Description

This file runs an n-queens solution counter for a given n x n board using MPI. The program begins by initializing MPI and then iterates through all permutations for an array of integers of length n. If a given permutation has a valid solution, the counter is incremented. At the end of the program, the number of solutions and execution time is output to terminal.

Compiling

This program requires the g++ compiler as well as MPI installed and able to be used. A Makefile is provided but the program can also be compiled using the following command

```
>> mpic++ -Wall -o nqueens nqueens.c
```

Usage

The program requires a command line argument <n>. The n value given will be the number of queens on the board as well as the size of the board. MPI is required to be able to run the program, the following command below can be used to run with <n> being substituted for the desired n value. The flag -np and its value <num_procs> can be removed, or <num_procs> can be replaced with the number of processes to run.

```
>> mpirun -np <num_procs> ./nqueens <n>
```

Task/Channel Model

The parallel algorithm implemented uses tuples to represent a board configuration. Each i-th permutation is sent to the MPI process and calculated, when the i-th permutation is found, the configuration is tested for a correct solution, if the configuration is valid then the process reports back to the original thread and keeps a running tally of the number of valid configurations each process has found. When the processes finish their work their totals are summed using MPI_Reduce into the root process. This gives the final number of solutions.