CSCE 313

Lab 5

Multiprocessor Real-Time Fractal Generation

Due Date: 4/15, 11:59pm

Design Requirements

The objective of this lab is to write a Mandelbrot fractal generator for the following requirements:

- Initially display the fractal between -2.5 – 1i and 1 + 1i. Afterwards, your system must automatically identify an interesting point around which to zoom. Subsequent frames should use a 4:3 aspect ratio.
- To identify the zoom point, use the pixel value that diverged after at least 50% of your iteration limit. Make sure only one processor selects the zoom point and communicates the point to the others using your shared memory.
- Use an exponential zoom rate, at: 1.5^{-zoom_level}.
- At each zoom level, re-render the frame.
- Use floating point values when generating the fractal.
- Begin with one processor, then scale up to four processors, one at a time. Parallelize the algorithm by assigning an equal number of pixels to each processor. Don't forget to use barriers to synchronize the processors after each frame.

Project Submission

In addition to the archived project directory, each group must submit a report that details their performance results for **one to four processors**, measured as:

1. average time (in seconds) to generate each frame over at least 4 frames,
2. average number of clock cycles to compute and paint each pixel over at least one frame,
3. number of cycles to compute one iteration of the polynomial evaluation loop, and
4. number of cycles per floating point operation performed in the polynomial evaluation loop

The report should contain all implementation-specific details, such as:

- the maximum iteration count,
- the method for finding the zoom point,
- the color calculation function (make sure there is no overflow)