After doing research and multiple batch jobs for the particle simulation I found that the best way to increase performance was by using pragma compiler directives. I used various pragma compiler directives for both the openmp and serial files and got a good increase in performance. For the openmp the grade improved by about 10 points. In the openmp file I also changed the variables used in the loop to local variables. I also decided to use pragma omp schedule dynamic for the loop in openmp and serial. This compiler directive divides the loop iterations into chunks and works until the iterations are completed. I found this compiler directive while doing research on different pragma compiler directives. For the mpi file I struggled to make improvements. I replaced mpi_allgather section with mpi_isend and mpi_recv. I thought that using these instead of allgather would improve the speed and performance of the particle simulator because Isend and recv are non-blocking communication methods. Instead, the performance dropped by about two points. However, the strong efficiency was .75 which was a bright spot. Overall, I found that pragma compiler directives worked the best, like how it improved the performance of the code in homework 1.