Magnetic Cube Tetris

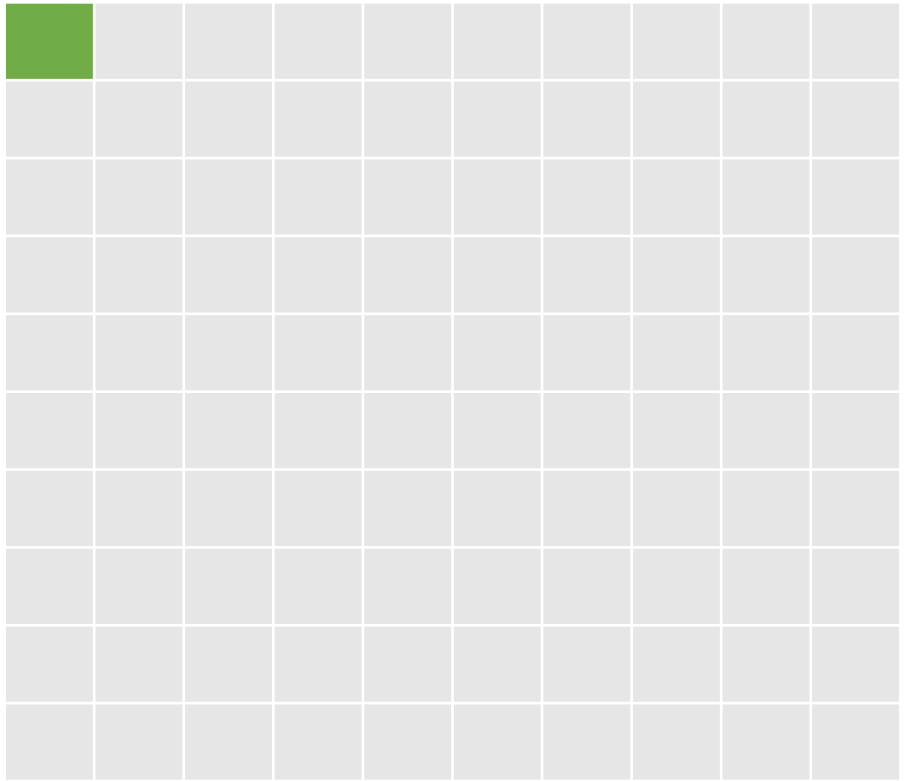
NPRG041 exam assignment

Spawning cubes

Everything happens in a rectangular area

Like in Tetris, things appear at the top

Unlike in Tetris, only one small cube appears at a time



Falling down

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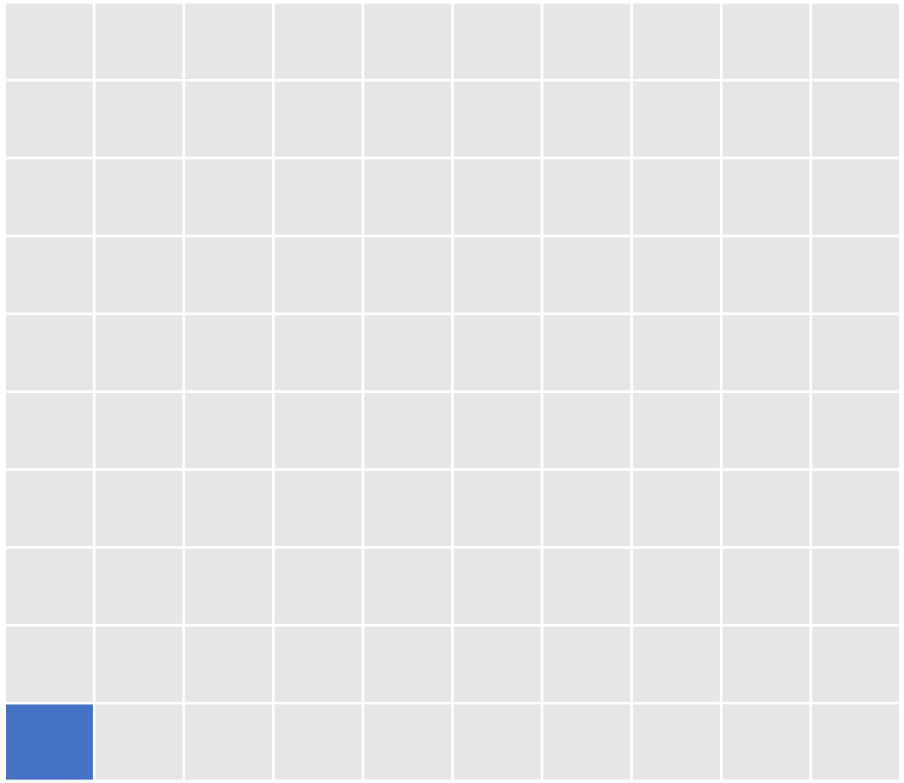

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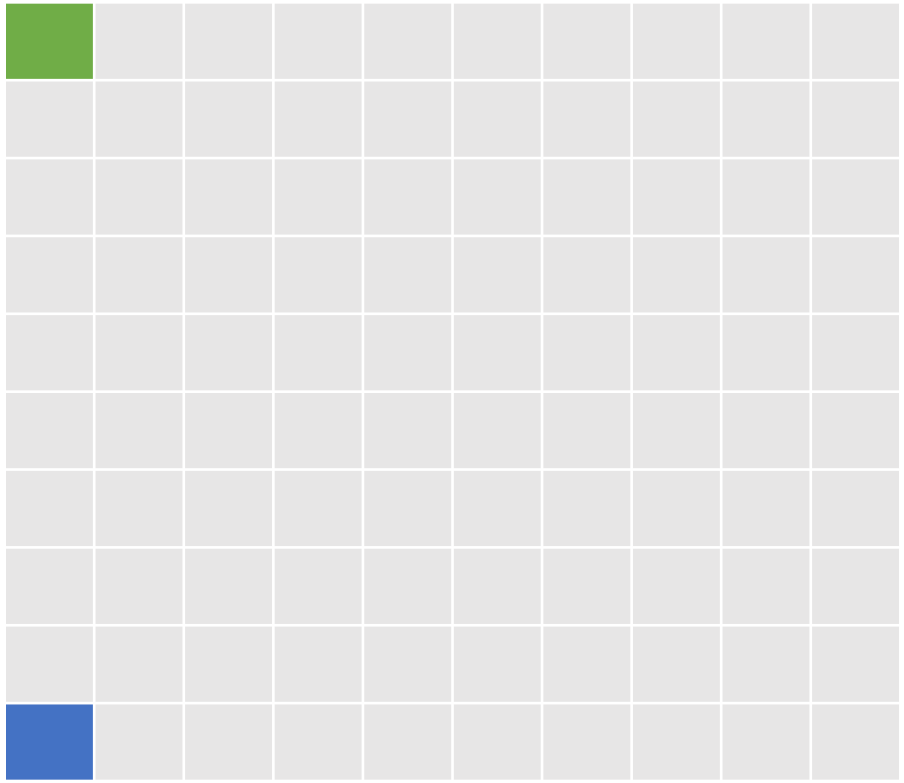
The next cube...



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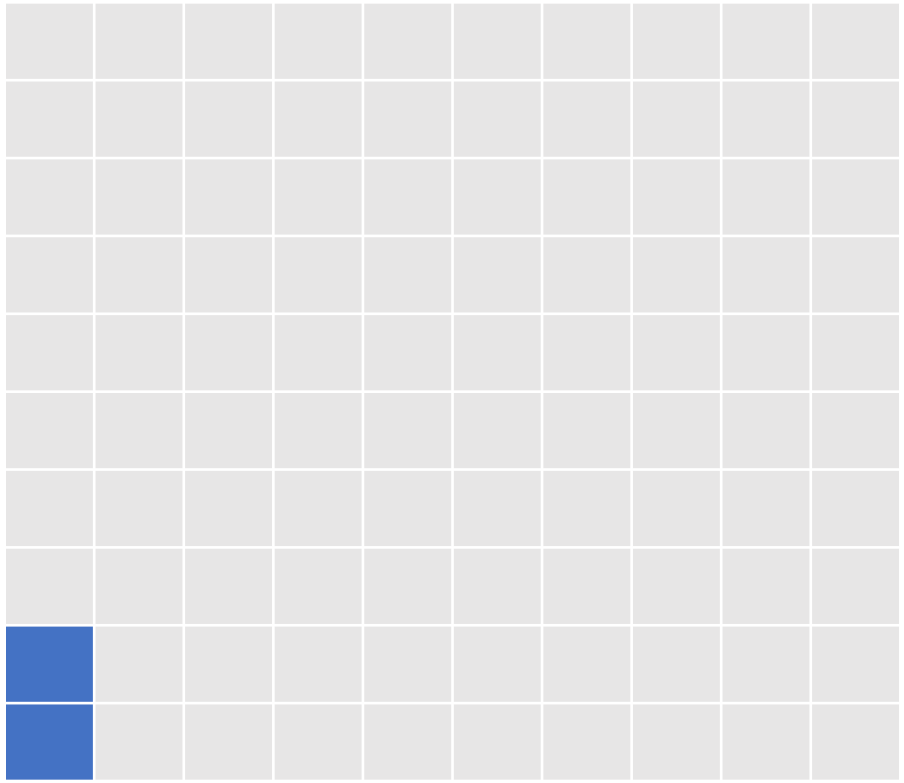

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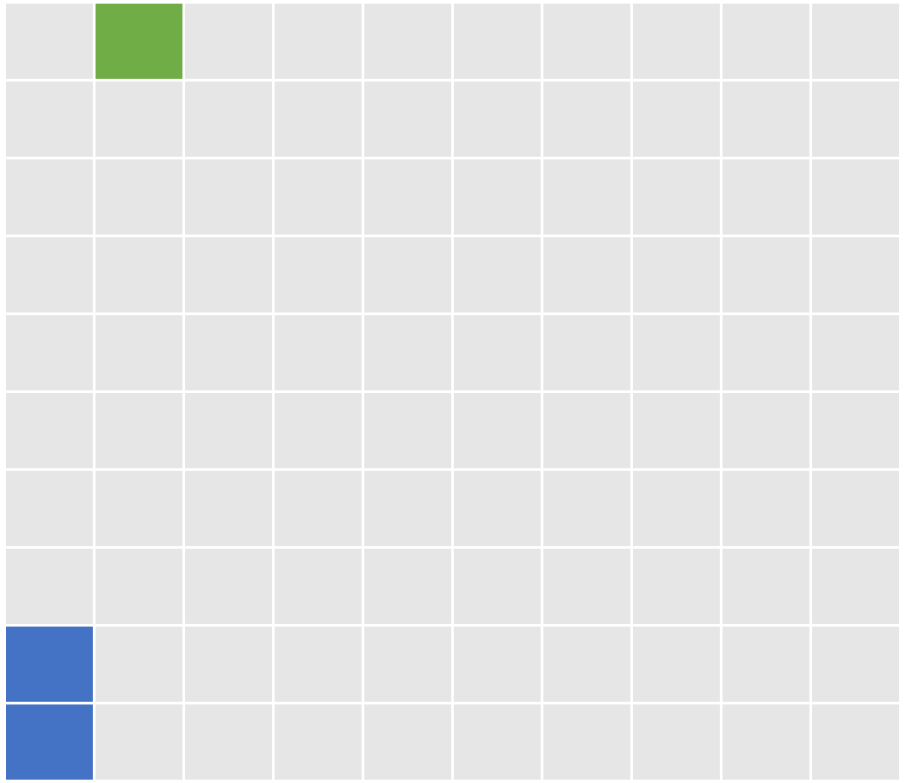

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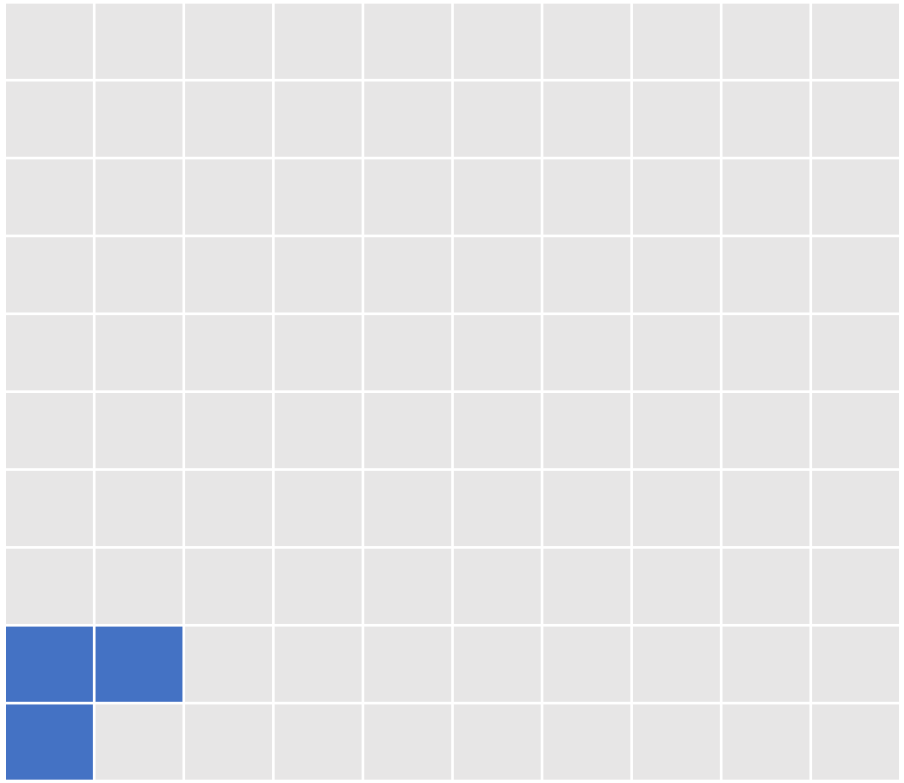

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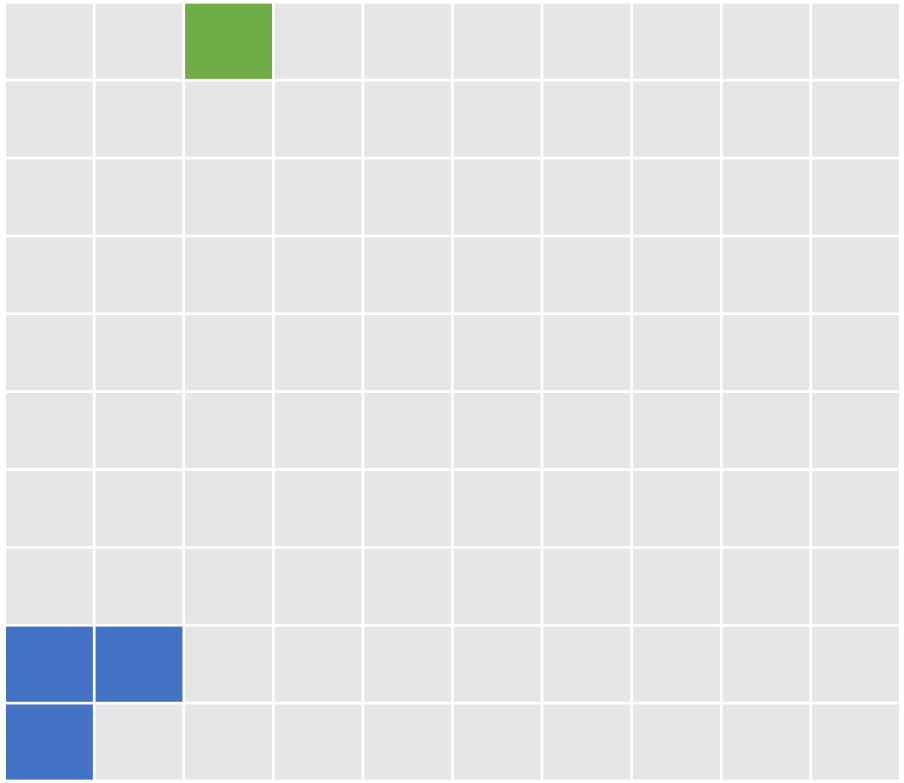
The bottom of the playing area is also magnetic...



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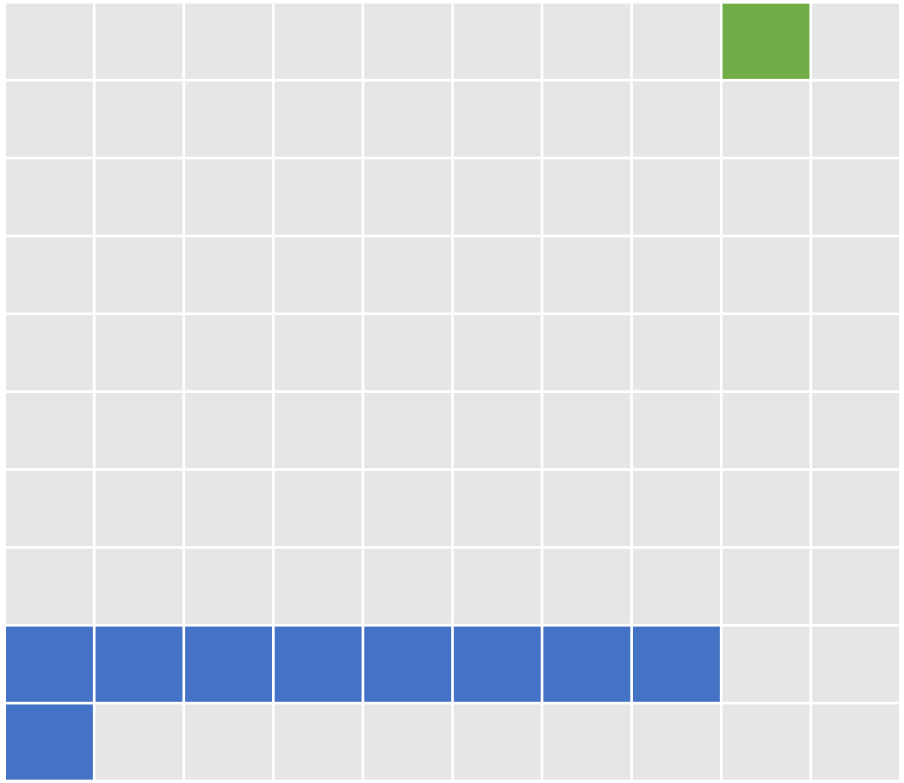
The bottom of the playing area is also magnetic, so the glued shapes never tumble



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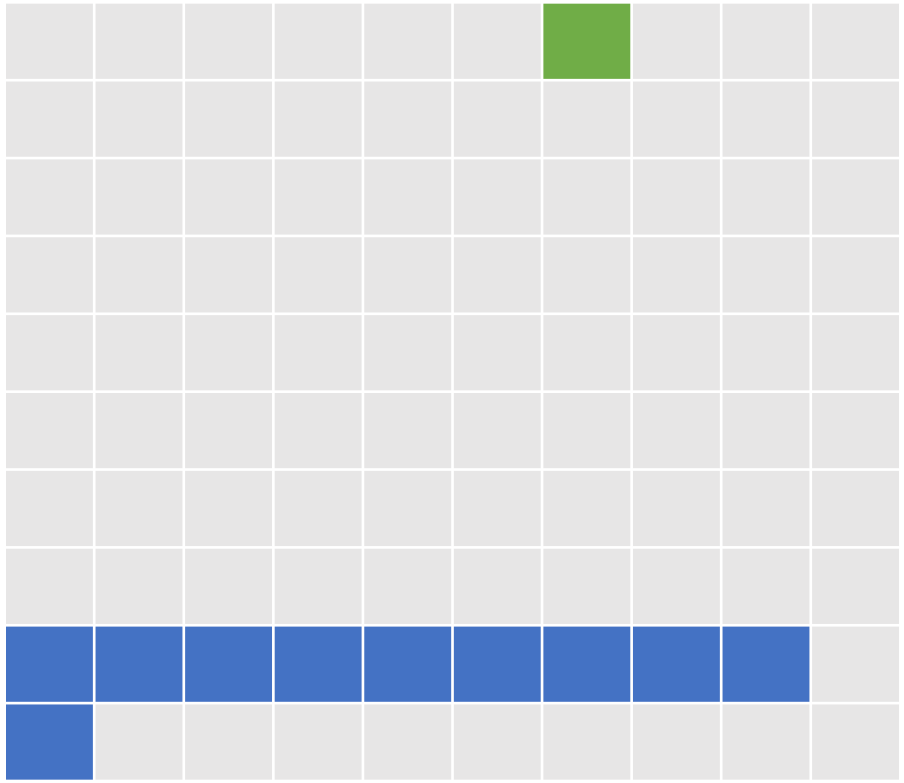
Thus,...



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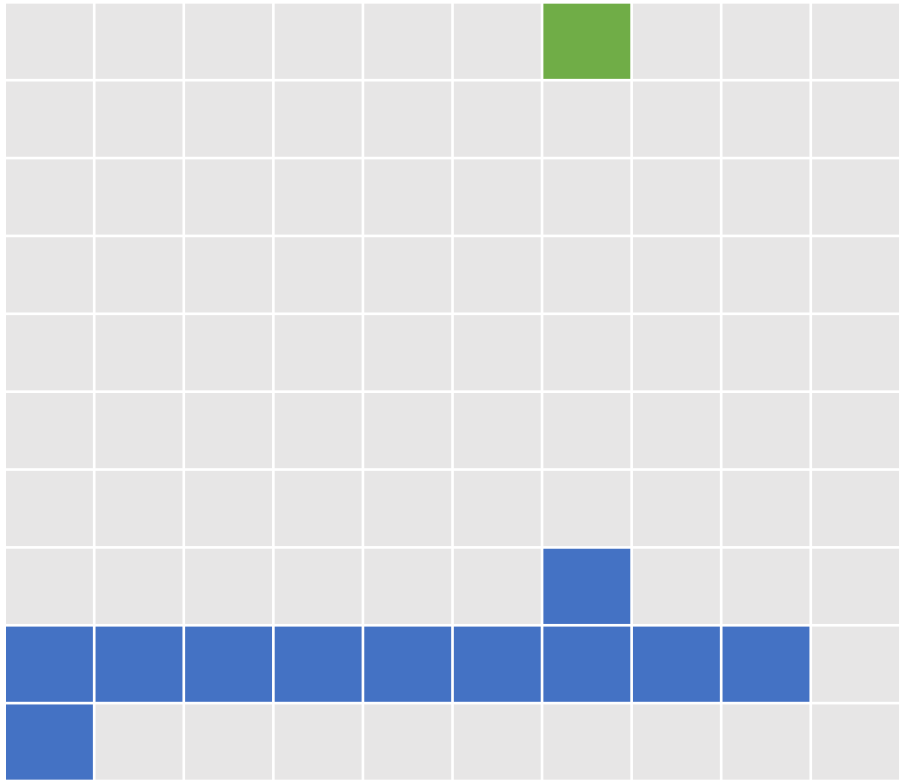
Thus, complex shapes...



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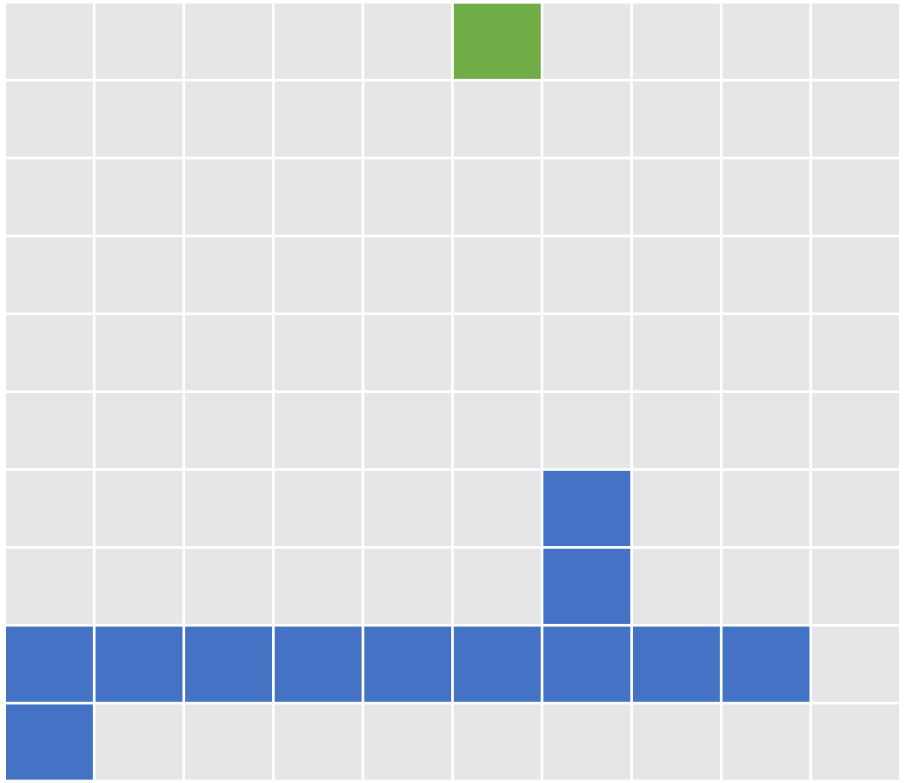
Thus, complex shapes may hold together



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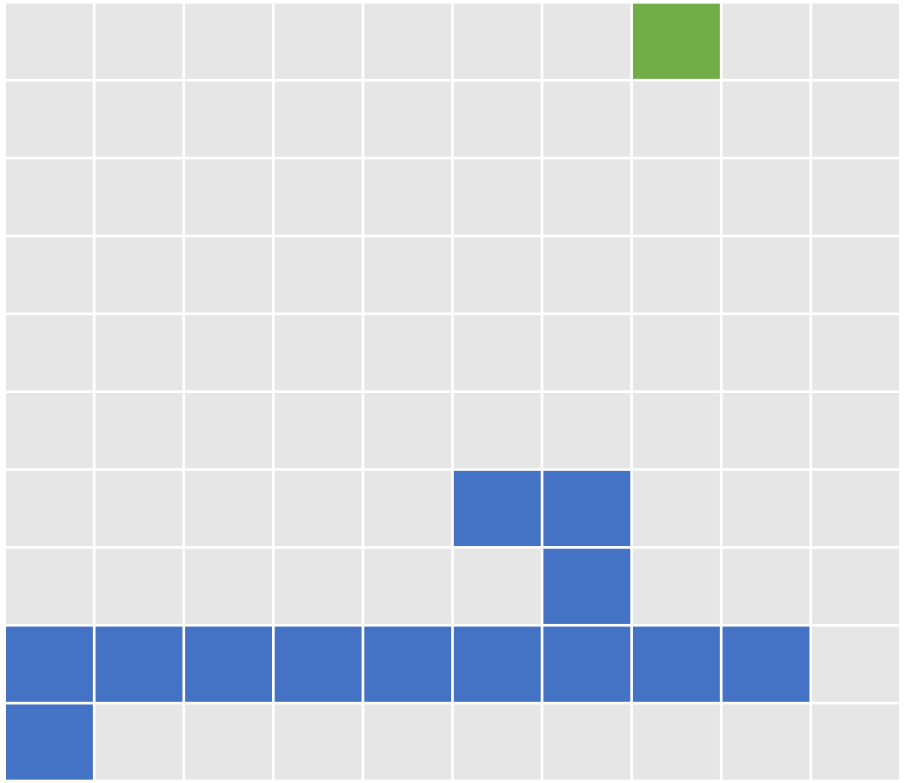

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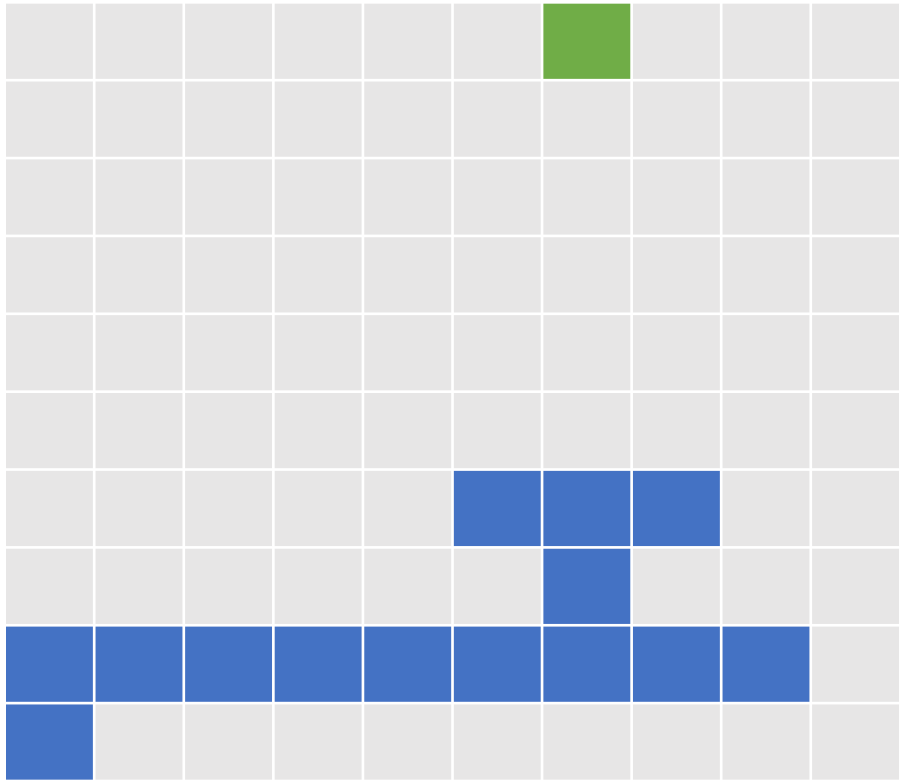
Thus, complex shapes may hold together and remain stable



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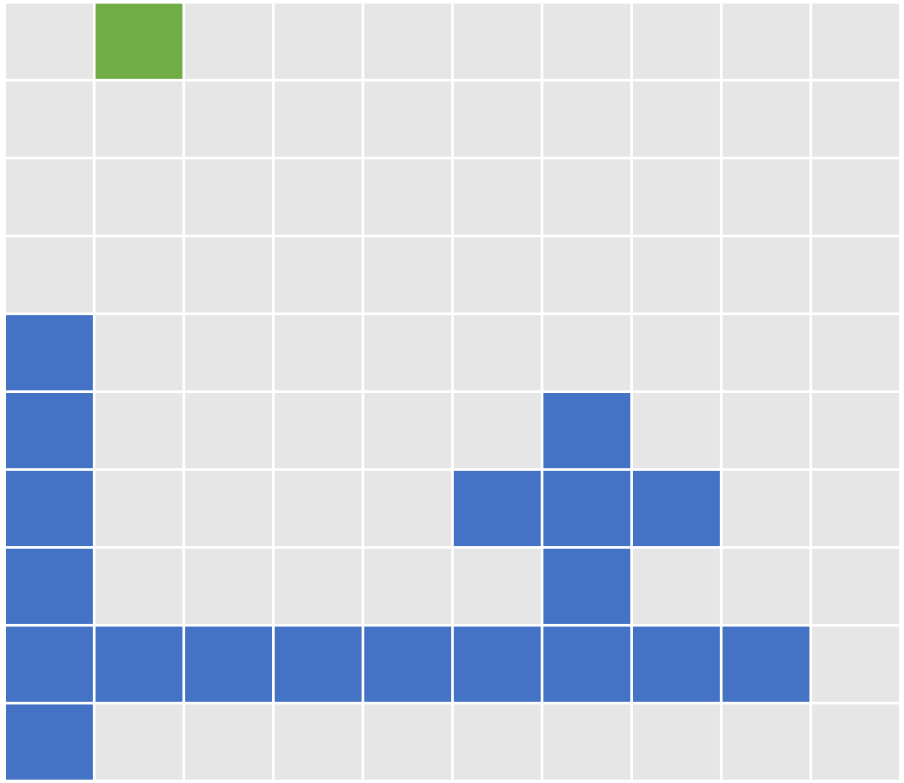

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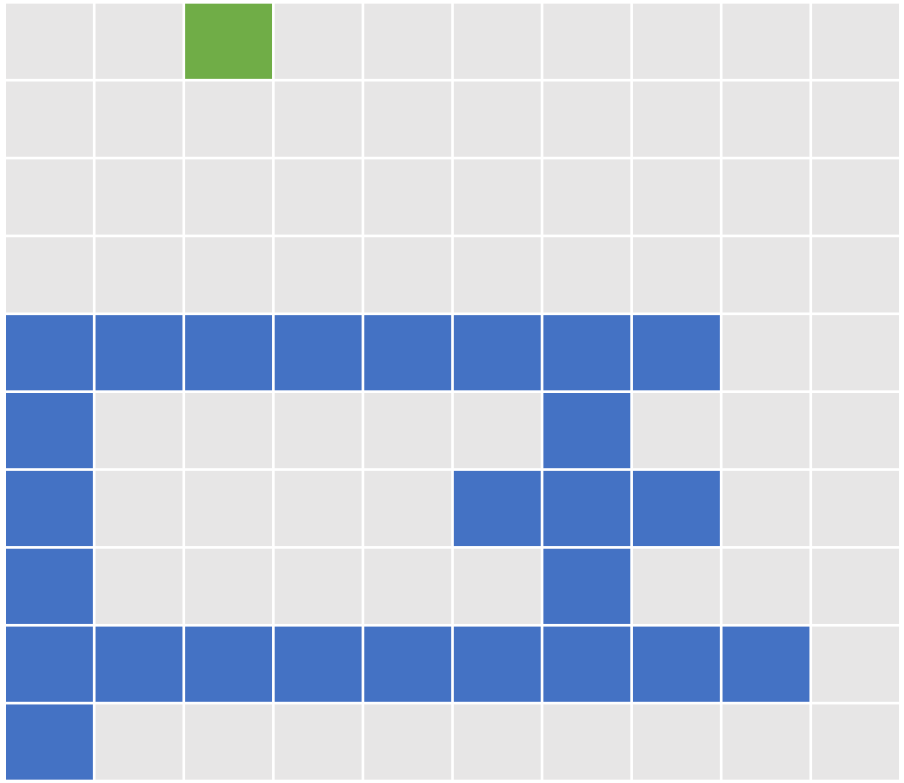

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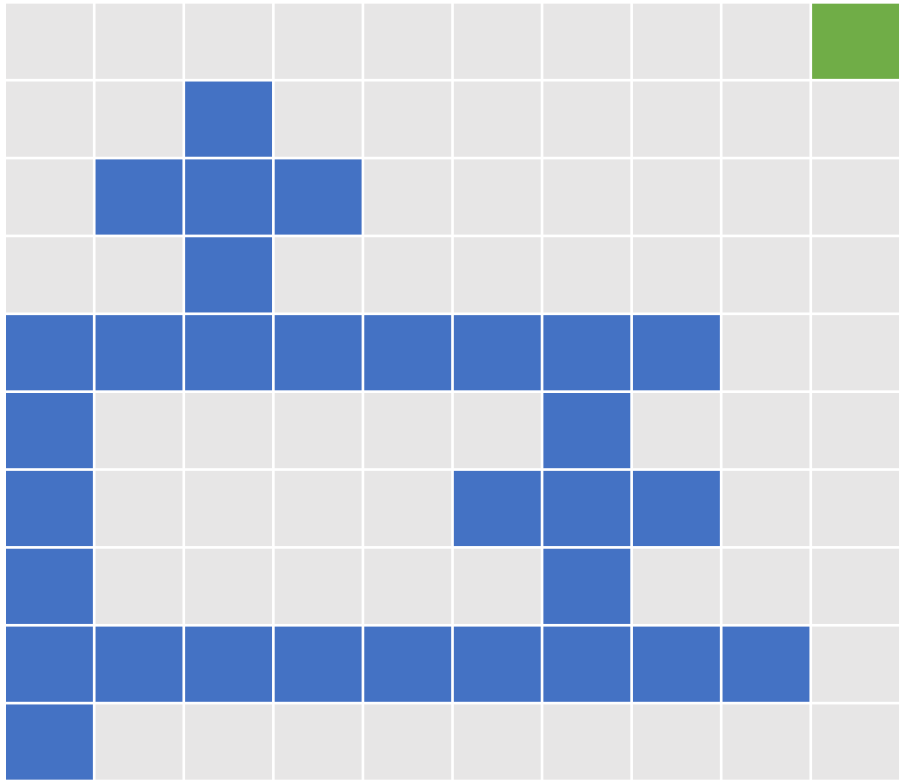
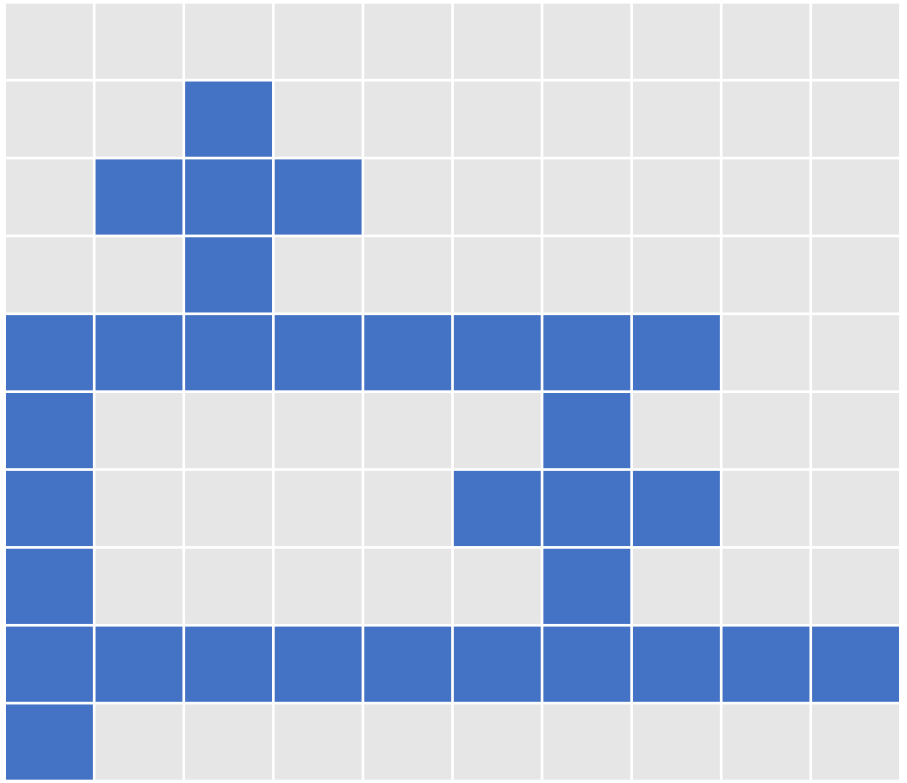
Thus, complex shapes may hold together and remain stable, until...



Annihilation

Like in Tetris, a line full of cubes...



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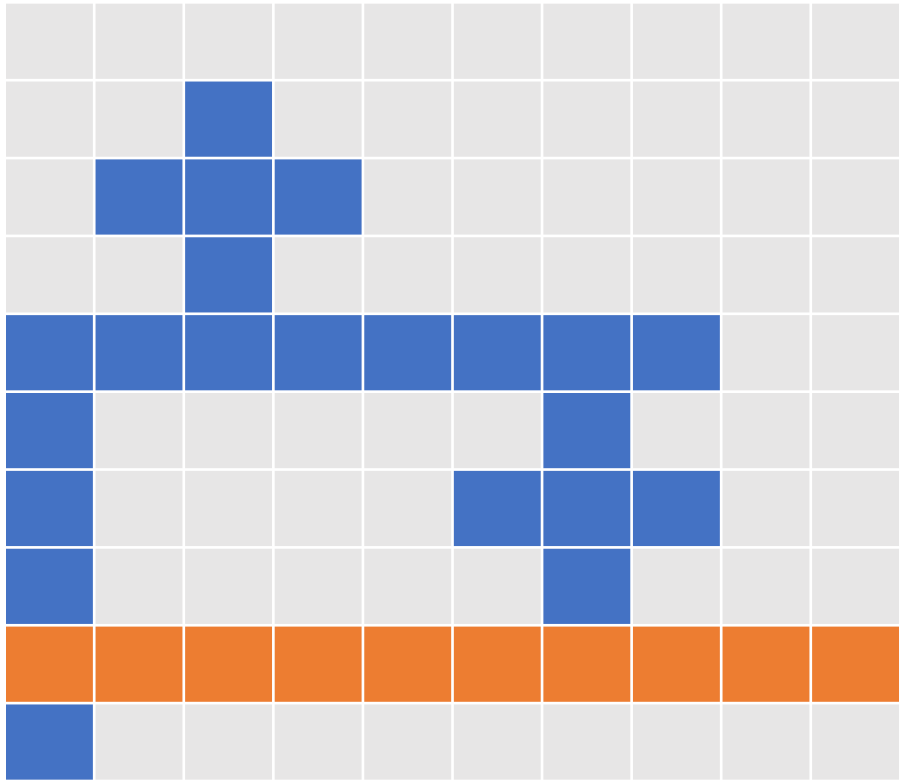
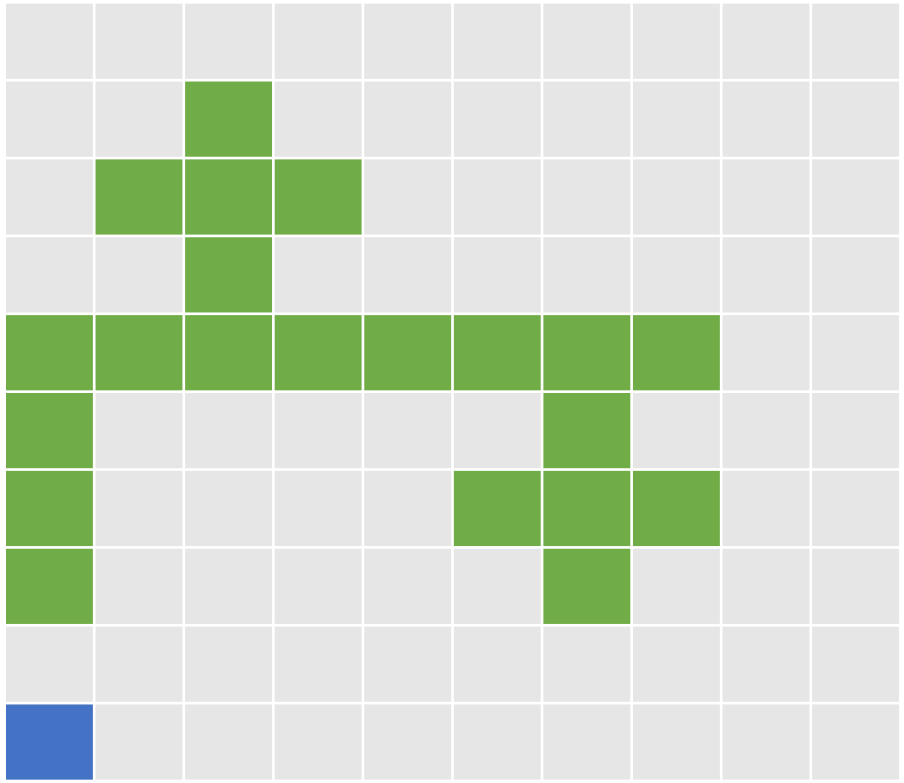


Annihilation

Like in Tetris, a line full of cubes will annihilate, removing support from the cubes above

The cubes that are not connected to the bottom of the area become loose and start to fall...



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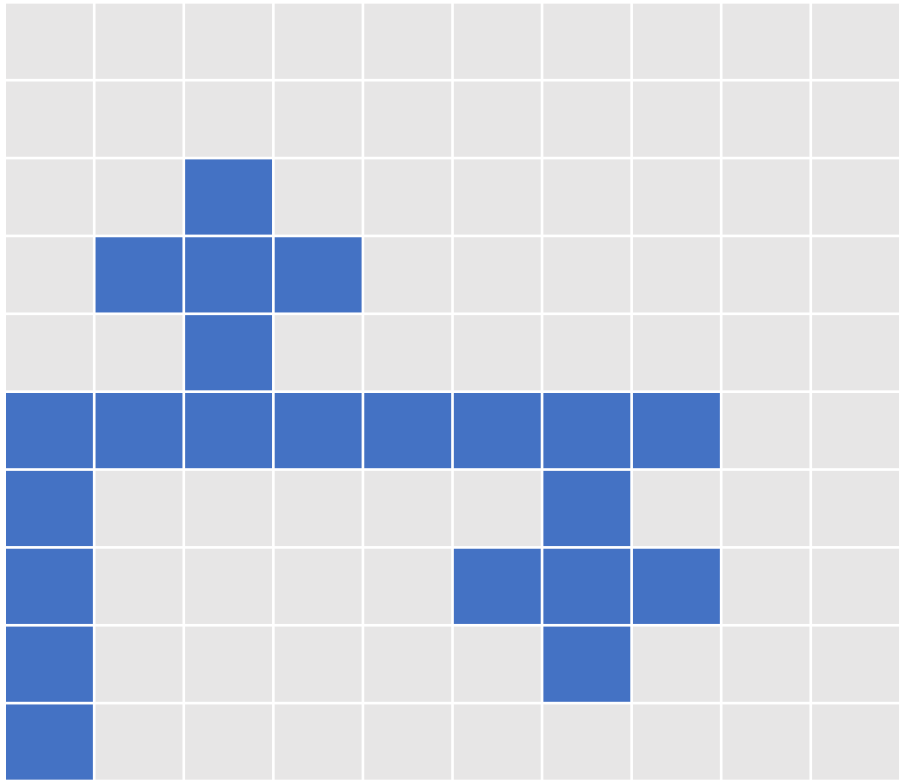

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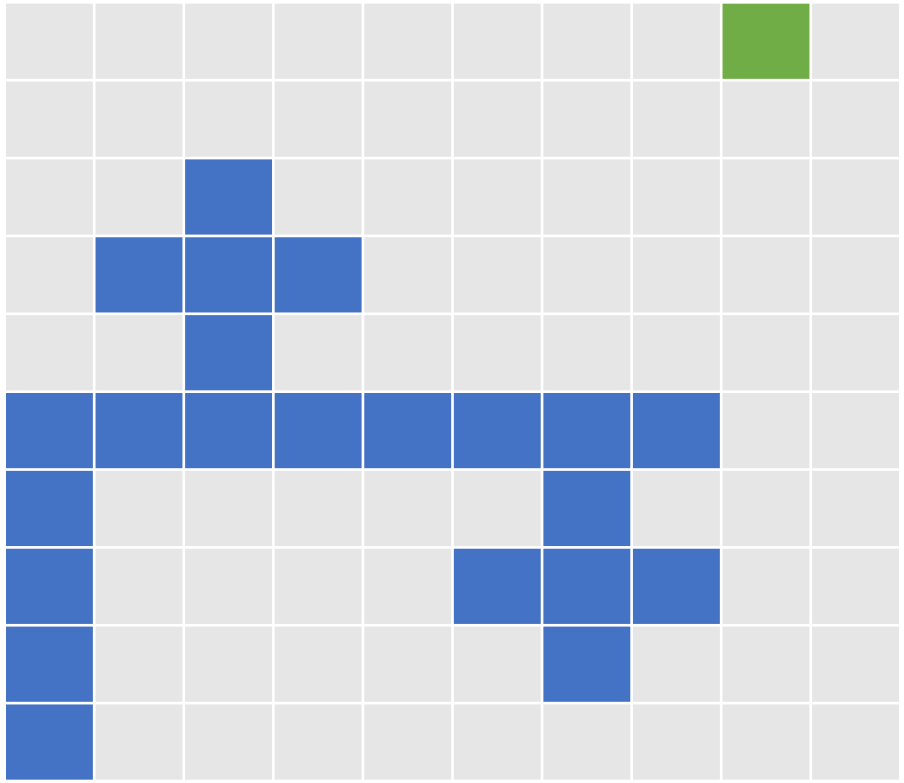
After the falling shape settles, another cube may appear...



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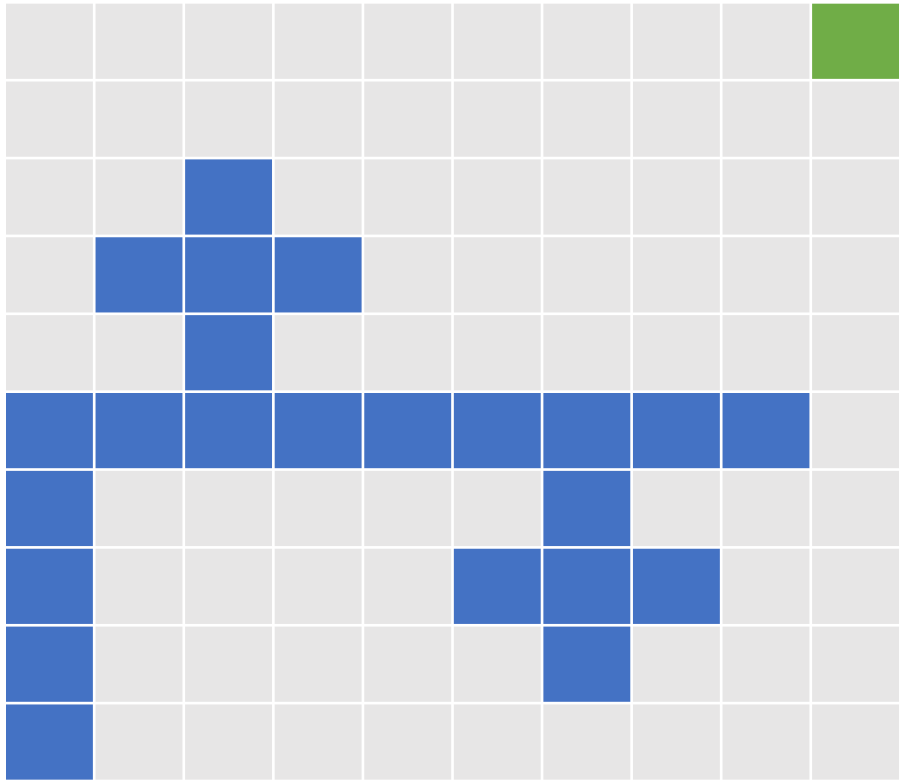
The cubes that are not connected to the bottom of the area become loose and start to fall, until one of them glues to a stable cube

After the falling shape settles, another cube may appear, and the game continues



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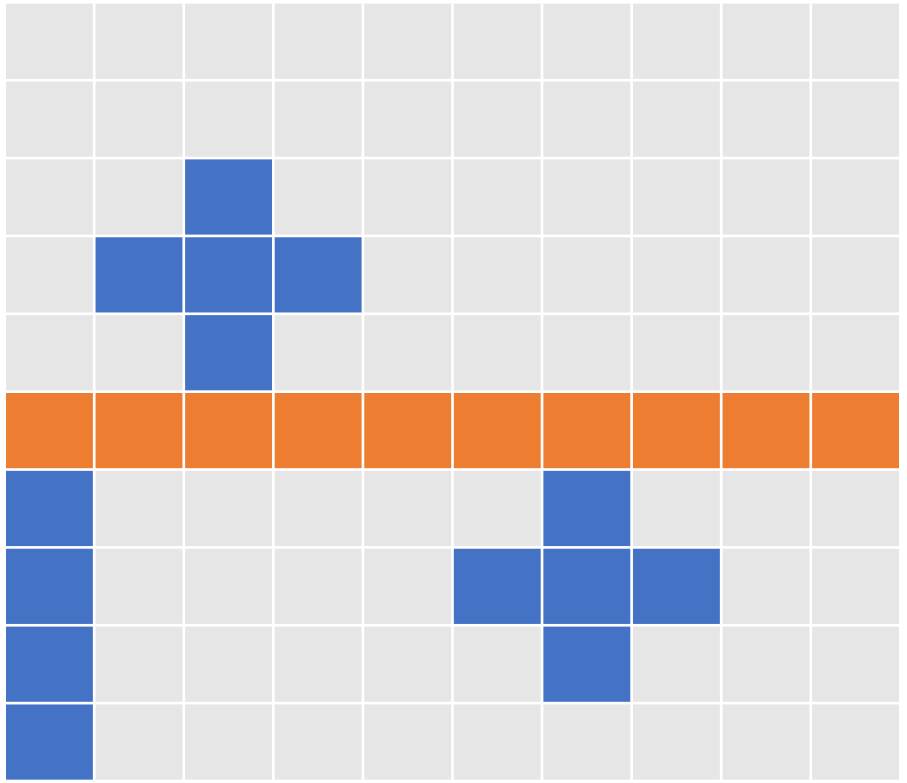
An annihilation may create...



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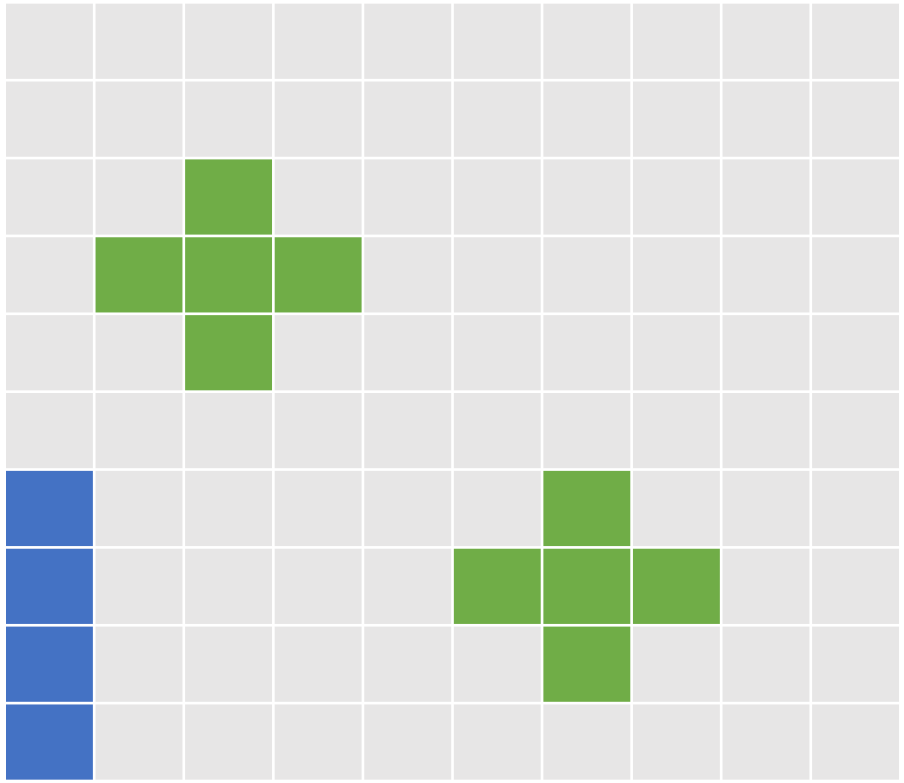
An annihilation may create more than one loose component – the components fall synchronously but independently



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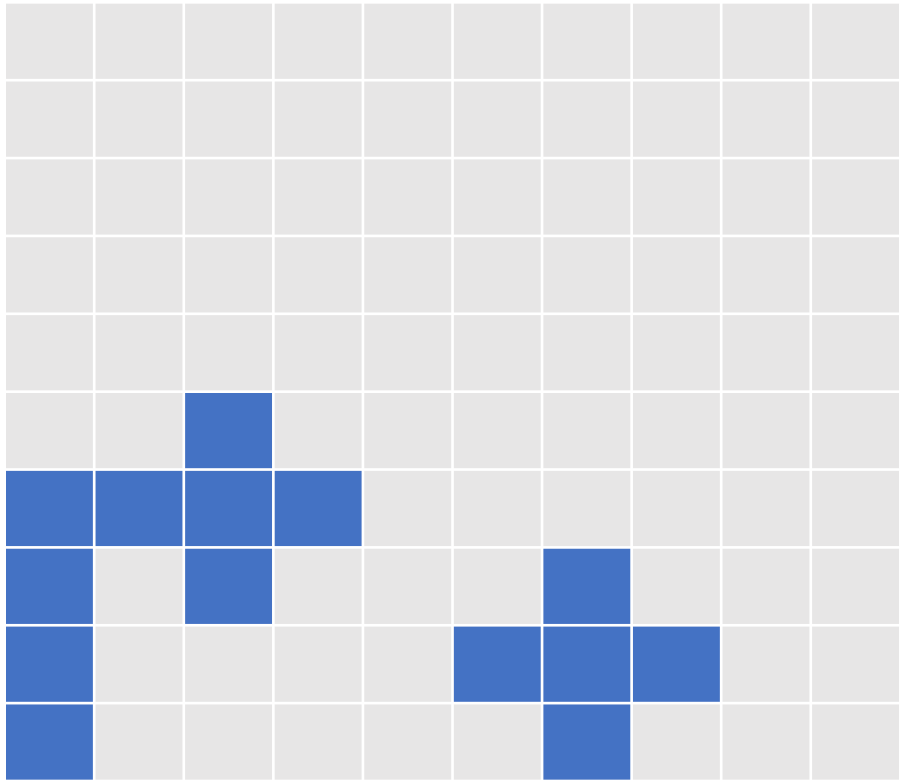
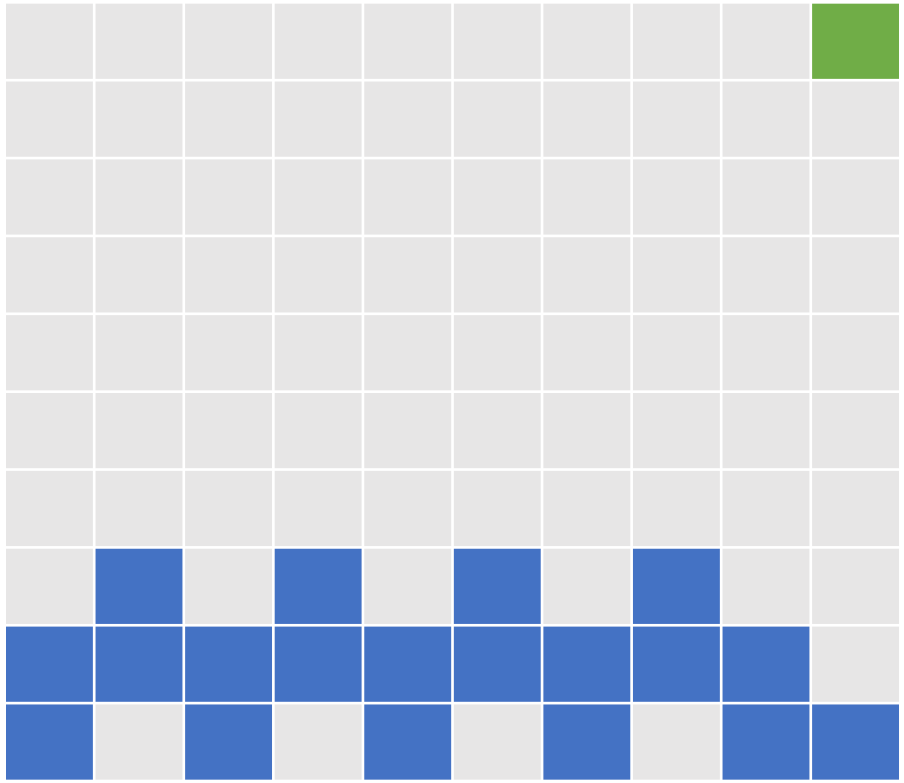
Some of the falling components may glue to stable parts, others may fall to the bottom



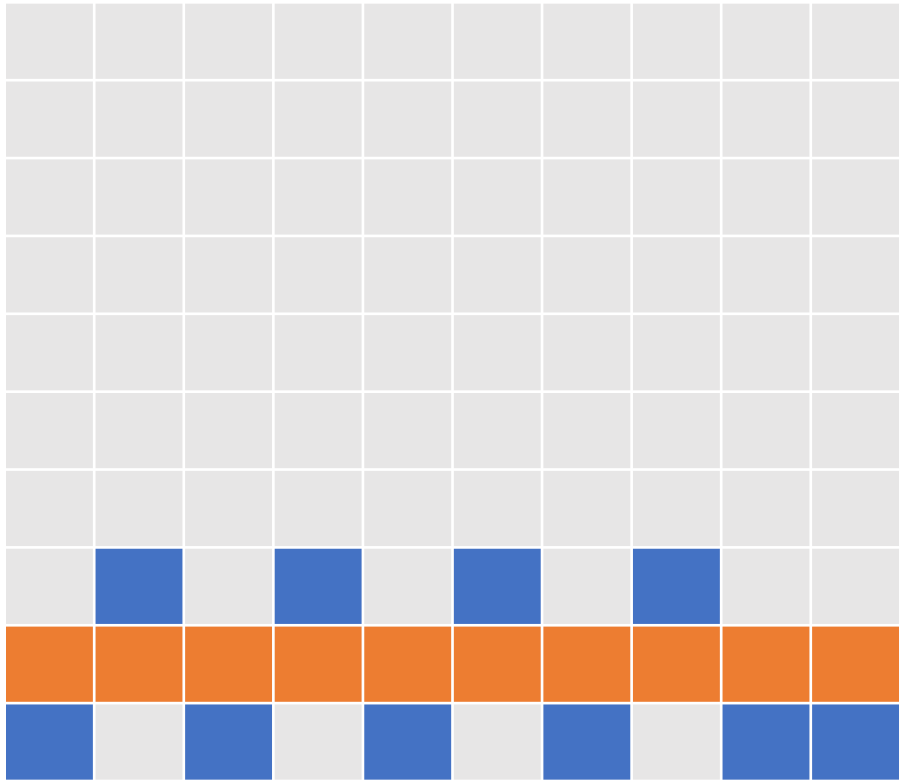
Annihilation cascade

One falling cube...



Annihilation cascade

One falling cube may provoke a cascade of annihilations and falls



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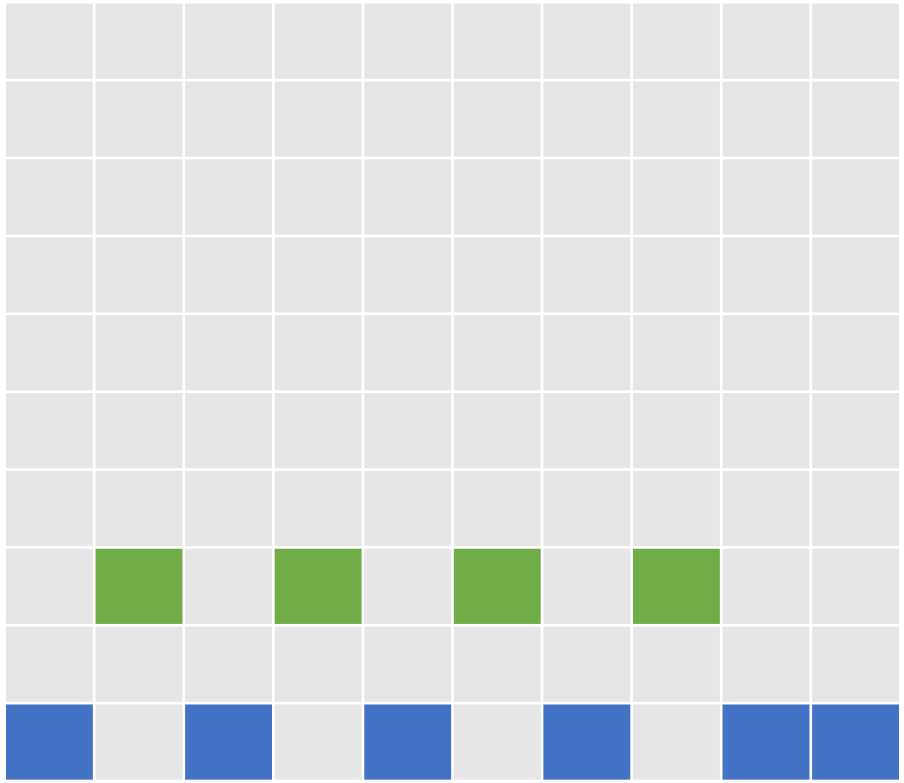

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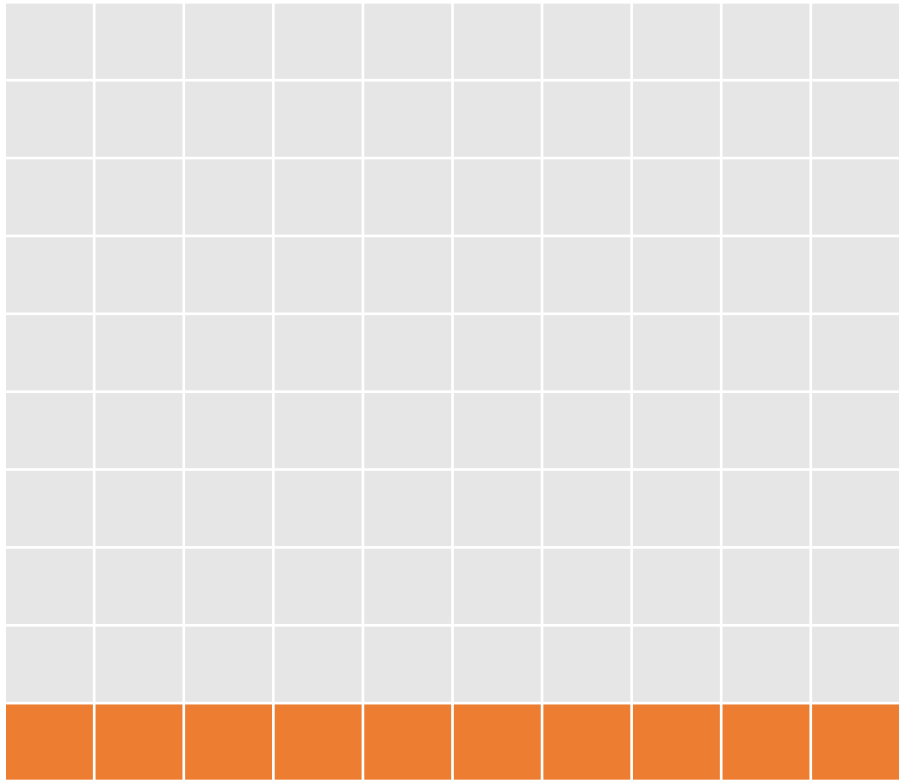

Annihilation cascade

One falling cube may provoke a cascade of annihilations and falls

Formal definition

- **Stable** cubes
  - All cubes in the bottom row are stable
  - If a cube is vertically or horizontally adjacent to a stable cube, it is also stable
- All other cubes are **free**
  - All free cubes are moved one position down
  - Then, stability is rechecked, possibly changing some free cubes into stable

- If a horizontal line is full of cubes
  - All such lines are simultaneously emptied
  - Then, stability is rechecked, possibly changing some stable cubes into free

  - Observation: Annihilation of a line could happen only after some free cubes moved into a line containing stable cubes, filling all the gaps. As a result, the whole line becomes stable, then annihilated.

The program

At the standard input:

- The first line contains the width and the height of the game-area rectangle
- Each subsequent line contains the horizontal coordinate (0-based) of a new cube spawned at the top row

At the standard output:

- Print vertical coordinate (0-based, bottom-up) of the position where each spawned cube was stopped (including in the case where it was subsequently annihilated)
- Print "A y" where y is the vertical coordinate for each annihilated row
- When the input file is completely processed, print the final game state using '#' for cubes and '.' for empty spaces

Example input & output

```
10 10
0
2
4
6
8
9
0
1
2
3
4
```

```
5
6
7
8
1
3
5
7
```

```
0
0
0
0
0
0
1
1
1
1
1
```

```
1
1
1
1
2
2
2
2
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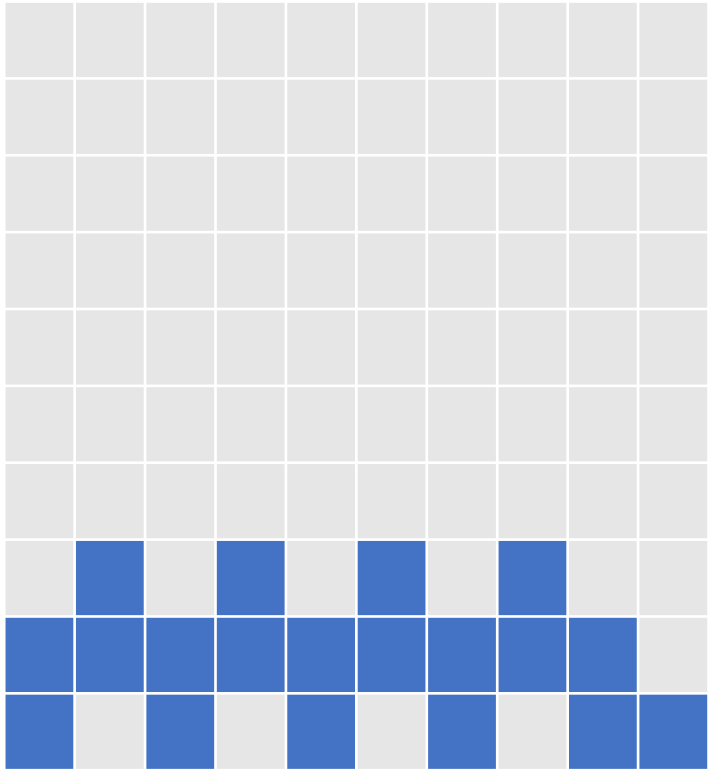

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```
5
6
7
8
1
3
5
7
9
```

```
0
0
0
0
0
0
1
1
1
1
1
```

```
1
1
1
1
2
2
2
2
1
A 1
A 0
```

```
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