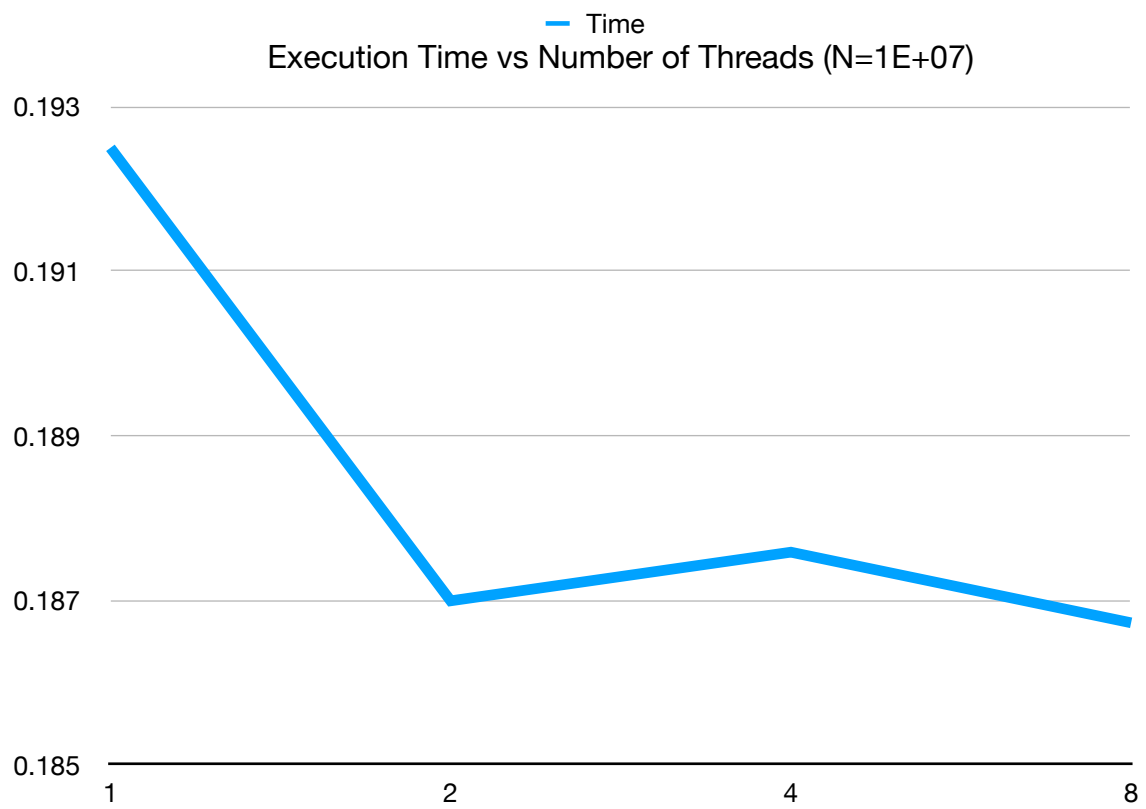


```
The execution time are
Size      1      2      4      8      estimate of pi is 3.14172
100000000 0.192497 0.186994 0.187585 0.186727 estimate of pi is 3.14167
200000000 0.395526 0.375040 0.372124 0.373744 estimate of pi is 3.14145
300000000 0.560806 0.559267 0.561613 0.561674 estimate of pi is 3.14178
400000000 0.748989 0.748515 0.746540 0.747170
Program ended with exit code: 0
```



```
np= 3 processors;    Time=0.676809s;    PI=3.1413  
Program ended with exit code: 0
```

Checking for correctness of program :

MATRIX I

```
0 4 7 5 3 7 4 7 2 0
4 6 9 4 8 0 2 2 4 1
0 6 0 5 6 3 9 7 1 3
9 2 1 6 1 3 7 4 7 2
6 7 9 3 8 4 2 9 9 5
0 5 0 4 6 9 2 9 3 0
2 6 4 2 0 5 7 0 2 3
9 8 3 1 6 1 6 3 2 6
1 9 2 0 1 9 0 0 5 9
8 2 0 8 5 6 1 3 3 4
```

MATRIX II

```
0 9 7 2 3 5 7 9 9 0
0 3 4 7 3 9 4 9 6 1
6 5 9 0 9 6 1 3 0 6
4 6 8 5 6 2 9 1 7 0
9 3 3 5 1 9 4 7 3 0
7 9 9 1 5 2 8 6 0 2
2 0 1 7 3 9 2 4 6 3
2 9 6 3 4 9 5 5 2 4
8 1 7 3 4 8 9 8 2 2
4 6 3 1 2 3 4 1 7 5
```

Time for serial 0.000001

FINAL MATRIX SERIAL

```
176 214 251 130 191 244 197 192 110 104
186 175 234 143 175 279 183 228 155 87
147 175 176 190 134 285 191 201 180 84
146 213 244 154 163 257 259 239 216 75
280 318 369 193 254 419 320 357 224 154
179 222 228 144 144 248 228 222 112 71
109 133 165 119 132 190 144 163 135 80
141 218 213 173 145 308 208 272 242 92
160 189 207 103 132 192 202 206 139 94
167 249 249 130 148 203 264 216 201 55
```

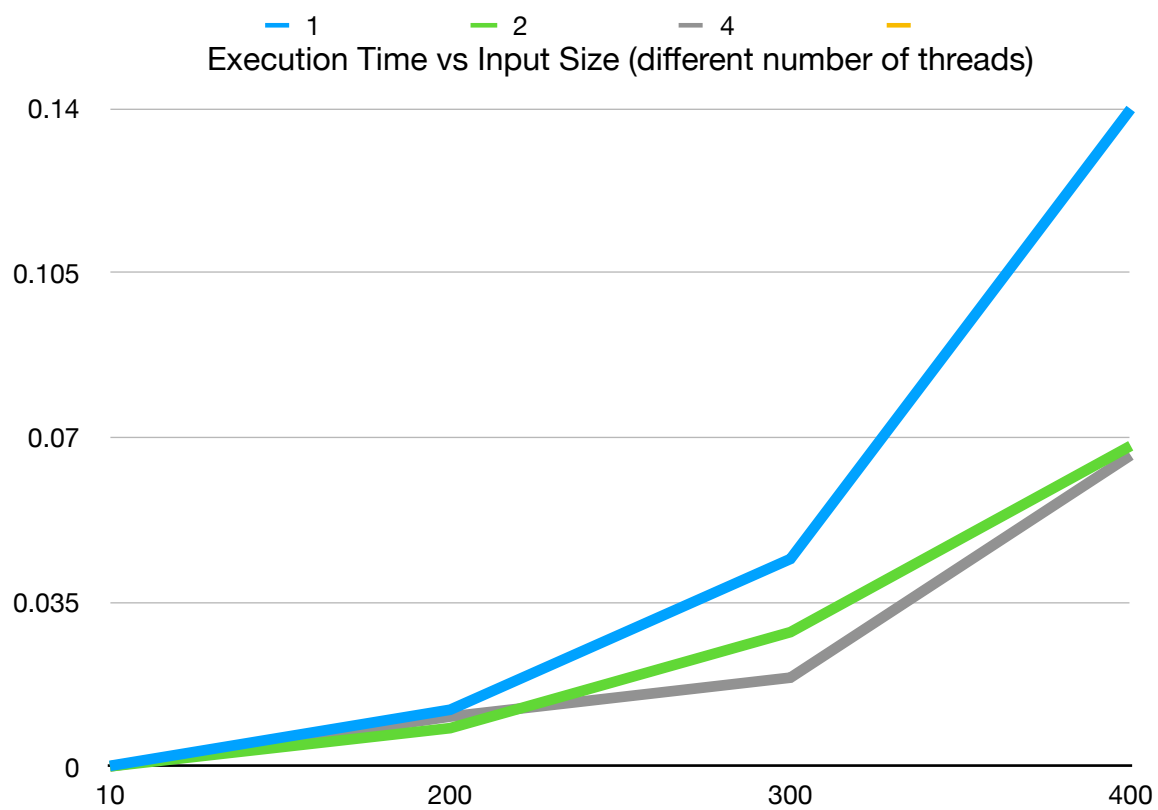
Time for parallel 0.000001

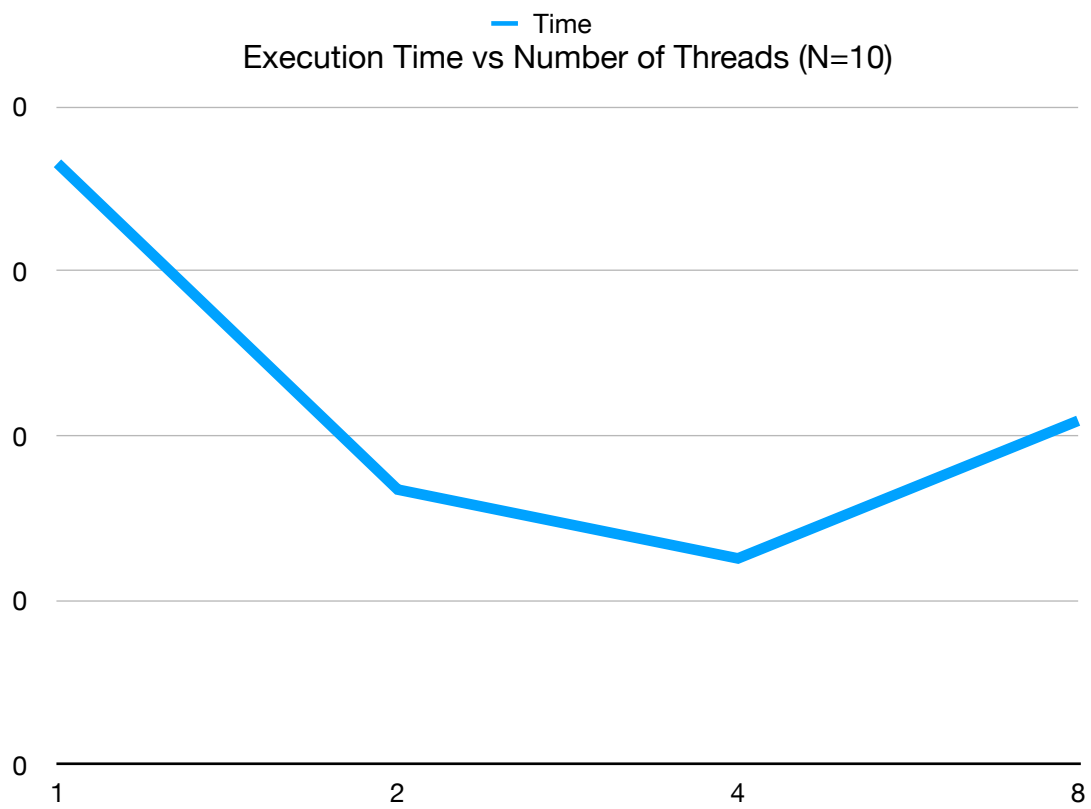
FINAL MATRIX PARALLEL

```
176 214 251 130 191 244 197 192 110 104
186 175 234 143 175 279 183 228 155 87
147 175 176 190 134 285 191 201 180 84
146 213 244 154 163 257 259 239 216 75
280 318 369 193 254 419 320 357 224 154
179 222 228 144 144 248 228 222 112 71
109 133 165 119 132 190 144 163 135 80
141 218 213 173 145 308 208 272 242 92
160 189 207 103 132 192 202 206 139 94
167 249 249 130 148 203 264 216 201 55
```

The execution time are

Size	1	2	4	8
10	0.000201	0.000092	0.000069	0.000115
200	0.012134	0.008218	0.010681	0.004713
300	0.044190	0.028630	0.018951	0.018838
400	0.139835	0.068237	0.066235	0.063584

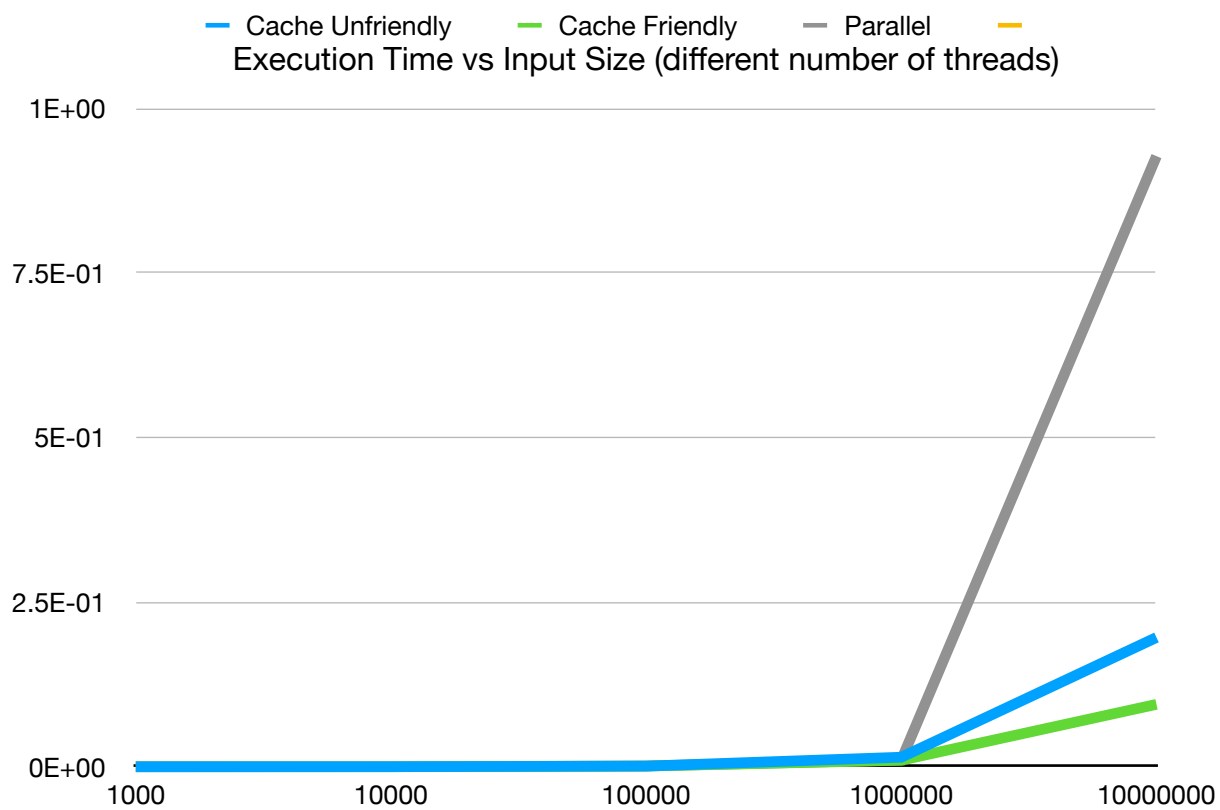


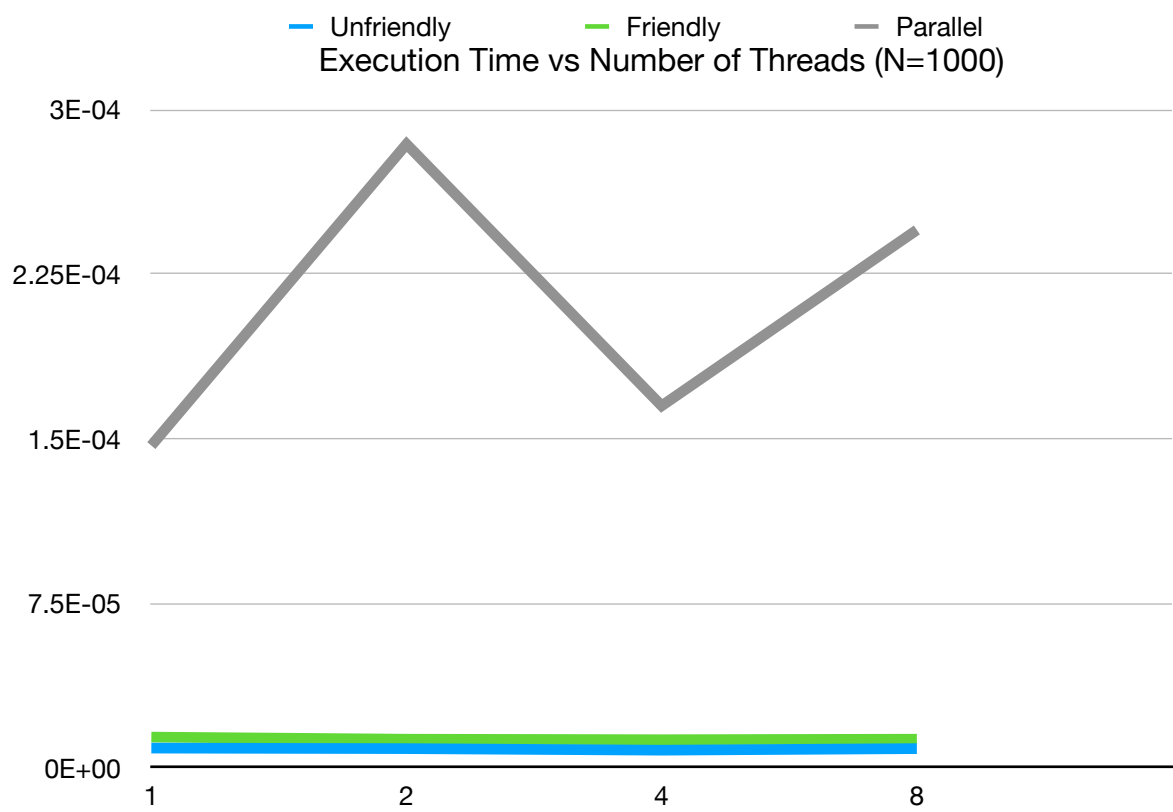


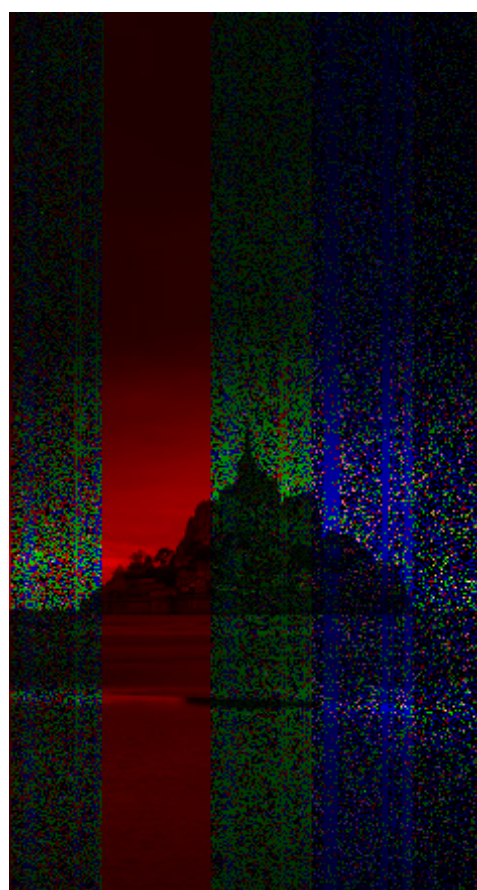
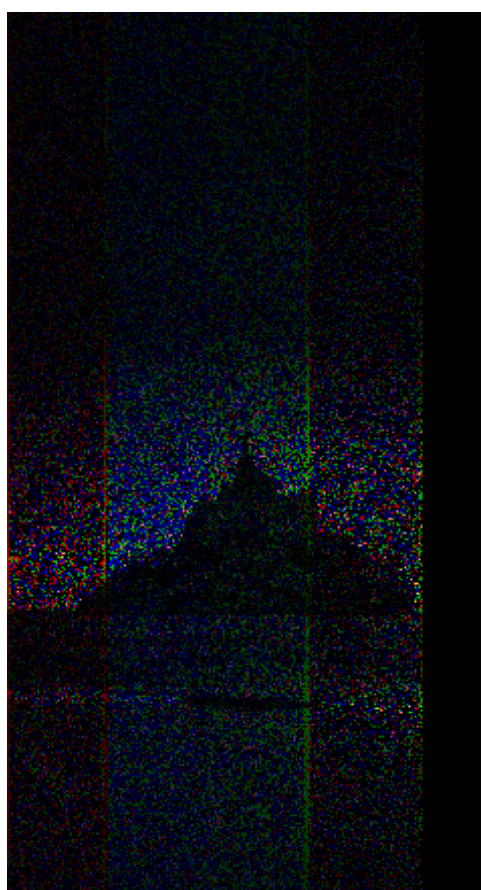
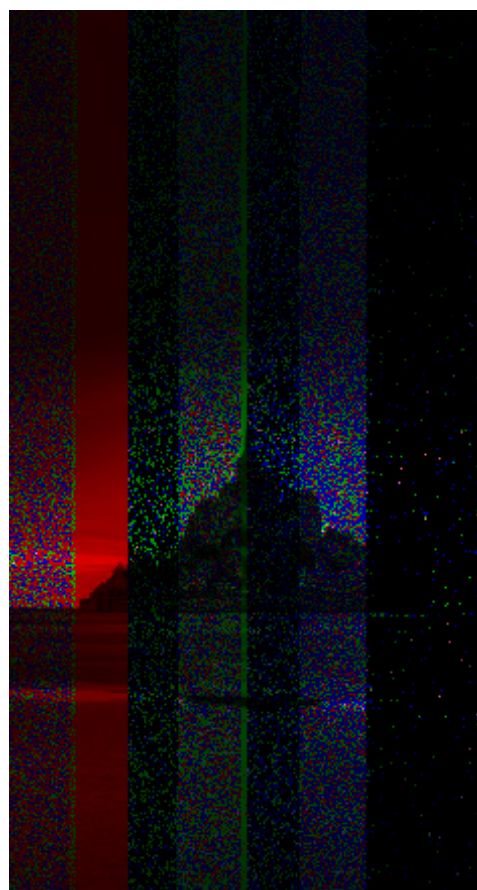
```

1 Thread
value of N  CACHE UNFRIENDLY SEIVE  CACHE FRIENDLY SEIVE  Parallel
1000       9.05991e-06              1.40667e-05           0.000146866
10000      8.32081e-05              0.000110865          0.000128031
100000     0.00108314              0.00106502           0.00121284
1000000    0.014565                  0.0099349            0.01018
10000000   0.19637                    0.094821             0.0927289
2 Thread
value of N  CACHE UNFRIENDLY SEIVE  CACHE FRIENDLY SEIVE  Parallel
1000       8.82149e-06              1.3113e-05           0.000284195
10000      8.4877e-05              0.000109911          6.79493e-05
100000     0.00106597              0.00108385           0.000579834
1000000    0.013519                  0.010247             0.00575209
10000000   0.192795                    0.095643             0.047327
4 Thread
value of N  CACHE UNFRIENDLY SEIVE  CACHE FRIENDLY SEIVE  Parallel
1000       8.10623e-06              1.28746e-05           0.000164986
10000      9.20296e-05              0.000121117          0.00013113
100000     0.00103498              0.001091             0.000653028
1000000    0.0142961                  0.0103719            0.00381684
10000000   0.207059                    0.097033             0.0352631
8 Thread
value of N  CACHE UNFRIENDLY SEIVE  CACHE FRIENDLY SEIVE  Parallel
1000       8.82149e-06              1.3113e-05           0.000245094
10000      9.10759e-05              0.000109911          0.000138044
100000     0.00108314              0.00106502           0.000594139
1000000    0.016186                  0.0105779            0.00371909
10000000   0.202369                    0.100233             0.034878
Program ended with exit code: 0

```



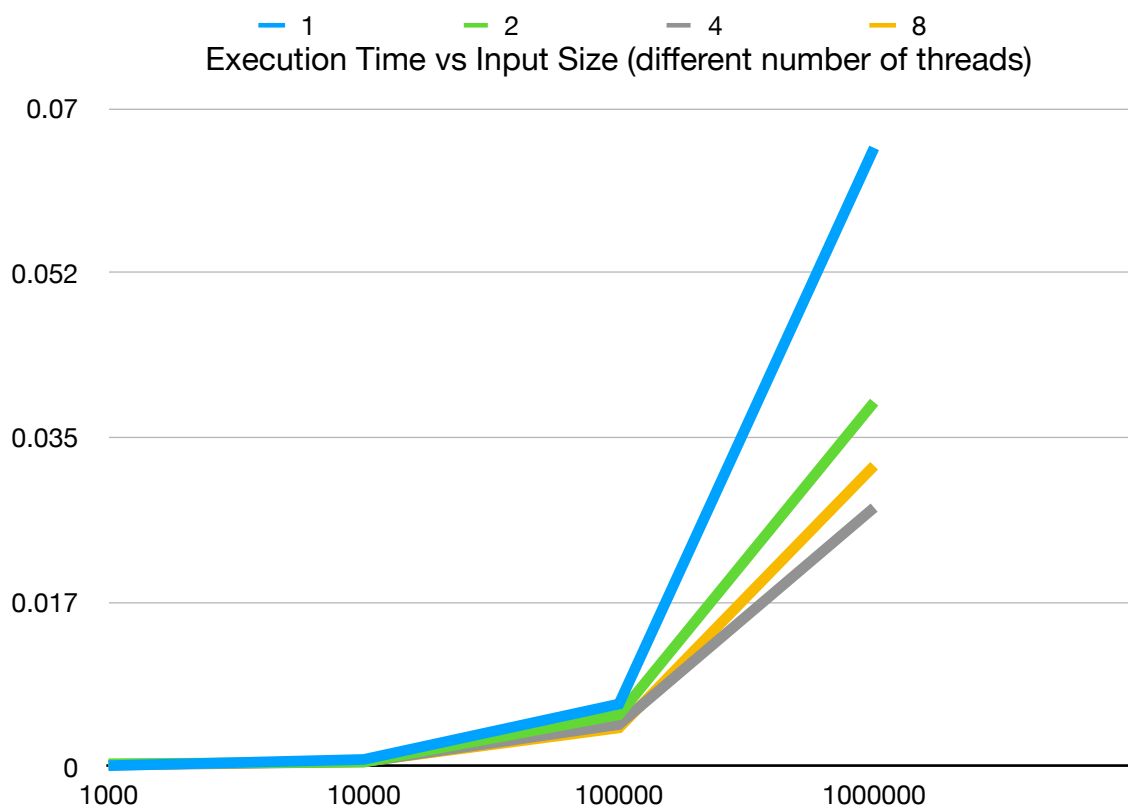


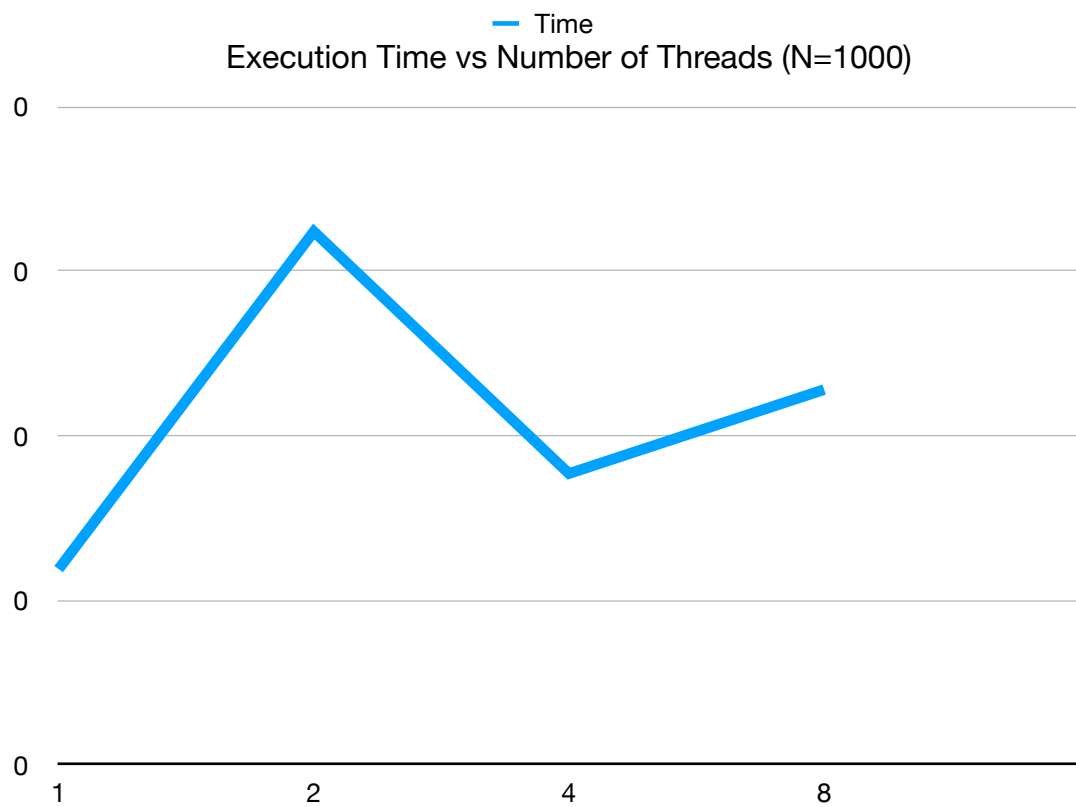


The execution time are

Size	1	2	4	8
1000	0.000119	0.000324	0.000177	0.000228
10000	0.000781	0.000498	0.000527	0.000556
100000	0.006673	0.005527	0.004497	0.004135
1000000	0.065785	0.038757	0.027550	0.031999

Program ended with exit code: 0



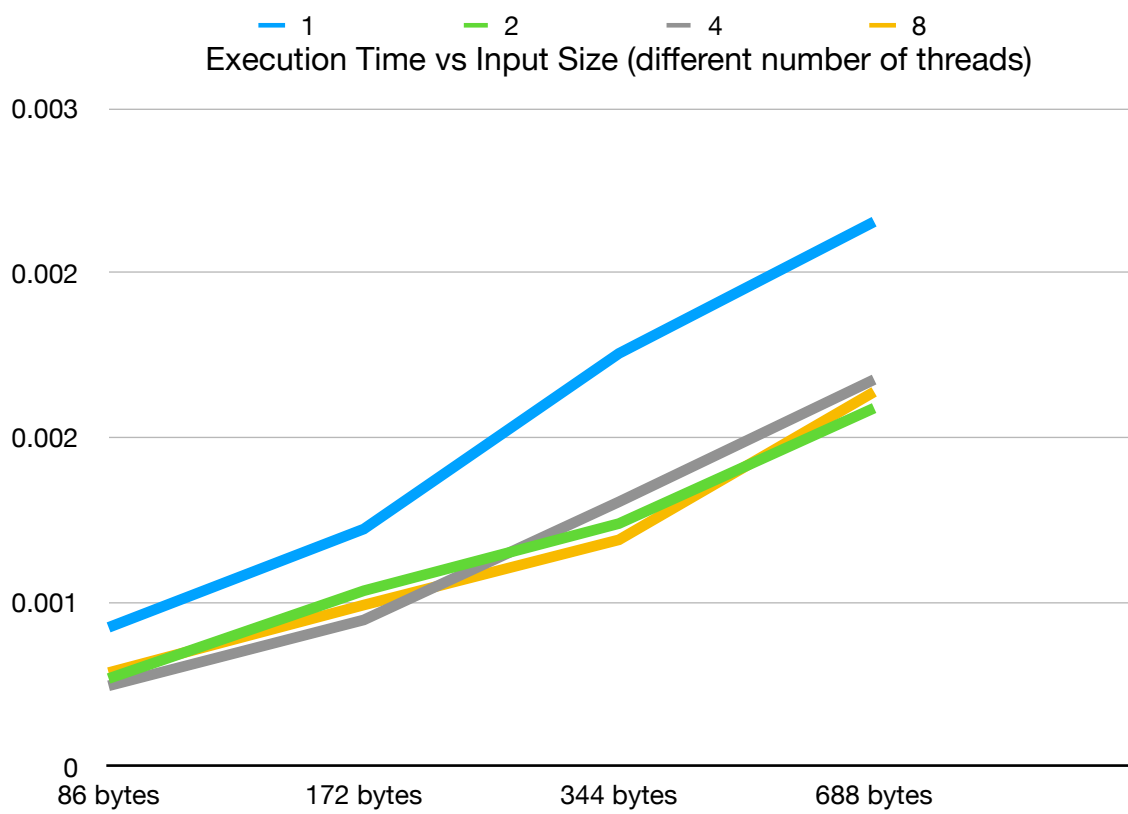


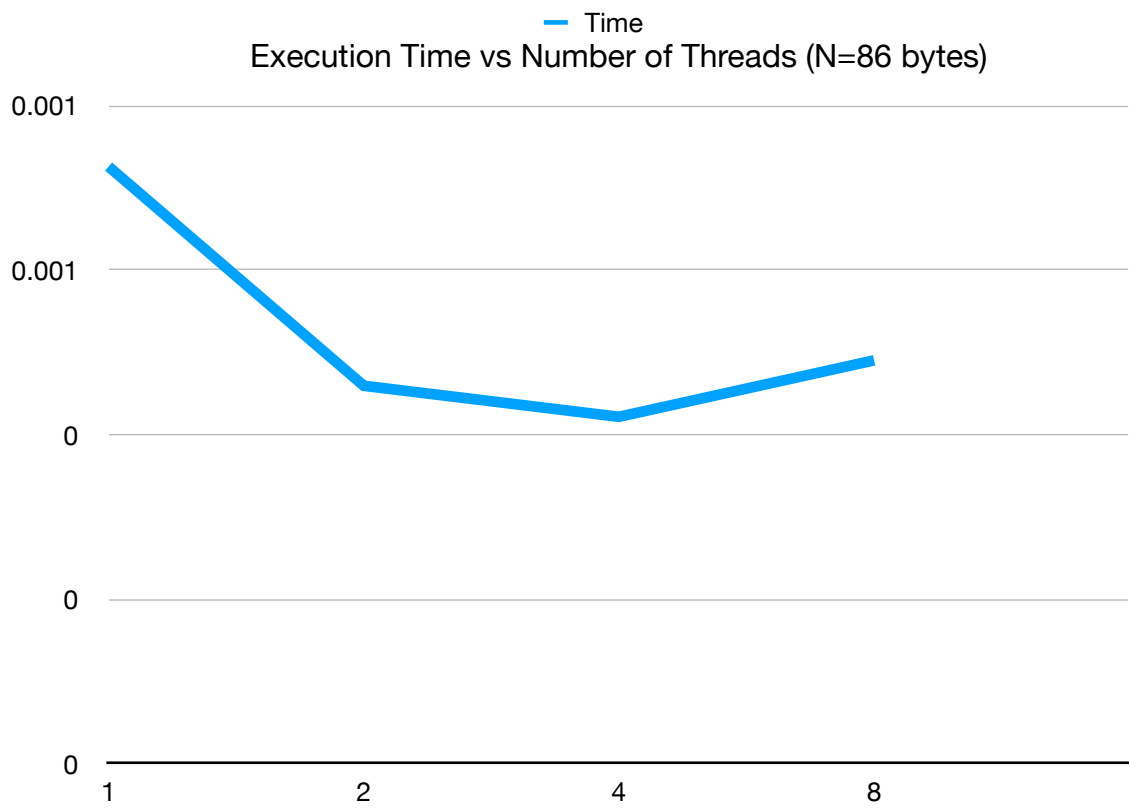
```
The: 2
around: 0
graphics: 1
from: 0
by: 1
be: 1
any: 0
which: 1
various: 0
mount: 0
1 Threads
Time Taken: 0.000635
```

```
The: 2
around: 0
graphics: 1
from: 0
by: 1
be: 1
any: 0
which: 1
various: 0
mount: 0
2 Threads
Time Taken: 0.000402
```

```
The: 2
around: 0
graphics: 1
from: 0
by: 1
be: 1
any: 0
which: 1
various: 0
mount: 0
4 Threads
Time Taken: 0.000369
```

```
The: 2
around: 0
graphics: 1
from: 0
by: 1
be: 1
any: 0
which: 1
various: 0
mount: 0
8 Threads
Time Taken: 0.000429
Program ended with exit code: 0
```






```
MPI_MULTITASK:
C / MPI version

P0_SET_PARAMETERS:
Set INPUT1 = 4096
INPUT2 = 4096
Process 1 time = 0.007509

Process 1 returned OUTPUT1 = 237
Process 2 returned OUTPUT2 = 564
Process 0 time = 0.008414
Process 2 time = 0.008749

MPI_MULTITASK:
Normal end of execution.
```

```
MPI_MULTITASK:
C / MPI version

P0_SET_PARAMETERS:
Set INPUT1 = 8192
INPUT2 = 8192
Process 1 time = 0.008992

Process 1 returned OUTPUT1 = 261
Process 2 returned OUTPUT2 = 1028
Process 0 time = 0.017989
Process 2 time = 0.018325

MPI_MULTITASK:
Normal end of execution.
```

```
MPI_MULTITASK:
C / MPI version

P0_SET_PARAMETERS:
Set INPUT1 = 16384
INPUT2 = 16384
Process 1 time = 0.020803

Process 1 returned OUTPUT1 = 275
Process 2 returned OUTPUT2 = 1900
Process 0 time = 0.062267
Process 2 time = 0.062323

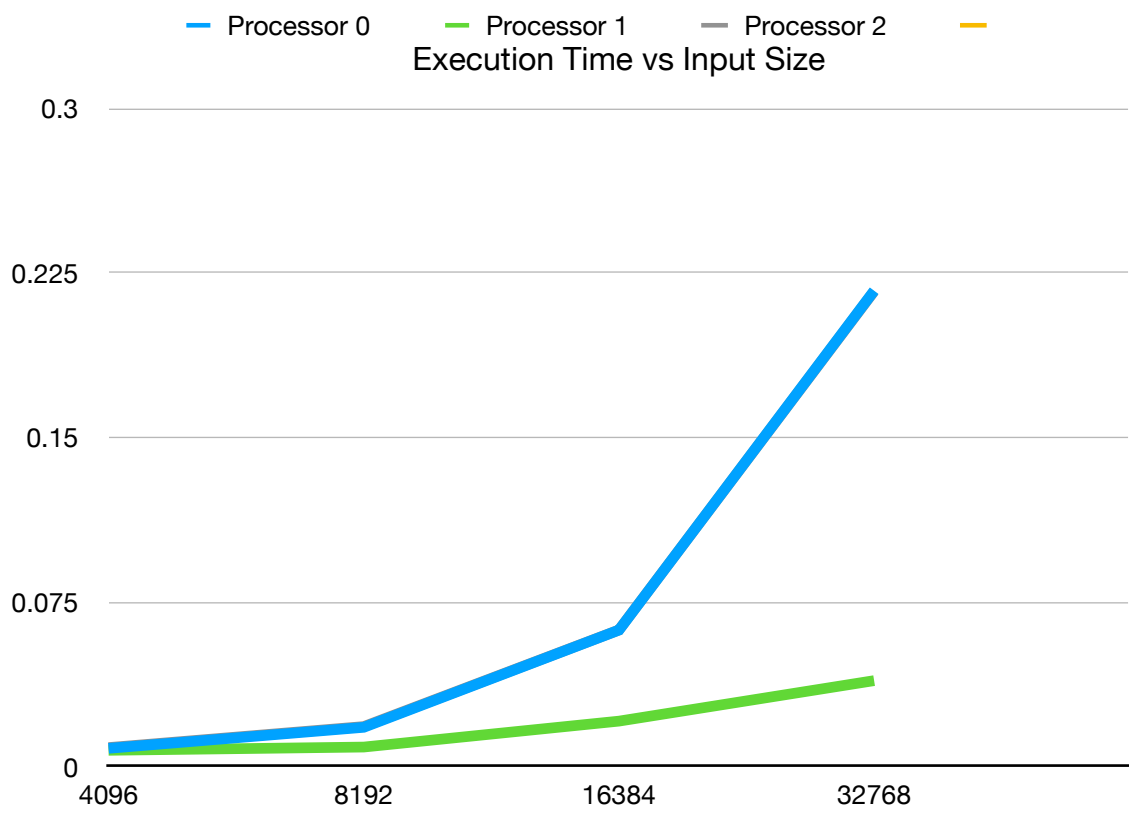
MPI_MULTITASK:
Normal end of execution.
```

```
MPI_MULTITASK:
C / MPI version

P0_SET_PARAMETERS:
Set INPUT1 = 32768
INPUT2 = 32768
Process 1 time = 0.039248
Process 2 time = 0.216605

Process 1 returned OUTPUT1 = 307
Process 2 returned OUTPUT2 = 3512
Process 0 time = 0.216878

MPI_MULTITASK:
Normal end of execution.
```



```

QUAD_MPI
C/MPI version
Estimate an integral of f(x) from A to B.
f(x) = 50 / (pi * ( 2500 * x * x + 1 ) )

A = 0.000000
B = 10.000000
N = 1024
EXACT =      0.4993633810764567

Use MPI to divide the computation among
multiple processes.
Process 2 contributed MY_TOTAL = 0.000637
Process 1 contributed MY_TOTAL = 0.575469

Estimate =      0.5761058738964471
Error = 7.674249e-02

Time = 0.001015

QUAD_MPI:
Normal end of execution.

```

```

QUAD_MPI
C/MPI version
Estimate an integral of f(x) from A to B.
f(x) = 50 / (pi * ( 2500 * x * x + 1 ) )

A = 0.000000
B = 10.000000
N = 2048
EXACT =      0.4993633810764567

Use MPI to divide the computation among
multiple processes.
Process 1 contributed MY_TOTAL = 0.537097
Process 2 contributed MY_TOTAL = 0.000637

Estimate =      0.5377333075866403
Error = 3.836993e-02

Time = 0.001026

QUAD_MPI:
Normal end of execution.

```

```

QUAD_MPI
C/MPI version
Estimate an integral of f(x) from A to B.
f(x) = 50 / (pi * ( 2500 * x * x + 1 ) )

A = 0.000000
B = 10.000000
N = 4096
EXACT =      0.4993633810764567

Use MPI to divide the computation among
multiple processes.
Process 1 contributed MY_TOTAL = 0.517912
Process 2 contributed MY_TOTAL = 0.000637

Estimate =      0.5185483443344734
Error = 1.918496e-02

Time = 0.001104

QUAD_MPI:
Normal end of execution.

```

```

QUAD_MPI
C/MPI version
Estimate an integral of f(x) from A to B.
f(x) = 50 / (pi * ( 2500 * x * x + 1 ) )

A = 0.000000
B = 10.000000
N = 8192
EXACT =      0.4993633810764567

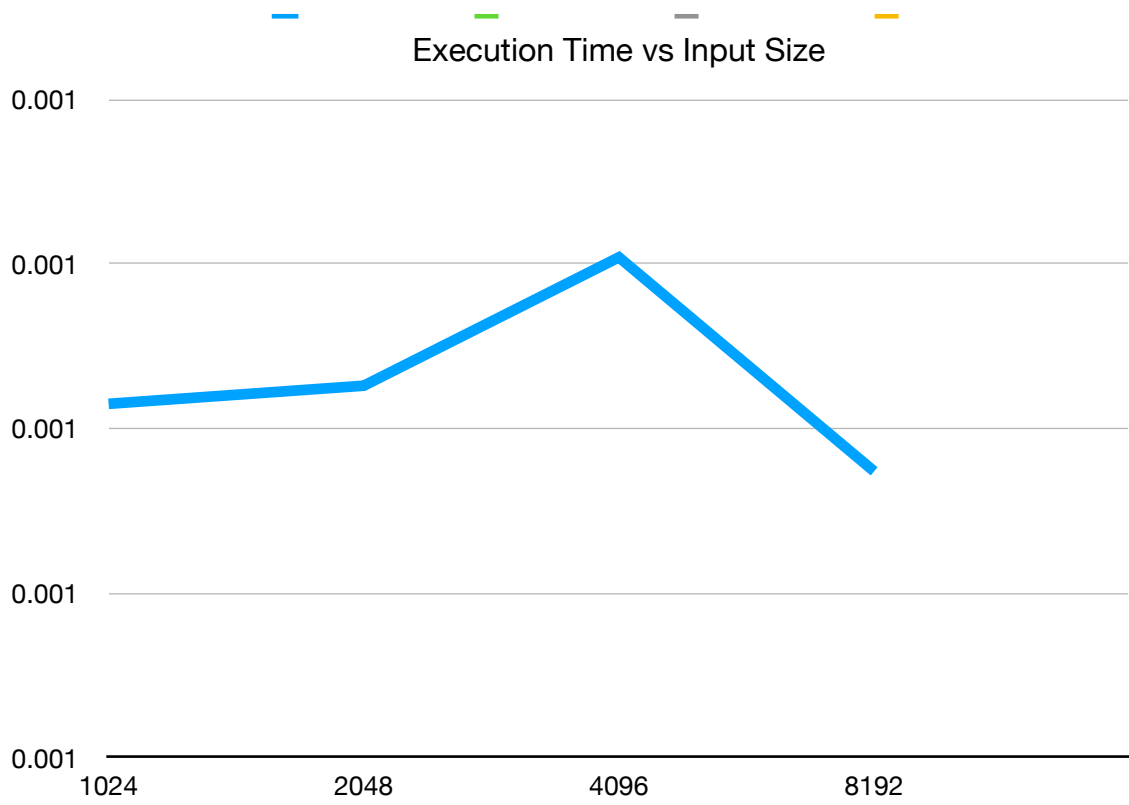
Use MPI to divide the computation among
multiple processes.
Process 2 contributed MY_TOTAL = 0.000637
Process 1 contributed MY_TOTAL = 0.508319

Estimate =      0.5089558627070492
Error = 9.592482e-03

Time = 0.000974

QUAD_MPI:
Normal end of execution.

```



RING_MPI:

C/MPI version

Measure time required to transmit data around
a ring of processes

The number of processes is 3

Timings based on 10 experiments

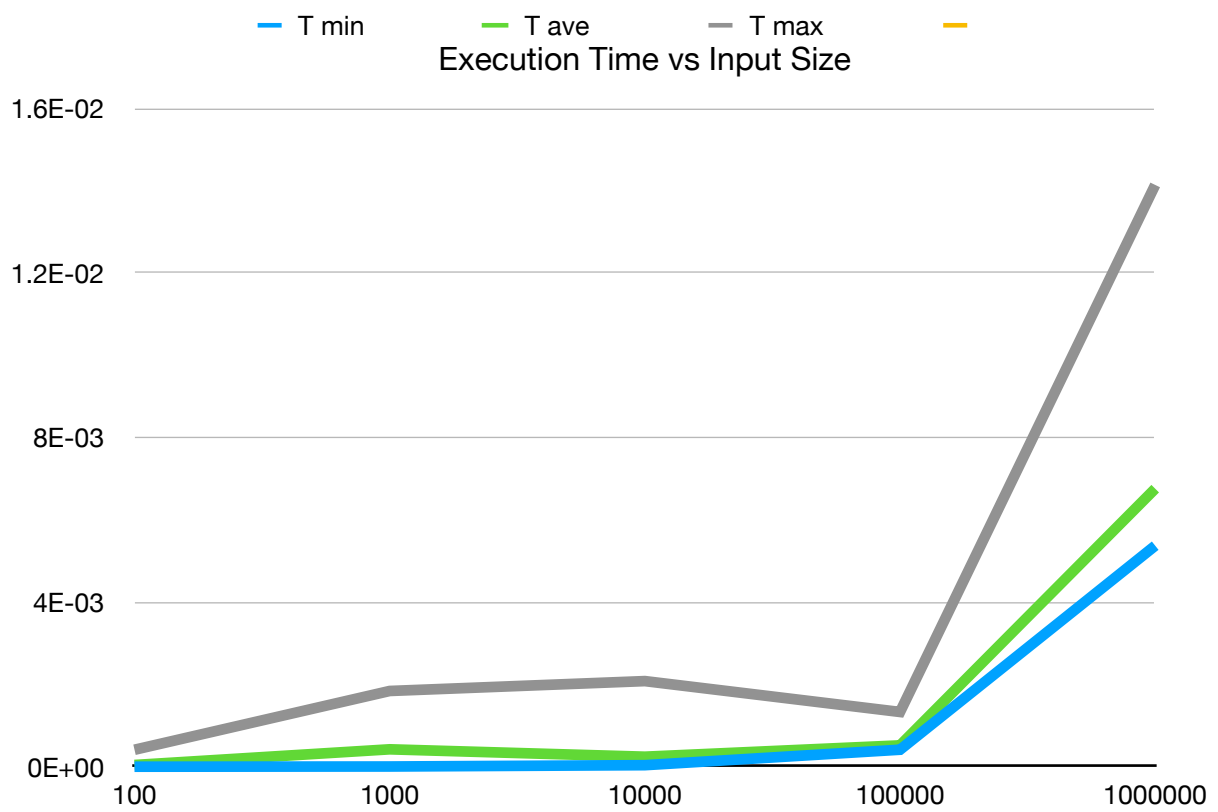
N double precision values were sent
in a ring transmission starting and ending at process 0
and using a total of 3 processes.

N T min T ave T max

100	2e-06	4.38e-05	0.000414
1000	7e-06	0.0004246	0.001842
10000	3.9e-05	0.0002451	0.002082
100000	0.000415	0.0005204	0.001332
1000000	0.005372	0.006757	0.014137

RING_MPI:

Normal end of execution.



```
[[cseu1@115CSGFWS01 1RV17CS164]$ ./a.out
16 size 0.000035 seconds with OpenACC
OpenACC matrix multiplication test was successful!
32 size 0.000263 seconds with OpenACC
OpenACC matrix multiplication test was successful!
64 size 0.002647 seconds with OpenACC
OpenACC matrix multiplication test was successful!
128 size 0.018331 seconds with OpenACC
OpenACC matrix multiplication test was successful!
256 size 0.085170 seconds with OpenACC
OpenACC matrix multiplication test was successful!
[[cseu1@115CSGFWS01 1RV17CS164]$
```

```
[cseu1@115CSGFWS01 1RV17CS164]$ ./prg11
256 * 256 size 0.001711 seconds with OpenACC
[cseu1@115CSGFWS01 1RV17CS164]$ vi prg11.c
[cseu1@115CSGFWS01 1RV17CS164]$ gcc prg11.c -lm -o prg11
[cseu1@115CSGFWS01 1RV17CS164]$ ./prg11
512 * 512 size 0.007294 seconds with OpenACC
[cseu1@115CSGFWS01 1RV17CS164]$ vi prg11.c
[cseu1@115CSGFWS01 1RV17CS164]$ gcc prg11.c -lm -o prg11
[cseu1@115CSGFWS01 1RV17CS164]$ ./prg11
1024 * 1024 size 0.030619 seconds with OpenACC
[cseu1@115CSGFWS01 1RV17CS164]$ vi prg11.c
[cseu1@115CSGFWS01 1RV17CS164]$ gcc prg11.c -lm -o prg11
[cseu1@115CSGFWS01 1RV17CS164]$ ./prg11
2048 * 2048 size 0.097845 seconds with OpenACC
[cseu1@115CSGFWS01 1RV17CS164]$ vi prg11.c
[cseu1@115CSGFWS01 1RV17CS164]$ gcc prg11.c -lm -o prg11
[cseu1@115CSGFWS01 1RV17CS164]$ ./prg11
4096 * 4096 size 0.281826 seconds with OpenACC
```