Project Milestone

15418 Parallel Computation

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SCHEDULE:
November 9th - November 30th: Implemented sequential and parallel version of tiling with minos. Start optimizing to be able to test and compare solvers on bigger board sizes with different inputs
November 30th - December 4th: Work on optimization - Brad and Daniel
December 4th - December 7th: Finish up optimizations and potentially add in Tetris rules time permitting - Brad and Daniel
December 7th - December 11th: Get final data and start working on report - Daniel, Make sure there are no bugs - Brad
December 11th - December 14th: Get demo set up and presentation ready - Brad and Daniel
December 14th - December 18th: Work on the final report and presentation - Brad and Daniel

SUMMARY:
So far, we've implemented a basic sequential and parallel solver for a general tiling problem (we allow polyominos up to length 5) for any size board. We have a script with timing and output information and some example inputs that we can run to compare our two solvers and see where they do better than each other. At the moment, we have found the most improvement from example.txt (this is the example provided in the project proposal) with a speedup of around 20x.

For future work, we are attempting to optimize the sequential version (and thus the parallel version) so we can test large boards with lots of polyominos of different sizes. We have tried doing large boards of size 10 x 12 with many duplicate dominos, but we ran into the issue of having numerous dominos lead to repeated boards being checked which lead to the program effectively stalling.

PROGRESS:
With respect to the goals and deliverables we stated in our proposal, we ended up deciding to change it from a Tetris-oriented problem to a more general tiling question with Tetris aspects. This is because we needed to increase our problem size as having a normal solvable tetris board often didn't give that many interesting results. We should still be able to produce a deliverable of a demo comparing the solvers, it will just instead be able to solve bigger problems rather than constrain the size of a smaller problem that we originally wanted to do.

GOALS:
Need To Achieve:

- A working, correct PC solver, single-threaded. This is entirely achievable and must happen since its logic is core part of our project.
- A PC solver with at least 2x speedup on GHC (8 cores).

Plan To Achieve:

- Optimizations to our PC solver to solve boards of bigger sizes with many duplicate pieces (main problem would be something along the lines of 10 pentominos and 50 dominos).
- A PC solver with at least 4x speedup on GHC.

Hope To Achieve (not very likely):

- Adding Tetris rules to constrain our problem space (but also potentially make it harder to parallelize).
- A PC solver with at least 7x speedup on GHC.

POSTER:
Our poster will contain a summary of our project along with graphs (and pictures to show what our code resulted in) and tables of the time comparisons between sequential and parallel tiling. We will also have a demo available where we can let anyone submit a board width and height and list of pieces and we can show the comparison between our sequential and parallel solver (and if it has a solution).

PRELIMINARY RESULTS:
We have a table of time comparisons down below for some example inputs, but they aren't very useful as they are on small boards where parallelization doesn't help out too much.

```
-- Performance Table ---
Scene Name      | sequential      | parallel
-----------------------------------------------
example         | 0.02043         | 0.001272
four_T          | 6.9e-05         | 0.000461
penta           | 3.4e-05         | 0.000269
simple_IJLO     | 0.000257        | 0.001575
hard            | 16.074553       | 1.272378
```

ISSUES:
At the moment, we mostly just need to implement the ideas we have for optimizations into our code and hopefully this will be sufficient in making larger test cases work.

MEETING:
We will be meeting with Professor Mowry at 8:10 PM ET on November 30th.