Class: Final Year (Computer Science and Engineering)

Year: 2023-24 **Semester:** 1

Course: High Performance Computing Lab

Practical No. 12

Exam Seat No: 2020BTECS00112

Full Name: Meet Gandhi

Title of practical: Analysis of MPI Programs

Problem Statement 1:

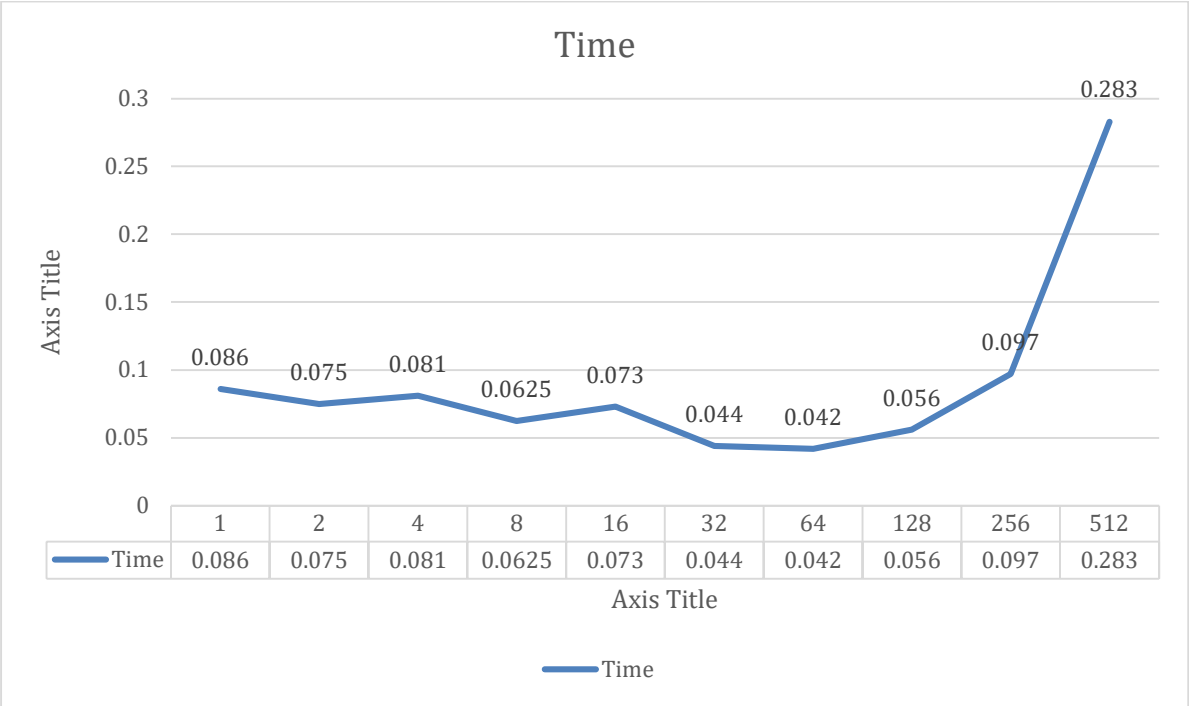
Execute the MPI program (Program A) with a fixed size broadcast. Plot the performance of the broadcast with varying numbers of processes (with constant message_size). Explain the performance observed.

Screenshot:

```
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 1 assignment_12A
0 have lb = 0 and hb = 512

Starting clock.

Elapsed time = 0.086867 s.
-----------------------------------------
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 2 assignment_12A
1 have lb = 256 and hb = 512
0 have lb = 0 and hb = 256

Starting clock.

Elapsed time = 0.075029 s.
-----------------------------------------
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 4 assignment_12A
1 have lb = 128 and hb = 256
2 have lb = 256 and hb = 384
3 have lb = 384 and hb = 512
0 have lb = 0 and hb = 128

Starting clock.

Elapsed time = 0.081262 s.
-----------------------------------------
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 8 assignment_12A
5 have lb = 320 and hb = 384
6 have lb = 384 and hb = 448
1 have lb = 64 and hb = 128
2 have lb = 128 and hb = 192
7 have lb = 448 and hb = 512
4 have lb = 256 and hb = 320
3 have lb = 192 and hb = 256
0 have lb = 0 and hb = 64

Starting clock.

Elapsed time = 0.062533 s.
-----------------------------------------
```

```
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 16 assignment_12A
2 have lb = 64 and hb = 96
1 have lb = 32 and hb = 64
6 have lb = 192 and hb = 224
9 have lb = 288 and hb = 320
3 have lb = 96 and hb = 128
8 have lb = 256 and hb = 288
5 have lb = 160 and hb = 192
7 have lb = 224 and hb = 256
10 have lb = 320 and hb = 352
4 have lb = 128 and hb = 160
15 have lb = 480 and hb = 512
12 have lb = 384 and hb = 416
11 have lb = 352 and hb = 384
14 have lb = 448 and hb = 480
13 have lb = 416 and hb = 448
0 have lb = 0 and hb = 32

Starting clock.

Elapsed time = 0.073306 s.
-----------------------------------------
```

Analysis:



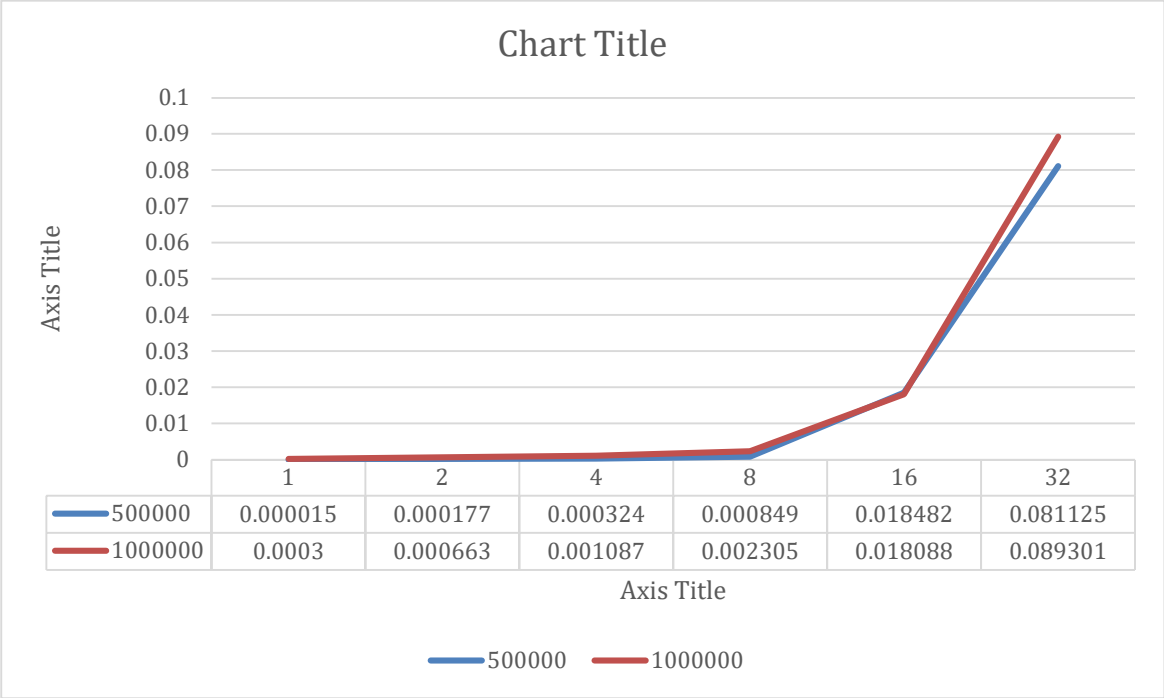
Problem Statement 2:

Repeat problem 2 above with varying message sizes for reduction (Program B). Explain the observed performance of the reduction operation.

Screenshot:

```
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 1 assignment_12B 1000000
Average time for reduce : 0.000030 secs
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 2 assignment_12B 1000000
Average time for reduce : 0.000663 secs
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 4 assignment_12B 1000000
Average time for reduce : 0.001087 secs
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 8 assignment_12B 1000000
Average time for reduce : 0.002305 secs
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 16 assignment_12B 1000000
Average time for reduce : 0.018088 secs
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 32 assignment_12B 1000000
Average time for reduce : 0.089301 secs
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 1 assignment_12B 500000
Average time for reduce : 0.000015 secs
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 2 assignment_12B 500000
Average time for reduce : 0.000177 secs
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 4 assignment_12B 500000
Average time for reduce : 0.000324 secs
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 8 assignment_12B 500000
Average time for reduce : 0.000849 secs
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 16 assignment_12B 500000
Average time for reduce : 0.018482 secs
PS E:\Acad\Sem VII\HPCL\Assignment 12> mpiexec -n 32 assignment_12B 500000
Average time for reduce : 0.081125 secs
PS E:\Acad\Sem VII\HPCL\Assignment 12>
```

Analysis:



GitHub: https://github.com/meetgandhi692/HPC-Lab/tree/9eeb3c100b78e258f402c1a575a546d518447a48/Assignment%2012