Lab9 Questions

YAO ZHAO

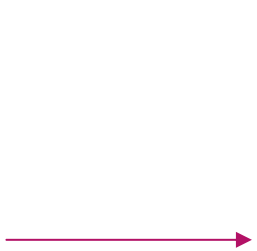
Lab9.A: Rectangle

- Seaflowery noticed a cockroach on a sheet. In order to kill it, she had to draw rectangles inside the sheet.
- To start with, she draws a $n \times m$ rectangle. Then, each time she draws, she can only draw rectangles **strictly inside** the last rectangle. She can draw rectangles any times, as long as the rectangle she draws has positive area.
- Now she wonders the number of possible patterns she can draw modulo $10^9 + 7$.
- Note that all the rectangles she draws must have their edges parallel to the coordinate axis and must have integer length and width. Also, strictly inside means that there will be no intersections(edges/points) between rectangles.
- Note that two patterns are considered different iff the final pictures are different.

Sample 1 Input

4 4

X	X	X	X
X	1	2	X
X	3	4	X
X	X	X	X



no draw → 1

All possible 1*1 rectangles: (1,1) (2,2) (3,3) (4,4) → 4

All possible 1*2 rectangles: (1,2) (1,3) (2,4) (3,4) → 4

All possible 2*2 rectangles:(1,2,3,4) → 1

Sample 1 output

10

Lab9.B: K-Valid

- A 01-sequence A is called $K-valid$ for a positive integer K, if there are no K consecutive 1s in the sequence.
- You are given two integers N, M. Satori wonders the number of sequences of length N that are $M-valid$, modulo 10^9+7.

Sample 1 Input

5 2

1	0	1	0	1
1	0	1	0	0
1	0	0	1	0
1	0	0	0	1
0	1	0	1	0
0	1	0	0	1
0	0	1	0	1
1	0	0	0	0
…				
0	0	0	0	1
0	0	0	0	0

7 sequence contains more than 2 K,
but no K consecutive 1s

Sample 1 output

13

5 sequence only contains 1 K

1 sequence only contains 0 K