Question1：

a)

It is easy to know that in a $57 * 43$ maze, the maze has 1212 blocks and 1239 white cell. So, the probability you are at G is,

$$\mathrm{P}(\text{You are initially at G}) = \frac{1}{1239} \approx 0.000807$$

b)

c)

For b) and c), I just have a general thought:

We first find the shortest path from the right-bottom white cell to the G, then we only must find a sequence that regardless where we start we could reach right-bottom white cell. So we find the shortest path for all white cell from it to the right-bottom cell, then we compare those paths. For example, if path A is a subsequence of path B, we discard A and keep B, otherwise we merge A and B to a longer sequence. We define, if for shorter path A, if A is a common subsequence of B and for example A=LLURDD, B=LLDRRUURDD, if in A between for LLU in B, between LL and U, we have some R can counteract the L, we also think A is not a subsequence of B. And then we use this judgement to merge them.

Another thought is that we can start from G and consider G as a CUT, from nearest to further to find if some cells can have the same sequence to G, then those cells form a new CUT, iteratively find if there are some cells have the same sequence to the CUT then update the CUT. Finally, merge the path between all the CUTs to get the sequence.

d)

d.1)

From the calculation in the python code, I found that the number of cells that satisfy the condition is 286, and the total number of cells surrounded by 5 blocks is 428, so the probability is,

$$\mathrm{P} = \frac{286}{428} \approx 0.668224$$

d.2)

ALG:

```
input {Y0, Y1, ... , Yn}, {A0, A1, ... ,An-1}
result = []
Xi stores the xy-coordinate of all cells surrounded by i blocks for i
from 0 to 8
result = [find all cells with observation Y0]
for j from 0 to n-1:
    temp_set = result
    result.clear()
    for cell in temp_set:
        x_new, y_new = Aj(cell.x, cell.y)
        if [x_new, y_new] is in set Xi which satisfies Yj+1:
            result.append([x_new, y_new])
    temp_set.clear()
return result
```

result is the set that contain the cells that we most likely to be in.