

Tutorial No. 3

MPI

Exercise 3.1

1. Implement with MPI a *communication ring* between n processes: Process 0 asks the user for an integer value, which is sent to every other processes in turn and back to Process 0 (See Figure 1);
2. Propose a practical use for this algorithm.

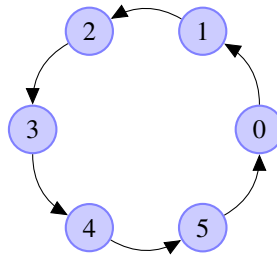


Figure 1: A communication ring between six processes

Exercise 3.2

The value of π may be approximated by integrating the function $f(x) = \frac{4}{1+x^2}$ over the interval $[0, 1]$ (See Figure 2). Implement with MPI a program that computes with p processes an approximation of π by evaluating an estimate of the integral of f as follows: Process 0 asks the user for a number n of slices; each process evaluates f at the middle of n/p slices and sums the results; Process 0 gathers all partial sums, computes the total sum and displays it as an estimate of π .

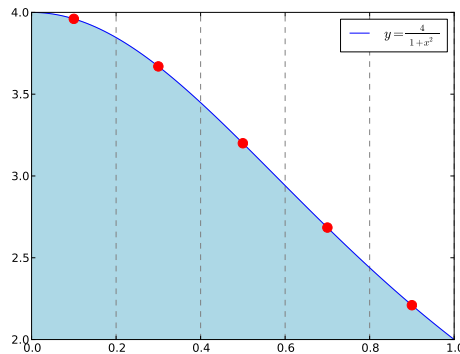


Figure 2: Integrating $f(x)$ to approximate π

Exercise 3.3

1. Using MPI routines, propose several algorithms to implement the `MPI_Alltoall()` routine, which sends data from all processes to all processes;
2. Discuss your implementations from the point of view of network use and resource contention.