MPI Exercise

GTC-X developers

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Exercise 1

This is a simple example to try out all the different MPI operations.

- Create a file with following entries: 10 9 3 7
- Read the file into an array A(i). Perform the following operations in 4 different MPI's.
  - **MPI 1:** A(1) * 12
  - **MPI 2:** A(2) * 3
  - **MPI 3:** A(3) * 7
  - **MPI 4:** A(4) * 13

  Output the values calculated by each MPI and the corresponding process ID.
- Find the sum of all the above values and write it to a file. Check that the value = 10*12 + 9*3 + 3*7 + 7*13

Exercise 2

Speed-up using MPI.

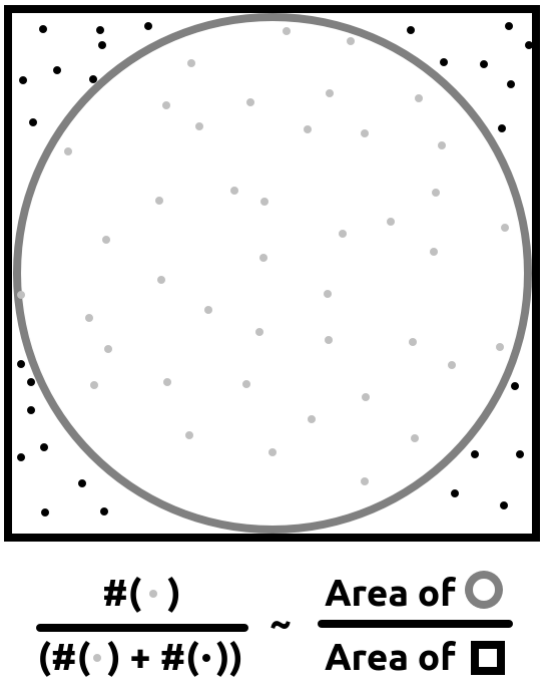
- Write an MPI code to find if the given number is a prime using simple for loop that is partitioned across different MPI's.
- Find the number closest to 0.5 in the attached file "Data.out".
- Find the probability distribution of the numbers in "Data.out", using histogram binning operation.

Perform the above operations with different number of MPI's and report the time taken. For what number of MPI's does the code runs the fastest?

Exercise 3

Simple Monte-Carlo example.

- **Find the area of a circle of radius 1:** To do this generate 2d random numbers with uniform distribution between −1 and 1. Count the number of points that fall inside the circle. If N is the total number of random points generated and N_C number of them fall inside the circle, then N_C/N is approximately equal to the ratio of the area of the circle to the area of a square with side length 2. Hence you can find the area of the circle. The relation becomes exact when $N \longrightarrow \infty$. Compare with the exact result. Does MPI speed-up the process?



- **Area of an ellipse:** The above exercise is trivial, as we know an exact expression for the area of a circle. But there is no such relation for an ellipse. So use the above method to find the area of an ellipse with major axis 1 and minor axis 0.8.