

## 439 — Thy Comp — Project #3 TM Conway's Game of Life

### Project #3 – TM Conway's Game of Life

#### Introduction

John Conway's Game of Life (GOL) is a simple 2D cellular automata with some impressive qualities. It is equivalent to a Turing Machine (TM) in power. This project is to build a TM that simulates Conway's GOL; that is, build a TMGOL. The program will be written in Javascript with an HTML web page for display. The Tm will be runnable at full speed, and also under user control stepping one new-generation cell being written at a time.

#### Conway's GOL

Look this up on the web at Wikipedia. Especially note the GOL objects called gliders, Bill Gosper's glider gun, oscillators, and spaceships.

#### TMGOL

As your TM "tape", you will use a 2D grid and your TM tape head will be able to move UDLR, as in project #2. The grid displayed must be at least 32 by 17 cells in size (large enough to display the small period-3 Pulsar oscillator, and wide to display Gosper's glider gun).

Above this 2D TM tape, you will also display an array (folded into 2D as appropriate) showing all your TMGOL states. (We recommend horizontally TM encoded states, as discussed in class, to simplify understanding.) You will highlight both the location of the TM tape head on the 2D tape and also the array cell showing the TM's current state.

As in project #2, your TMGOL (the TM that simulates the Game of Life on the 2D tape) can move the tape head and read and/or write the cell under the tape head. As in project #2, you should assume that off-grid cells

Optionally, you may choose to speed up performance by only looking at filled grid cells and their immediate neighbors. are empty.

Special note, in GOL, the next generation is fully computed before changing any displays. You can choose to do this many ways. For simplicity, we recommend using colors to show empty or full, and a second pair of symbols to show/mark if the next generation at a given cell will be a birth or death (e.g., 'O' for birth and 'X' for death). If you use this technique, you can assume that your TM has the ability to turn off all of these birth/death marks simultaneously as a tape head "operation".

#### Complexity Order

You should prepare a 1-page (at most) paper describing your analysis of the Big-O running time of your TM algorithm used to build 1 new generation of the GOL grid. Address the usual issues such as main operations, input size, etc.

#### Team

The team size is the same as before, but you can change team members from the previous project if you wish.

#### Academic Rules

Correctly and properly attribute all third party material and references, if any, lest points be taken off.

#### Project Reports, Readme File, Submission, and Grading

As before.