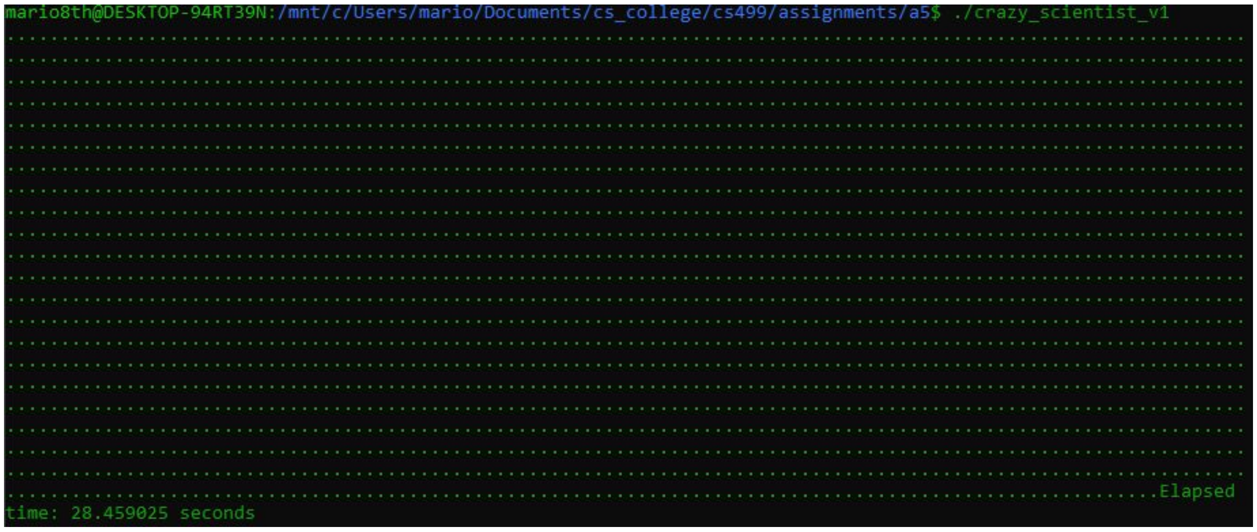
Gavin Valencia
CS499 A5
11/12/18

Question 1)



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mario8th@DESKTOP-94RT39N:/mnt/c/Users/mario/Documents/cs_college/cs499/assignments/a5$ ./crazy_scientist_v1
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time: 28.459025 seconds
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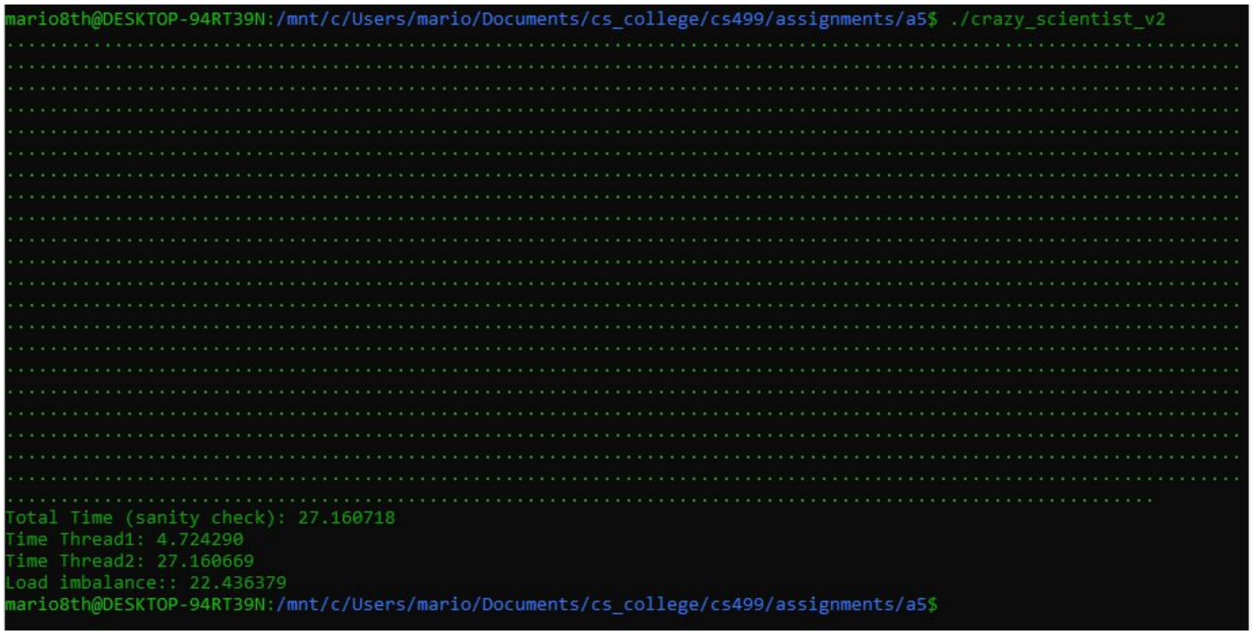
Paralyses the loop by splitting it into two parallel sections with the outer loop ending or starting at SIZE/2

Average Execution Time: 27.2928894 seconds

Question 2)



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mario8th@DESKTOP-94RT39N:/mnt/c/Users/mario/Documents/cs_college/cs499/assignments/a5$ ./crazy_scientist_v2
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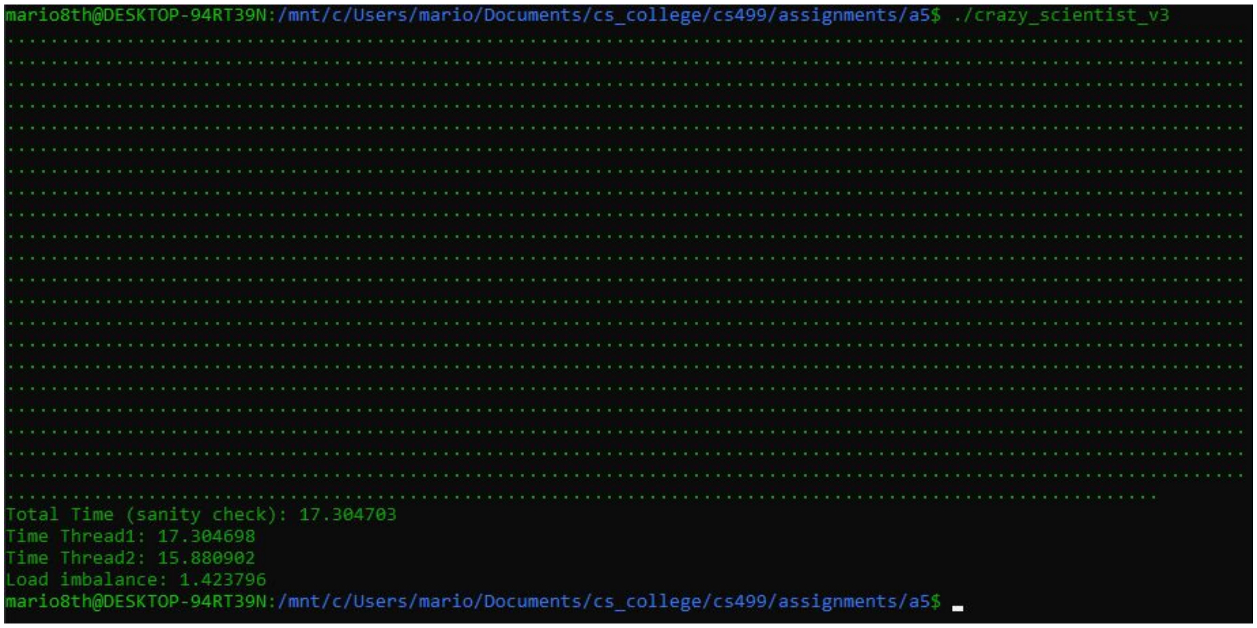
Total Time (sanity check): 27.160718
Time Thread1: 4.724290
Time Thread2: 27.160669
Load imbalance:: 22.436379
mario8th@DESKTOP-94RT39N:/mnt/c/Users/mario/Documents/cs_college/cs499/assignments/a5$
```

Same as v1, but times when each section finishes it's portion of the contained loop

Average Load Imbalance: 22.6426029
Average Execution Time: 27.4305211

Question 3)



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mario8th@DESKTOP-94RT39N:/mnt/c/Users/mario/Documents/cs_college/cs499/assignments/a5$ ./crazy_scientist_v3
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Total Time (sanity check): 17.304703
Time Thread1: 17.304698
Time Thread2: 15.880902
Load imbalance: 1.423796
mario8th@DESKTOP-94RT39N:/mnt/c/Users/mario/Documents/cs_college/cs499/assignments/a5$ 
```
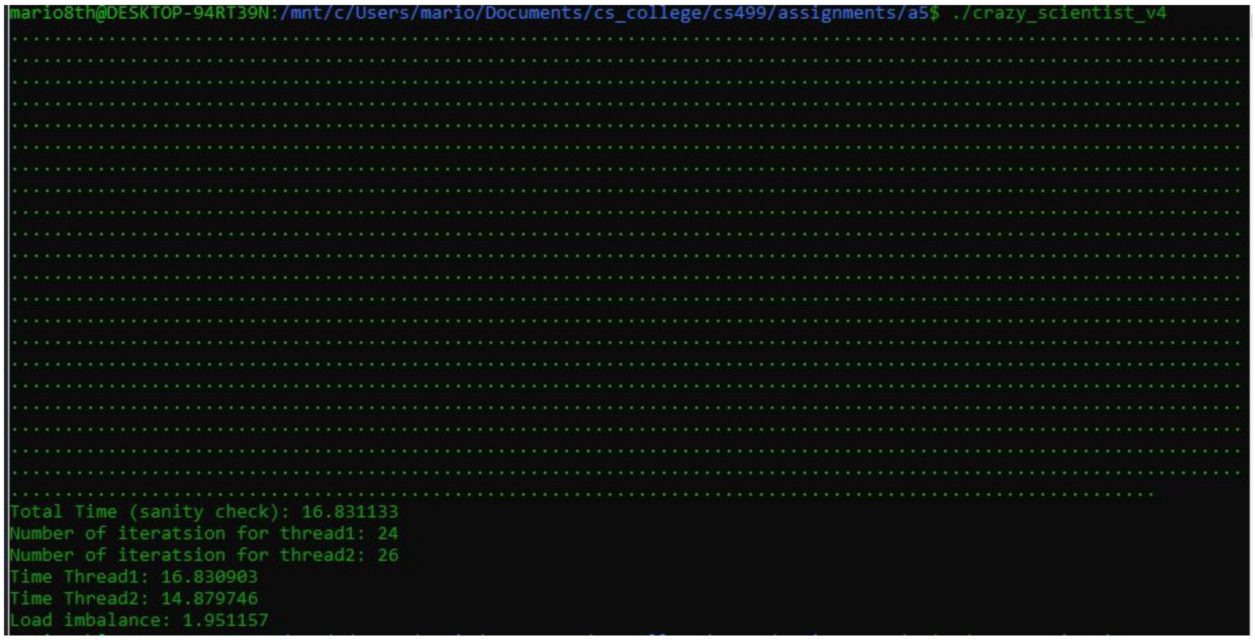

Creates a dynamic for parallel section with a nowait clause so the times are saved when each thread is done with all available loop iterations.

Average Load Imbalance:	1.4276278
Average Execution Time:	17.1351614

Both the load balance and execution time are improved significantly. Due to the rows being selected dynamically, each thread grabs the next available iteration. As such, when the iterations get longer later in the cycle, both threads continue working. This is contrary to in v2, where thread 1 received the shortest threads in the first half while thread 2 recieved the longest the the latter half. Now both threads receive both long and short iterations.This also improves the load imbalance.

Question 4)



```
mario8th@DESKTOP-94RT39N:/mnt/c/Users/mario/Documents/cs_college/cs499/assignments/a5$ ./crazy_scientist_v4
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Total Time (sanity check): 16.831133
Number of iteratsion for thread1: 24
Number of iteratsion for thread2: 26
Time Thread1: 16.830903
Time Thread2: 14.879746
Load imbalance: 1.951157
```

A do_work function is called by two threads. Each thread enters a while loop, then waits at a mutex lock. In the mutex lock, each thread checks if the total number of iterations has met the total number, if so it unlocks and breaks from the while loop, else it grabs the current iteration and increment it for the next thread. Once past the lock it loops through the inner j loop while doing the crazy computation. Once done it goes back to the lock. After the max iterations has been met, each thread saves the time it exited and returns.

Average Load Imbalance:	1.6690599
Average Execution Time:	16.7471131

While the load imbalance is better than in v2, it is slightly worse than in v3. This is most likely due to how Pthreads decide which thread is able to access the lock. However, the average execution time is better than voth v2 and v3. This is most likely due to the amount of overhead. In omp, there may be more overhead that is abstracted from the user, but with pthreads I controlled all the overhead of choosing the next iteration, and was able to optimize it slightly. This slight optimization only resulted in a small improvement.