Exercise Sheet 10

Exercise 1 (Approximate π via Monte Carlo)

π can be approximated via Monte Carlo simulation.

Approach: Inscribe a circle of radius r inside a square with side length $2r$.

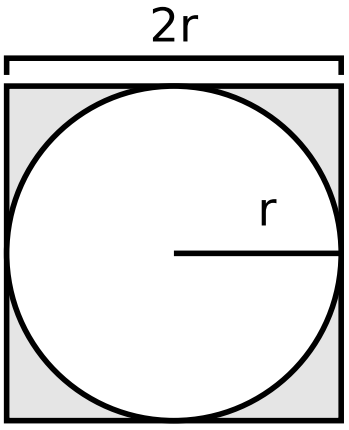
$$A_S = (2r)^2 = 4r^2$$

$$A_C = \pi r^2 \Longrightarrow \pi = \frac{A_C}{r^2}$$

Generate random dots in the square. The number of dots in A_C in relation to the number of dots in A_S is equal to the surface ratio.

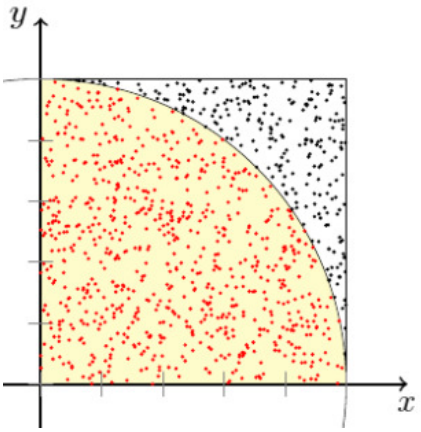
$$\frac{A_C}{A_S} = \frac{\pi r^2}{4r^2} \Longrightarrow \frac{A_C}{A_S} = \frac{\pi}{4}$$

The dots can be generated in parallel by the workers. The master receives the dots and calculates π.



A = Surface ratio
r = Radius
C = Circle
S = Square

Image source: Wikipedia



1. Develop a MPI application, which calculates π via Monte Carlo simulation.
2. Start a MPI cluster (e.g. in a public Cloud infrastructure service like Amazon EC2) and execute your MPI application in the MPI cluster.
3. Test your MPI application with different numbers or worker nodes to discover if your application scales well with a growing number of worker nodes.
4. Present your application and the outcome of your performance measurements during the exercise session.