ASSIGNMENT 0

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Introduction

The scenario involves a defending country (DC) that aims to protect its border against an attacking country (AC), whose goal is to send an infiltrator across the border. To achieve this defense, the DC deploys a wireless sensor network along the border, creating a grid-based system. The sensors are motion sensors that can detect an infiltrator in motion.

Elements of the Scenario

1. **Border:**
    - The border is represented as a long rectangular strip of land.
    - The rectangle is discretized into a grid, and its width is denoted as W cells.
    - The length of the rectangle is considered infinite for modeling purposes.
2. **Sensors:**
    - Each cell in the border grid is equipped with a motion sensor.
    - The sensor's sensing range is limited to its cell.
    - The sensors have a duty cycling policy to extend their battery life.
    - Duty cycling involves making decisions every 10 seconds independently. A coin, with a probability p of heads, is flipped.
    - If heads, the sensor is switched ON for the next 10 seconds; if tails, it is switched OFF.
    - Sensors do not communicate with each other while making decisions.
3. **Infiltrator:**
    - The infiltrator aims to cross the border without triggering any sensors.
    - The infiltrator moves in steps and can move to any of the 8 neighboring cells in each step.
    - It takes 9 seconds to move to another cell, preceded by 1 second of studying the surrounding cells.

- The infiltrator must ensure that both the departure and destination cells are sensor-OFF to avoid detection.

Objective

The primary objective is to study the time taken by the infiltrator to cross the border when width of the border and the probability of the sensor being ON is varied.

Solution(LOGIC)

- The infiltrator is considered to be at coordinates (0,0) at one of the sensors in first row of sensors.
- Then a coin is tossed.The movement of infiltrator is dependent on the status of sensor on which infiltrator is.
- If that sensor turns out to be ON based on the coin tossed and the probability given, then the infiltrator does not move and time gets incremented by 10 seconds.
- If the sensor is OFF then infiltrator moves to any one of the three sensors which are in next row of sensors and touching the current sensor and time increments by 10 in this process.

PLOTS

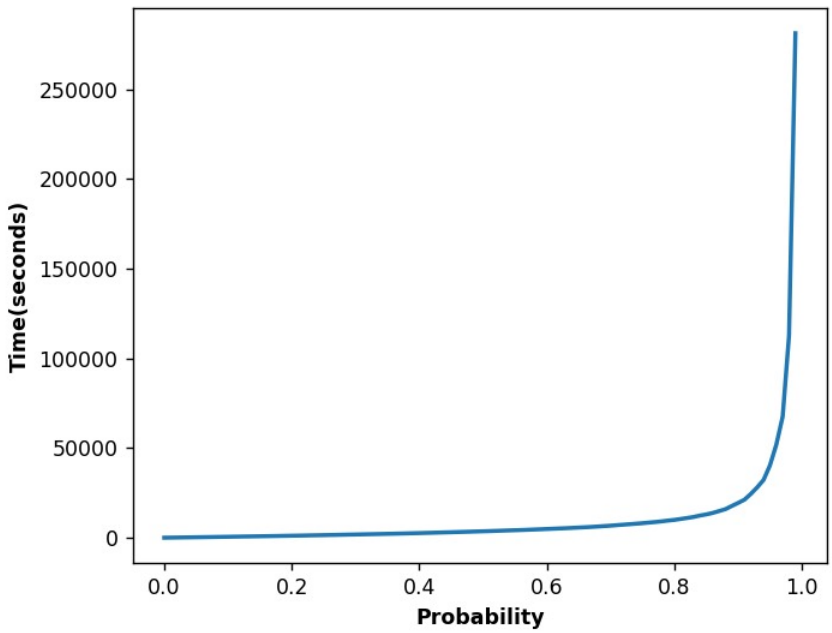

Figure 1: Time VS Probability

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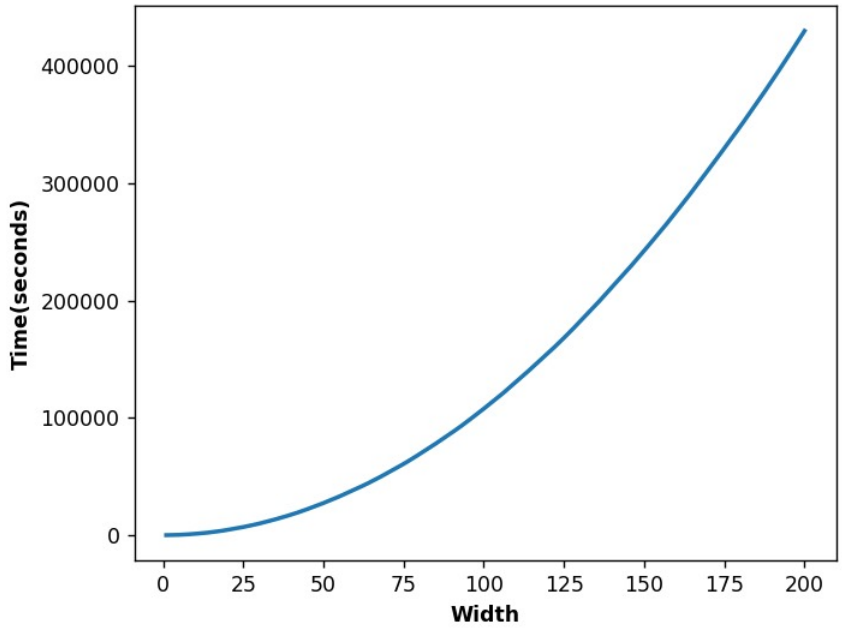

Figure 2: Time VS Width

Observations

1. The time taken by the infiltrator to reach the other end increases when probability varies and width kept constant at 5.The graph is strictly increasing and it tends to infinity when probability tends to 1. [Figure 1: Time VS Probability]

2. The time taken by the infiltrator to reach the other end also increases when width varies and probability kept constant at 0.5.This graph is also strictly increasing one. [Figure 2: Time VS Width]