भारतीय प्रौद्योगिकी संस्थान धारवाड
Indian Institute of Technology Dharwad

Computer Architecture Lab
Assignment 0

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A basic problem statement for introduction to Java, version control , plotting using Python, and documentation using LaTeX

Group Members
Amogh Dasture, 180010014
Rupesh Kalantre, 180010029
Paritosh Gavali, 180010024

Course Instructor
Prof. Rajshekhar K

1. Problem Statement

Consider the scenario where one country, called the defending country (DC), wishes to defend its border against another country, called the attacking country (AC), whose aim is to send an infiltrator to cross the border and enter DC's land. DC decides to deploy a wireless sensor network along the border. If a sensor detects an infiltration attempt, DC can then send its troops to counter the infiltration.

Some assumptions and constraints :

Border : The border is a long rectangular strip , which contains cell(sensors).In our code we have considered the length of border to be 1000 , where as width will change from [l] to [r].

Sensors : Every cell in the grid has exactly one Sensor. The Sensor can be ON or OFF with probability of P.Each Sensor is a motion sensor , i.e. it can detect an infiltrator who is moving. If the infiltrator is stationary, the sensor does not trigger and infiltrator is not caught.Each sensor operates independently.They are powered on first time at T = 0. Every Sensor will update its ON/OFF status every 10 seconds according to probability P.

Infiltrator : Infiltrator moves in steps.In each step he may move around any of 8 surrounding cells , or not move at all. He is aware of ON/OFF status of all Sensors , including the one on which he is standing on.As sensors detect motion , he can move from one cell to another if and only if current cell sensor and the sensor on which he is stepping should be OFF.So , best possible strategy for Infiltrator will be to move one step forward (iff possible) or not move at all.Infiltrator will take 10 seconds to take one step.

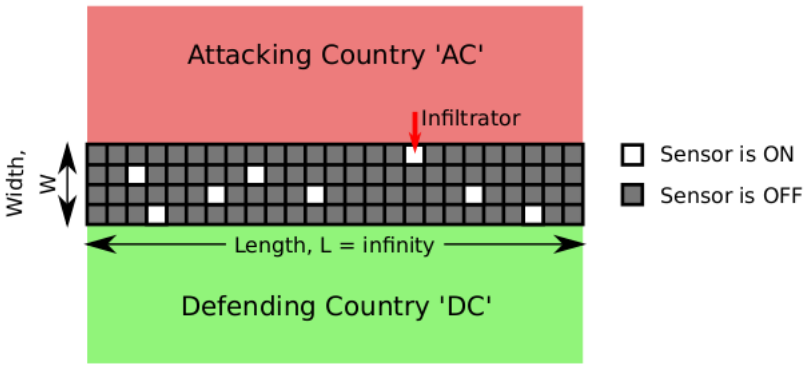


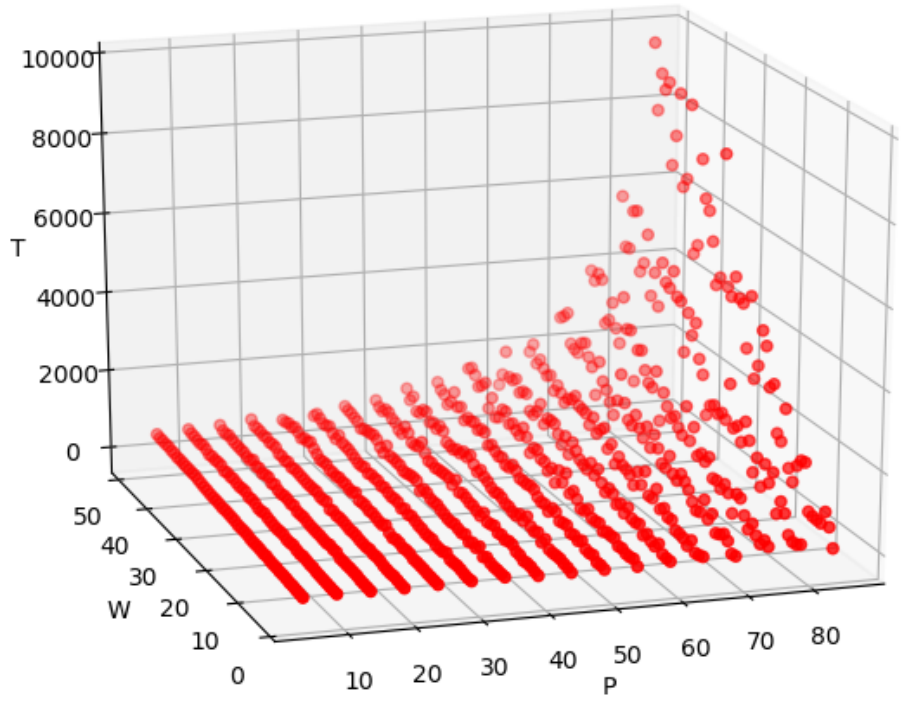
Figure 1: Illustration of the scenario

Algorithm Used

The infiltrator moves in a greedy manner so as to get close to the other side of the grid. This implies that the infiltrator moves only when the sensor he is standing on is OFF and one of the three cells at the bottom are OFF.

Observations

A 3D-plot of values of t vs. p and w is given below. We can see that t increases almost linearly with w but increases exponentially with p. Also we can see an asymptotic increase in t as the value of p approaches 1.



Code Overview

Classes are made for representing the infiltrator, clock as well as the grid. The interaction between these classes is defined in the 'main()' function in the Simulation class. The Java program runs the simulation for various values of p and w and dumps the values in a .csv file. Then a short python script with matplotlib is used to make a 3D-plot from the values.