Team Eclipse
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ECE 454 Lab 5 Report

In this lab, our group utilized various speedups to achieve the result of approximately 8x the speed of the sequential_game_of_life (~13-15s vs ~110-115s on lab machine). Our group utilized the following techniques to achieve this:

- **Pthread parallelization**: we created 8 threads using pthread_create, dividing the board into 4 horizontal pieces and 2 vertical pieces (4 x 2 = 8). Each thread runs one slice of the board and is synchronized using barrier function covered in the lecture slides before each iteration. Finally, pthread_join is called in the main function.
- **Loop blocking**: using techniques similar to that of Lab2, we divided the slice of each thread into further smaller chunks increment by T, where T is either 32 or size of the width/length of the slice, whichever that is smaller. We followed i->j->jj->ii loop order to achieve the best result by traversing in column order
- **Loop-Invariant Code Motion (LICM)**: Take the const int computation and board value computation out of the loop as much as possible to reduce its number of time ran and remove dependency as much as possible to also achieve so
- **Local variable "cache"**: use local variable to save previously loaded board value to reuse 6/9 of the value in each iteration, greatly reducing array load time.