Assignment0

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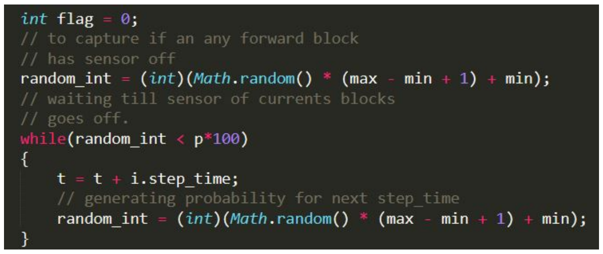
4 September 2020

1 Objective:

To simulate the Border crossing scenario and get an idea about the time taken to cross the border for different widths of the border grid and different probabilities in the duty cycle of the sensors using JAVA.

2 Basic Approach:

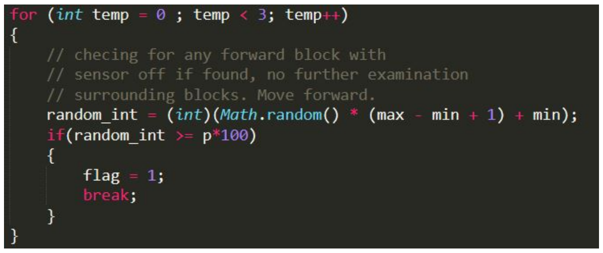
According to the problem statement the infiltrator spends the 1 second in analysing the surroundings.
So after each duty cycle the infiltrator spends the 1 second in checking
1) The sensor of the cell on which he is currently standing on.



```java
int flag = 0;
// to capture if an any forward block
// has sensor off
random_int = (int)(Math.random() * (max - min + 1) + min);
// waiting till sensor of currents blocks
// goes off.
while(random_int < p*100)
{
    t = t + i.step_time;
    // generating probability for next step_time
    random_int = (int)(Math.random() * (max - min + 1) + min);
}
```

Figure 1

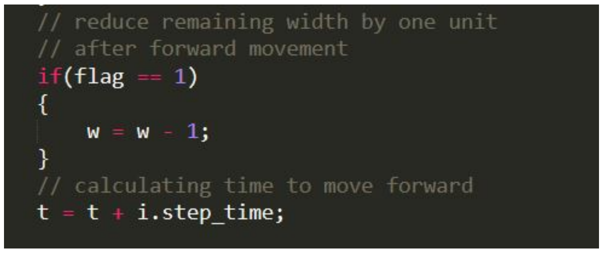
2) Only after the infiltrator finds that the sensor he is standing on is off he checks the three sensors ahead of him.



```java
for (int temp = 0 ; temp < 3; temp++)
{
    // checing for any forward block with
    // sensor off if found, no further examination
    // surrounding blocks. Move forward.
    random_int = (int)(Math.random() * (max - min + 1) + min);
    if(random_int >= p*100)
    {
        flag = 1;
        break;
    }
}
```

Figure 2

3)If any of the front 3 sensors are off the infiltrator moves to the next cell and takes 9 seconds to do so.After moving to the next cell the same process is repeated until the infiltrator has crossed the border.



```
// reduce remaining width by one unit
// after forward movement
if(flag == 1)
{
    w = w - 1;
}
// calculating time to move forward
t = t + i.step_time;
```

Figure 3

3 Simulation Results:

Following are the results of simulation in graphical format.

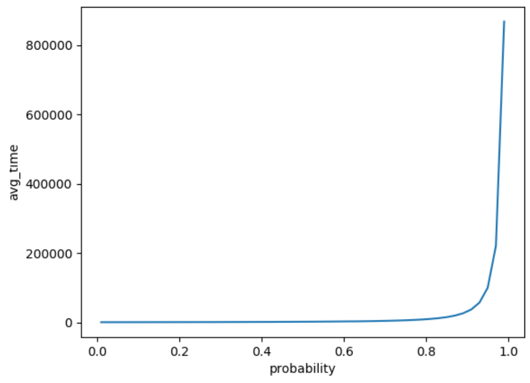


Figure 4 : time vs probability

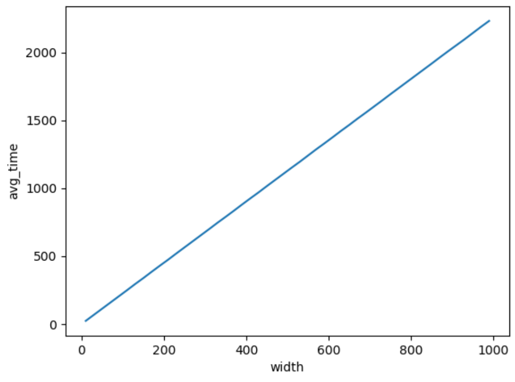


Figure 5 : time vs width

Conclusions:

1)We can clearly see that as the width of the grid increases the crossing time increases.

2)As we increase 'p' (the probability of the sensor being ON in a certain duty cycle) the time taken to cross also increases.

4 Code Specifications:

The basic logic is simple and is properly explained in the Basic approach section.*Refer to Figure 1,2 and 3 in Section 2.*

Sensor simulation:
To simulate the duty cycles of the sensors in built function **Math.random()** has been used.
Math.random() gives a random float value between 0.0 to 1.0,
lets say the probability of sensor being ON in a certain duty cycle is **'p'** then,we can say that:

if Math.random()*100≥p*100 the sensor is off,

As the probability of **Math.random()** being greater than **p** is **1-p** which is also the probability of the sensor being off in the real world duty cycle.

Accuracy:
To get a better knowledge of the border crossing time by the infiltrator We repeat the main method multiple times and take their average to give the final answer.
Also refer to the comments provided in the Code itself for further clarification

5 How to run the code?

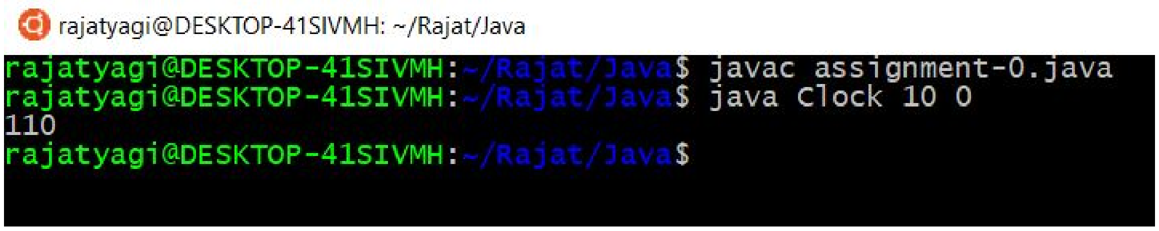
Running the code is fairly simple
compile the code in your terminal by the command:

javac [filename].java

and run the code by the command:

java clock [value of width] [value of probability]

Example:



```
rajatyagi@DESKTOP-41SIVMH: ~/Rajat/Java
rajatyagi@DESKTOP-41SIVMH:~/Rajat/Java$ javac assignment-0.java
rajatyagi@DESKTOP-41SIVMH:~/Rajat/Java$ java Clock 10 0
110
rajatyagi@DESKTOP-41SIVMH:~/Rajat/Java$
```

Figure 6