Cmpe 300 Programming Project
Fall 2013
Parallel Scramble with MPI

Due date: Monday, January 06, 2014

In this project, you are supposed to implement the parallel version of the Scramble algorithm which is given in the first assignment:

```
procedure Scramble(A[1:n]) recursive
    input:   A[1:n] (an array of integers with size n)
    output:  A[1:n] (array altered by the procedure)

        if n=3 then
            interchange(A[1],A[2])
            interchange(A[2], A[3])
        else
            m := n/3
            for i:=1 to m do
                Temp1[i] := A[i]
                Temp2[i] := A[i+m]
                Temp3[i] := A[i+2*m]
            endfor
            Scramble(Temp1)
            Scramble(Temp2)
            Scramble(Temp3)
            for i:=1 to m do
                A[i] := Temp3[i]
                A[i+m] := Temp1[i]
                A[i+2*m] := Temp2[i]
            endfor
        endif
```

The given scramble algorithm has three steps:

i- It splits the given list into three sub portions.
ii- It scrambles each portion.
Iii- It concatenates these three portions, changing their order.

1. The parallel Scramble Algorithm

You are going to read the data from an input file with 1 processor, and distribute the data to its three sub-processors, until the bottom level. Each processor will scramble its data. Then you are going to merge the scrambled sets in parallel. Then write the scrambled list to an output file.

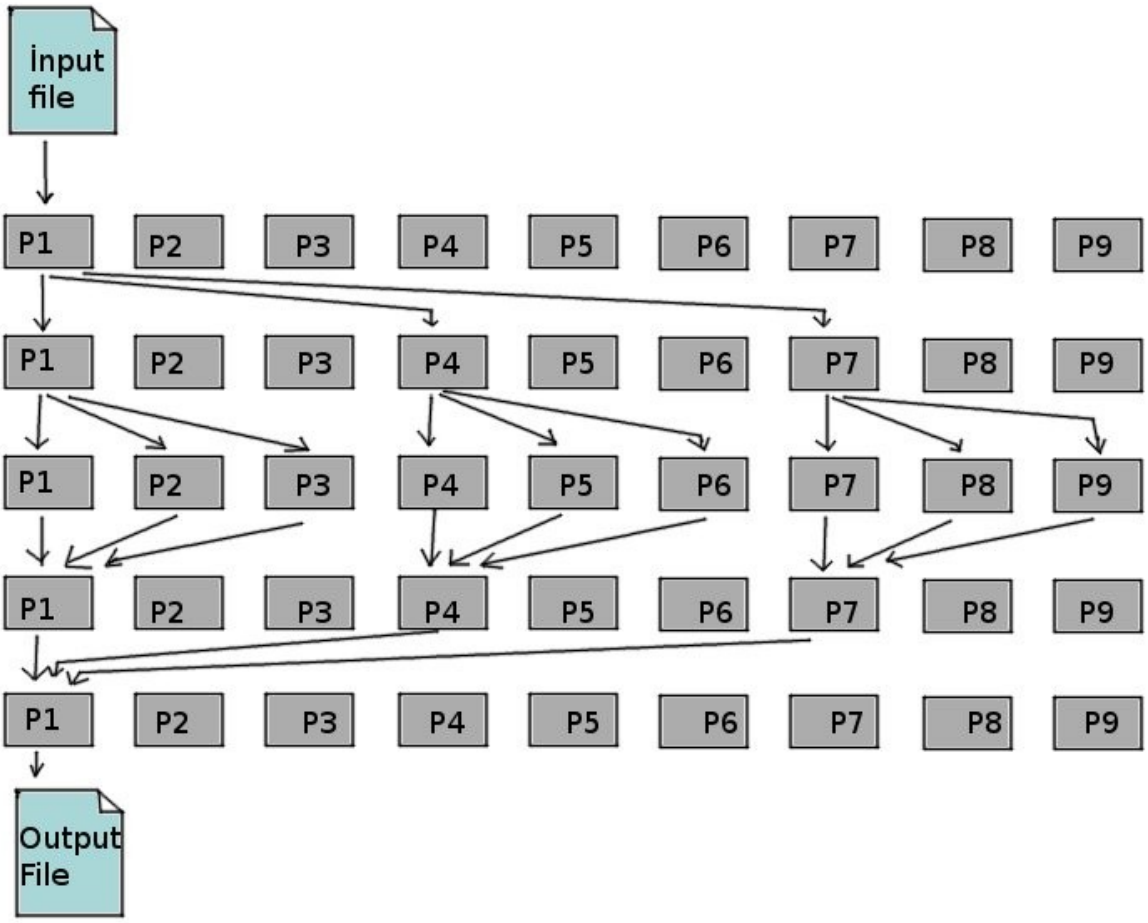

Figure: An example run with 9 processors

2. Input and output

Your program will read double values from a text file where each line contains a single double value. Example:

```
VALUE_1
VALUE_2
...
...
VALUE_N
```

The output format will be exactly the same as the input format, except that the values are going to be scrambled. You may assume that the number of values (N) is a positive power of 3.

2.1 How to run the program

You should read the names of the input and output files as the arguments to your main. Furthermore, your program should be able to run with any number of processors which is a power of 3. Your program will be tested with the following script:

```
mpiexec -n NUM_PROCESSORS ./your_project INPUT_FILE OUTPUT_FILE
```

3. Submission Details

- Write your code with meaningful comments. Especially messaging parts should be commented.
- Submit your codes, documents, report and everything in a single zip file with a naming like: MUSTAFA_TUGRUL_OZSAHIN.zip
- Send your project file by e-mail to mustafatugrulozsahin@gmail.com. Subject of your e-mail must be: “Cmpe 300 MPI Project Submission Your_full_name”
- The project will be done individually, not as a group.
- The deadline will not be extended.
- For the MPI environment and tutorials check the course web page.
- Your code should be able to run on different cases (different sizes of data and different processor counts). Test your code comprehensively.
- You must prepare a document about the project, which is an important part of the project. Follow the guidelines given in the “Programming Project Documentation” link on http://www.cmpe.boun.edu.tr/~gungort/informationstudents.htm .

The Header Comment

You are requested to write a header comment in the source code file, which includes your main function. You are supposed to list the following information in the header comment.

```
/*
Student Name: Ali Veli
Student Number: 2008123456
Operating System: {Windows[Version] / Linux[Version] / MacOSX}
Compile Status: {Compiling/Not Compiling}
Program Status: {Working/Not Working}
Notes: Anything you want to say about your code that
will be helpful in the grading process.
*/
```