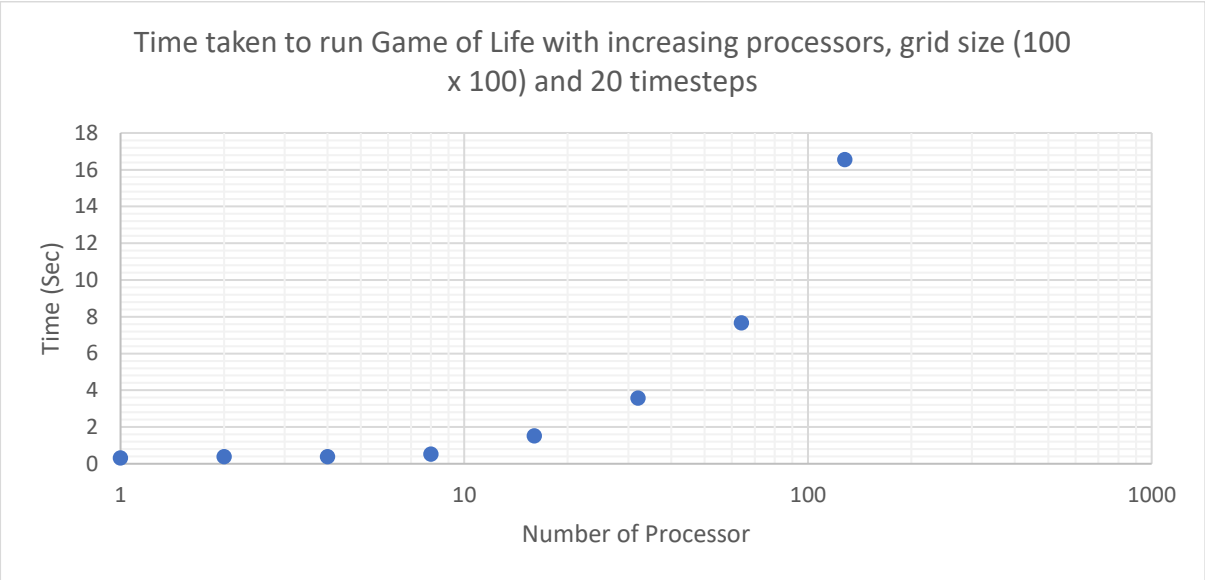
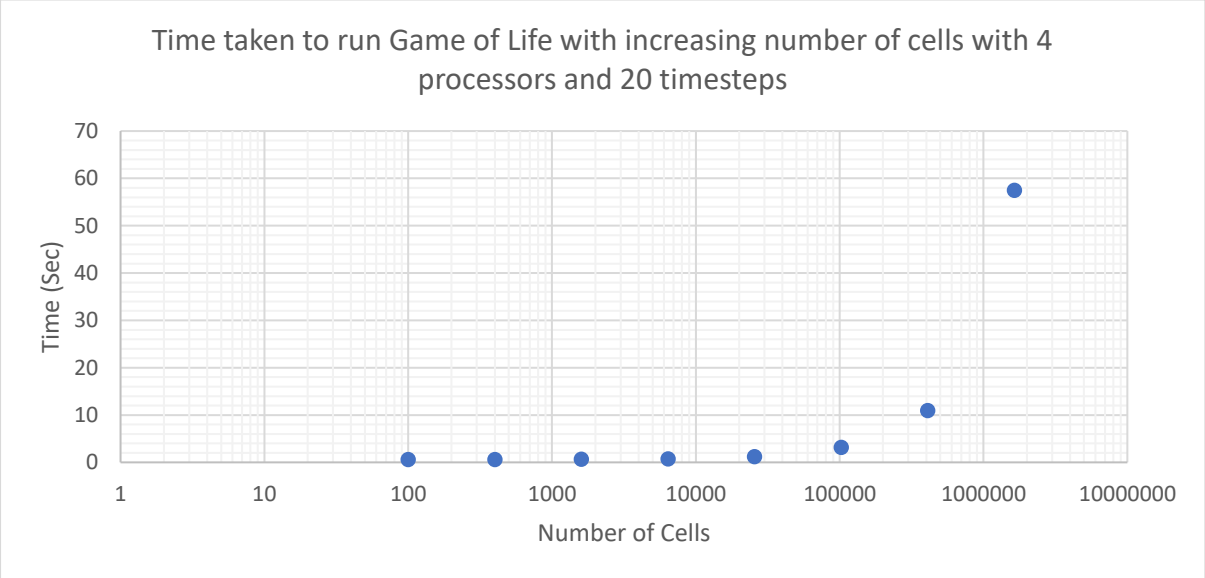
MPI Assignment 2 – Analysis + Discussion

This assignment involves developing a parallelised Conway's Game of Life program. The user may adjust the domain size and time simulation within the code, as well as adjusting the number of processors required using mpiexec in command prompt. The method of writing out is organised by the processor handling its own subdomain and the time of simulation i.e. where csv files of subdomains are stored inside their respective time folders.

The performance of the code has been tested on an Intel Core i5 8 Processor Windows machine:





We observe in the first exponential graph increasing number of overhead processes with increasing number of MPI communications eventually dominates the main code. In the second graph, the larger the grid size, the larger the arrays are copied between processors during MPI communication, thus taking more time. However, this may be alleviated by using a higher number of processors to handle larger domains as each individual processor would be copying a smaller subdomain and so the time taken would be reduced.

It is known that background processes produce noise in our data. In addition, once we start using more than 8 physical processors, the system begins to make virtual processors and reuses the physical processors to do this. The multiple increased load on the physical processors thus impedes the performance of the parallelisation.

A bottleneck in the code is the MPI_WAITALL after communicating between the top and bottom padded rows. This was written to correctly copy the corner paddings. Instead, it would be better to replace sending arrays with MPI_Types. Also, passing in vertical padding columns as an MPI_Type would have reduced the need to make an extra copy of the columns, and thus reduced time.

With smaller grids, it would be a lot quicker for all cells to die out compared to larger grids. Furthermore, having more alive cells initially would also quicken the death of all cells due to overcrowding. Although the random initialisations may affect the speed of the game, it is considerably negligible.