# Assignment: Implementing the Reduce operation

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1. On the CS machines, copy the contents of `rvdg/class/CS378S13/mpi/sum_to_one` to your directory.

   (`cp -r rvdg/class/CS378S13/mpi/sum_to_one <directory name>`)

2. Change to that directory.

3. Modify the file "hostfile" so that the machine that you are on is listed instad of `diligence.cs.utexas.edu`. What this will do is create multiple MPI processes, but they will all run on the same machine. As a result, you will be simulating a distributed memory parallel computer on a single CPU.

4. Type "source setup" or "source setup_bash". This initializes some environment variables for MPI.

5. Type "make run" // This will compile the code and run it on 5 machines as a parallel computer.

6. What does this code do?

   (a) It tests the routine `my_sum_to_one` in file `my_sum_to_one.c`.

   (b) It does so by using the Message-Passing Interface. To learn more about MPI, visit `http://www-unix.mcs.anl.gov/`

   (c) Let the processors be indexed $0, 1, 2, \ldots$. Then on processor $i$, the input vector is

   $$\begin{pmatrix} 0 + i * 10^{-(i+1)} \\ 1 + i * 10^{-(i+1)} \\ \vdots \\ 9 + i * 10^{-(i+1)} \end{pmatrix}$$

   In other words, the input vectors are given by

   $$\begin{pmatrix} 0.0000 \\ 1.0000 \\ \vdots \\ 9.0000 \end{pmatrix}, \quad \begin{pmatrix} 0.0100 \\ 1.0100 \\ \vdots \\ 9.0100 \end{pmatrix}, \quad \begin{pmatrix} 0.0020 \\ 1.0020 \\ \vdots \\ 9.0020 \end{pmatrix}, \quad \text{etc.}$$

   on processors $0, 1, 2, \ldots$.

   (d) The output is the sum of these vectors, gather to the root (in this case processor 0):

   $$\begin{pmatrix} 0.01234 \\ 5.01234 \\ \vdots \\ 45.01234 \end{pmatrix}$$

7. Notice that in the file `my_sum_to_one.c` I have merely implemented the parallel summation of these vectors by a call to the MPI library routine `MPI_Reduce`.

8. Your job is to reimplement this using a minimum-spanning-tree (MST) algorithm, as discussed in class.

9. Hint: in `my_bcast.c` you will find a recursively implemented MST broadcast, which you should be able to modify to come up with a MST reduce.