CS 311, Assignment 0 - Report

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1 Abstract

This report covers the algorithmic approaches used for solving the given problem statement while varying different parameters like width, probability of Sensors being ON, etc. to achieve the motive of infiltrator during the course of movement from AC (Attacking Country) to DC (Defending Country).

2 Assumptions & Parameters Involved

In accordance with the description of the challenge, the length has to be infinitely long. So, the length we have chosen is as follows:

$$L = 1000$$

From the challenge description, the sensor is switched **ON**, if we receive **Heads** in the coin toss, which in turn depends upon the array/spectrum of probabilities we are considering. The following Set P represents the set containing the probabilities of sensors being ON we have considered:

$$P = \{0.2, 0.35, 0.5, 0.65, 0.7, 0.75, 0.8\}$$

The time taken by the infiltrator to reach DC from AC will increase if width is increased. The following Set W represents the set of width we considered for pairing with $P's$ elements to understand how infiltrator will move on different time results.

$$W = \{3, 5, 7, 9, 11, 13, 15, 25, 35, 55, 75, 85, 100\}$$

The infiltrator only moves ahead from AC to DC and no step backwards it taken. With a time span of every 10 secs, a coin is tossed and based on the outcome, next step from the neighbouring 8 blocks is chosen.

3 Inferences

- **Varying width:**
  As the parameter 'w' (width) was increased, the time taken by the infiltrator to cross from DC to AC also increased. This reason behind is, as the width is increasing, the infiltrator will have to cover more distance while moving from AC to DC.

- **Varying probability of sensors being ON:**
  As the probability of sensors being ON increased, the time taken by the infiltrator to cross also increases. The reason behind that is that, as the probability of sensors being ON increases, the infiltrator's choice to proceed towards DC decreases and hence time required will increase.

Considering the above two statements, our algorithms and optimization are based on the same notion. The 3-D graph in Figure 1 depicts average time variation over width and probabilities.

4 Approach & Code

For the above given sets of P & W, we implemented all cross combinations i.e. for a given P, we tried all $W's$ with it and found out all different times. However to normalize the time taken for a given pair of (P,W) for 5 iterations, we just took average of all times.

5 Code, Compilation & Execution

We have created 3 main files of codes of java and one python file for graph plotting which are as follows:

- Infiltrator.java
- Main.java
- Sensor.java
- Graph_plot.py

Each file is embedded with a separate class except python file which finally top inherits to *Main.java* file. The command line executions are:
*>> javac .*java*
>> java Main input.txt output.txt

It is to be noted that ***input.txt*** contains the sets P & W.

The ***output.txt*** gives the following results:

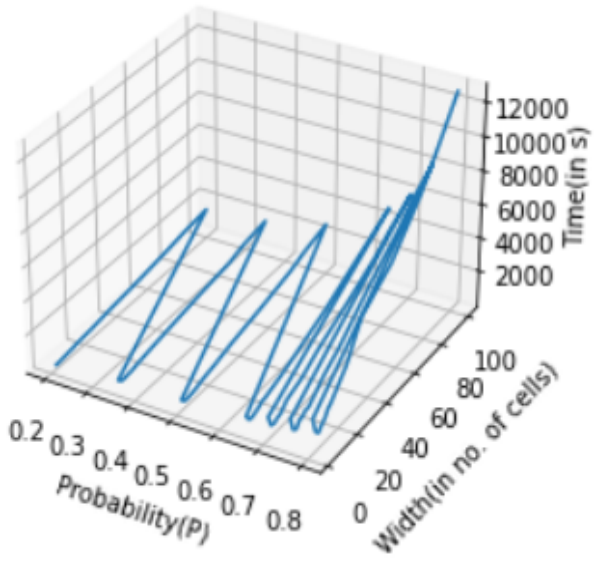

Figure 1: Variation of Probability, Width and Average Time

(P_i) (W_i) (Average time of 5 iterations of {P_i,W_i})
where (P_i) & (W_i) are elements of Sets P & W respectively.

We have also made a file called ***Graph_plot.py*** for plotting graph using Matplotlib libraries in Python. Further explanation and deductions are given in below section.

6 Graph

Figure 1 shows the plot and parameters used in plot are as follows:

- X-Axis: Width
- Y-Axis: Probability
- Z-Axis: Time

The above graph depicts and proves the deductions which we made about variations of time with change in probabilities and widths.