube.exe 20480000 0
[Proc: 0] number of processes = 16, initial local list size = 20480000, hypercube
quicksort time = 2.498230
[Proc: 0] Congratulations. The list has been sorted correctly.
[nimoshika@grace1 HW4-735]$ sbatch qsort_hypercube.grace_job
Submitted batch job 1953375
```

2) <u>Weak Scalability Study:</u>

List of size np where n=20,480,000 and p= 1,2,4,8,16,32, and 64.

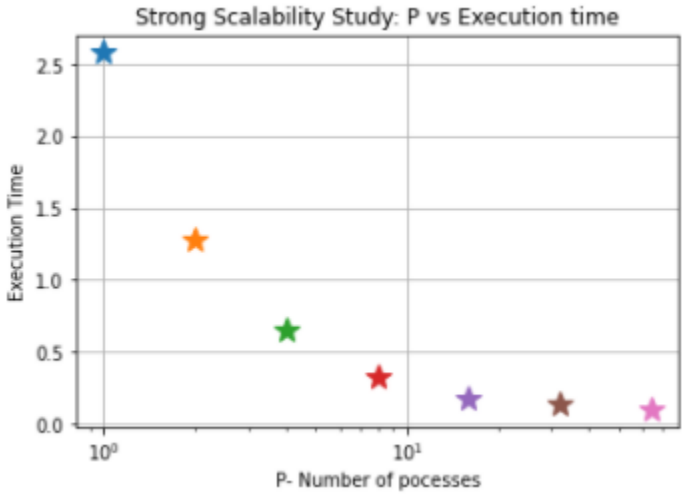


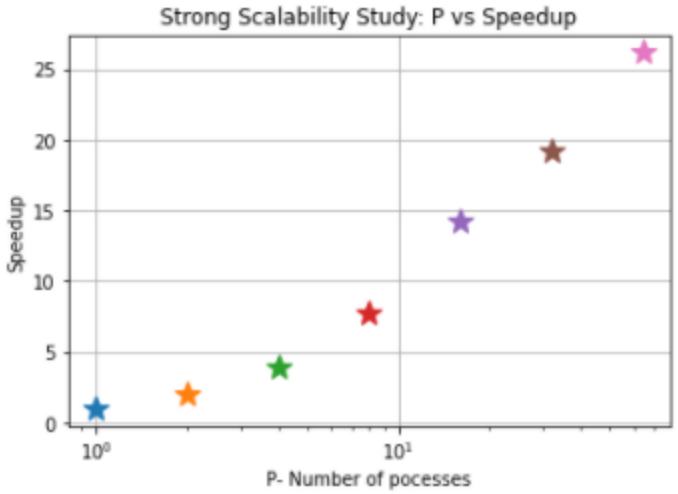


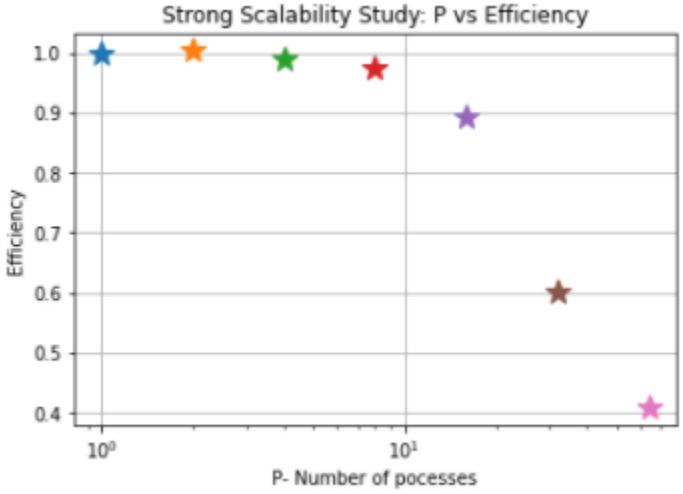


3) <u>Strong Scalability Study:</u>

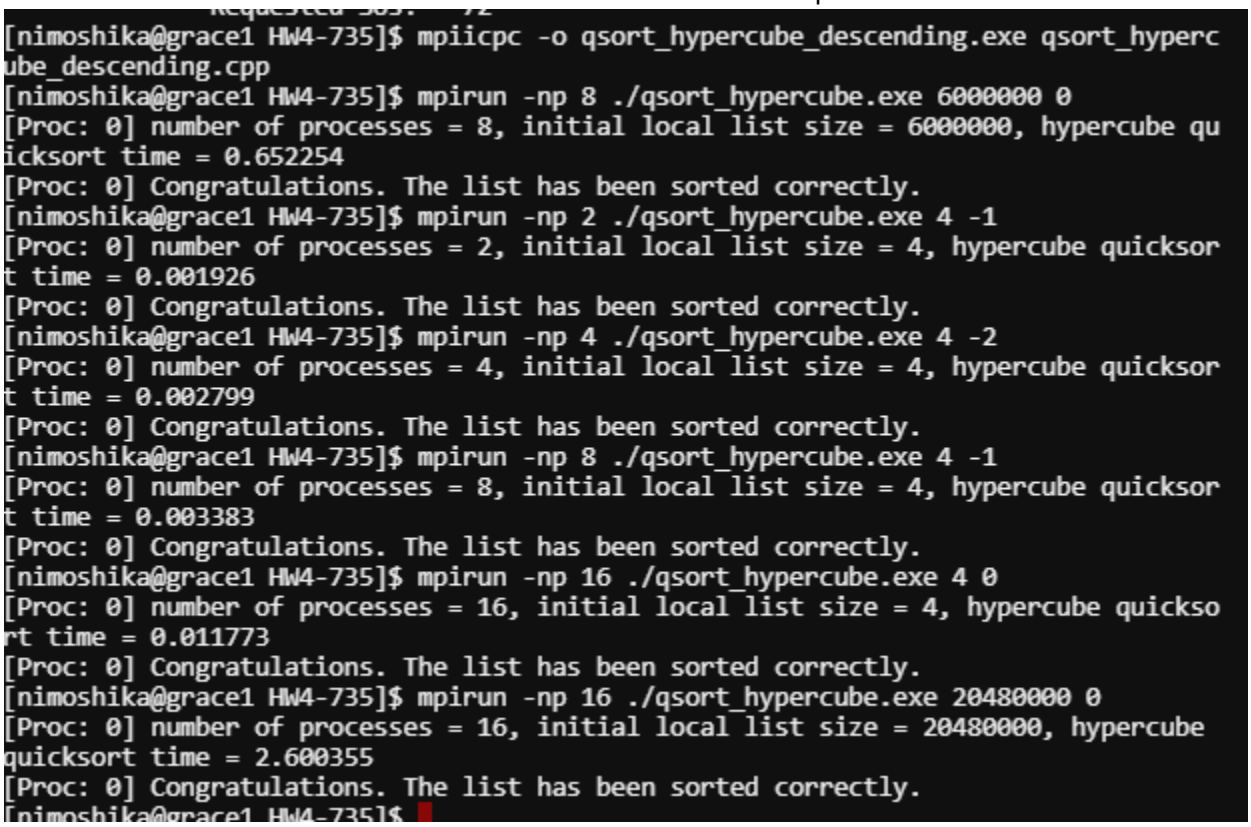
List of size n=20,480,000/P where p=1,2,4,8,16,32,64.




Strong Scalability Study: P vs Speedup
Speedup
0
5
10
15
20
25
10^0
10^1
P- Number of pocesses


Strong Scalability Study: P vs Efficiency
Efficiency
0.4
0.5
0.6
0.7
0.8
0.9
1.0
10^0
10^1
P- Number of pocesses

4) Screenshot attached to show the successful execution of tests from problem1.



```
[nimoshika@grace1 HW4-735]$ mpiicpc -o qsort_hypercube_descending.exe qsort_hyperc
ube_descending.cpp
[nimoshika@grace1 HW4-735]$ mpirun -np 8 ./qsort_hypercube.exe 6000000 0
[Proc: 0] number of processes = 8, initial local list size = 6000000, hypercube qu
icksort time = 0.652254
[Proc: 0] Congratulations. The list has been sorted correctly.
[nimoshika@grace1 HW4-735]$ mpirun -np 2 ./qsort_hypercube.exe 4 -1
[Proc: 0] number of processes = 2, initial local list size = 4, hypercube quicksor
t time = 0.001926
[Proc: 0] Congratulations. The list has been sorted correctly.
[nimoshika@grace1 HW4-735]$ mpirun -np 4 ./qsort_hypercube.exe 4 -2
[Proc: 0] number of processes = 4, initial local list size = 4, hypercube quicksor
t time = 0.002799
[Proc: 0] Congratulations. The list has been sorted correctly.
[nimoshika@grace1 HW4-735]$ mpirun -np 8 ./qsort_hypercube.exe 4 -1
[Proc: 0] number of processes = 8, initial local list size = 4, hypercube quicksor
t time = 0.003383
[Proc: 0] Congratulations. The list has been sorted correctly.
[nimoshika@grace1 HW4-735]$ mpirun -np 16 ./qsort_hypercube.exe 4 0
[Proc: 0] number of processes = 16, initial local list size = 4, hypercube quickso
rt time = 0.011773
[Proc: 0] Congratulations. The list has been sorted correctly.
[nimoshika@grace1 HW4-735]$ mpirun -np 16 ./qsort_hypercube.exe 20480000 0
[Proc: 0] number of processes = 16, initial local list size = 20480000, hypercube
quicksort time = 2.600355
[Proc: 0] Congratulations. The list has been sorted correctly.
[nimoshika@grace1 HW4-735]$
```