**CS4306 Algorithm Analysis**

Fall 2021

Department of Computer Science

Kennesaw State University

**Programming Assignment 1: Game of Life**

**Due Date: Thursday, September 2, 2021 (by 11:59pm)**

Report

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1. Description of the analysis of the problems:
2. The game of life rule:

* Birth: a dead cell with exactly three live neighbours becomes a live cell
* Survival: a live cell with two or three neighbours stays alive
* Overcrowding/ Loneliness: in all other cases a cell dies or remains dead:



1. IDE tool and operating system:

This analysis use Java programming language with IDE that is Intelli J Idea in a MacOS version 10.14.6. Also use execel to generate graph of the function of time.

1. Data structure, time and complexity:

Generally, with different types of representation of matrix or two dimensional array have different performance in time and space cost. This assignment I use a two dimensional array 10x10 that generated randomly.

The problem uses nested loops contain sizes M and N so the cost is O(M\*N) to generate the original array and update cells.

For example:

// populating the grid  
for (int i = 0; i < M; i++) {  
  
 for (int j = 0; j < N; j++) {  
 int randomNum = randomNumberGenerator.ints(0,2).findFirst().getAsInt();  
 grid[i][j] = randomNum;  
 System.*out*.print(grid[i][j] + " ");  
 if (j == M - 1) {  
 System.*out*.println();  
 }  
 }  
 }

1. System time:

Also, we use the function System.nanoTime() to calculate the time that the program run for each generation execute.

For the size, I also run both size 10\*10 and 5\*5.

Graphical user interface, text

Description automatically generated

From every execute time, we collect the time and draw the figure below:

Chart, line chart

Description automatically generated

Figure 1: System Time

We could see that the bigger size of the array will take more time to execute in each generation.

1. Source code and screen shot:

Text

Description automatically generated

Text

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Text

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A picture containing text, electronics, keyboard

Description automatically generatedText

Description automatically generated

A picture containing shape

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