

HW 3 – Game of Life

Prof. John R. Gilbert

May 10, 2004

*It's not true that life is one damn thing after another;
it is one damn thing over and over.
-Edna St. Vincent Millay*

Problem Description

Implement a parallel simulation of Conway's Game of Life[1] in OpenMP and MPI.

Requirements

Your program should read the initial configuration of the Life grid from an input file. It should then run for a user-specified number of iterations (or generations in Life parlance) and print the final configuration of the grid to an output file.

The format of the input and output files is very simple. For each occupied cell in the grid, there is a single entry per line of the form:

x y

Value of x varies from 0 to X-DIM-1 and that of y varies from 0 to Y-DIM-1, where X-DIM and Y-DIM are the width and length of the Life grid respectively. Additionally, the first line of the output file should be of the form:

X-DIM Y-DIM

Putting it all together, your program should take exactly five command-line arguments: the input file, the output file, X-DIM, Y-DIM and the number of iterations/generations to run the program for.

Finally, you have to submit a 1-2 page report which answers the following questions:

- What domain decomposition technique did you employ?
- How did you perform load balancing?
- What was the performance of your programs? Specifically, run the parallel programs with the provided input file - max.dat[2] with a 1000x1000 board for 2000 iterations on 1, 2, 4 and 8 processors and measure the computation and communication times. Plot these results. How do the MPI and OpenMP programs compare against each other? Explain your results in light of the domain decomposition and load balancing techniques that were used.

Implementation Notes

- Read the accompanying instructions[2] on the class webpage to get started.
- Start by writing a serial implementation of the Game of Life first. Design the program in such a way that you can re-use the data structures and the functions later for the parallel implementations without major changes. Ensure correctness using well-known Game of Life configurations[1] as inputs.
- For easy verification of your results (ok, for the coolness factor!), we recommend that you use the g2 graphics library[3] for visualization. Read the instructions[2] for more details. We also encourage you to read the manual on the g2 website.

Grading Criteria

Both parts (OpenMP and MPI) of the homework carry equal weight. Your programs will be graded using the following criteria:

1. Correctness – 30%
2. Performance – 50%
3. Documentation – 15%
4. Completion of HPCS Study Logs and Questionnaires – 5%
5. Extra Credit – 30%

To earn the extra credit you will have to implement and comparatively evaluate two or more domain decomposition techniques.

References

- [1] *Game of Life*, <http://www.math.com/students/wonders/life/life.html>.
- [2] *HW-3 Instructions*, <http://www.cs.ucsb.edu/~cs240a/hw/hw3/instructions.txt>.
- [3] *g2 Graphics Library*, <http://g2.sf.net>.