CPSC 439 – Project #2 Cellular Automaton Rule 150 with Turing Machine

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For Project #2 the task was to display Wolfram's Cellular Automaton Rule 150 on a 41x20 grid using a Turing machine. The Turing machine's tape head moves across the cells, reads their values, and writes on the row below based on the rules of Wolfram's Cellular Automaton Rule 150. Each cell must be read by the Turing machine and then subsequent rows are written based on what the Turing machine reads. To create the matrix that modeled this I had to iterate through the matrix and initialize each cell value as either 0 or 1 in compliance with Cellular Automaton Rule 150. Then to display it graphically I had to iterate through each row and column and draw when the Turing Machine read the appropriate values. Therefore, because I had to iterate through the columns and the rows, the Big O running time of the program is $O(n \times m)$ where n would the number of columns and m would be the number of rows.

The matrix must be iterated through a total of two times. The first time the matrix must be iterated through is to initialize the matrix with the appropriate values. Then the Turing machine must read through each cell of the matrix for display. Each element of the matrix is read at to determine whether or not to write. If the Turing Machine reads the appropriate values, then a black rectangle is written. Because the matrix is iterated through twice the running time would appear to be $O(2 (n \times m))$ however the 2 eventually tends towards 1 so our true Big O running time would be $O(n \times m)$.