

INF3380 Exercise Set 5

for Chapter 6 “Programming Using the Message Passing Paradigm”

Exercise 1

Write a new Hello World program, where all the processes first generate a text message using `sprintf` and then send it to Process 0. (Hint: you may use `strlen(message)+1` to find out the length of the message). Afterwards, Process 0 is responsible for writing out all the messages on the standard output.

Exercise 2

Write three simple parallel programs for adding up a number of random numbers. Each process should first generate and sum up locally an assigned number of random numbers. To find the total sum among all the processes, there are three options:

- Option 1: let one process be the master and let each process use `MPI_Send` to send its local sum to the master.
- Option 2: let one process be the master such that it collects from all the other processes by the `MPI_Gather` command.
- Option 3: let one process be the master and make use of the `MPI_Reduce` command.

Exercise 3

Show how the row-wise matrix-vector multiplication program (Program 6.4 in the textbook) needs to be changed, so that it will work correctly in case the dimension of the matrix is not a multiple of the number of processes p .

Exercise 4

Consider the column-wise implementation of matrix-vector multiplication (Program 6.5 in the textbook). Modify the implementation to use `MPI_Allreduce` to perform the required reduction operation and then have each process copy

the locally stored elements of vector \mathbf{x} from the vector \mathbf{fx} . Write another implementation that performs p single-node reduction operations, each time using a different process as the root.