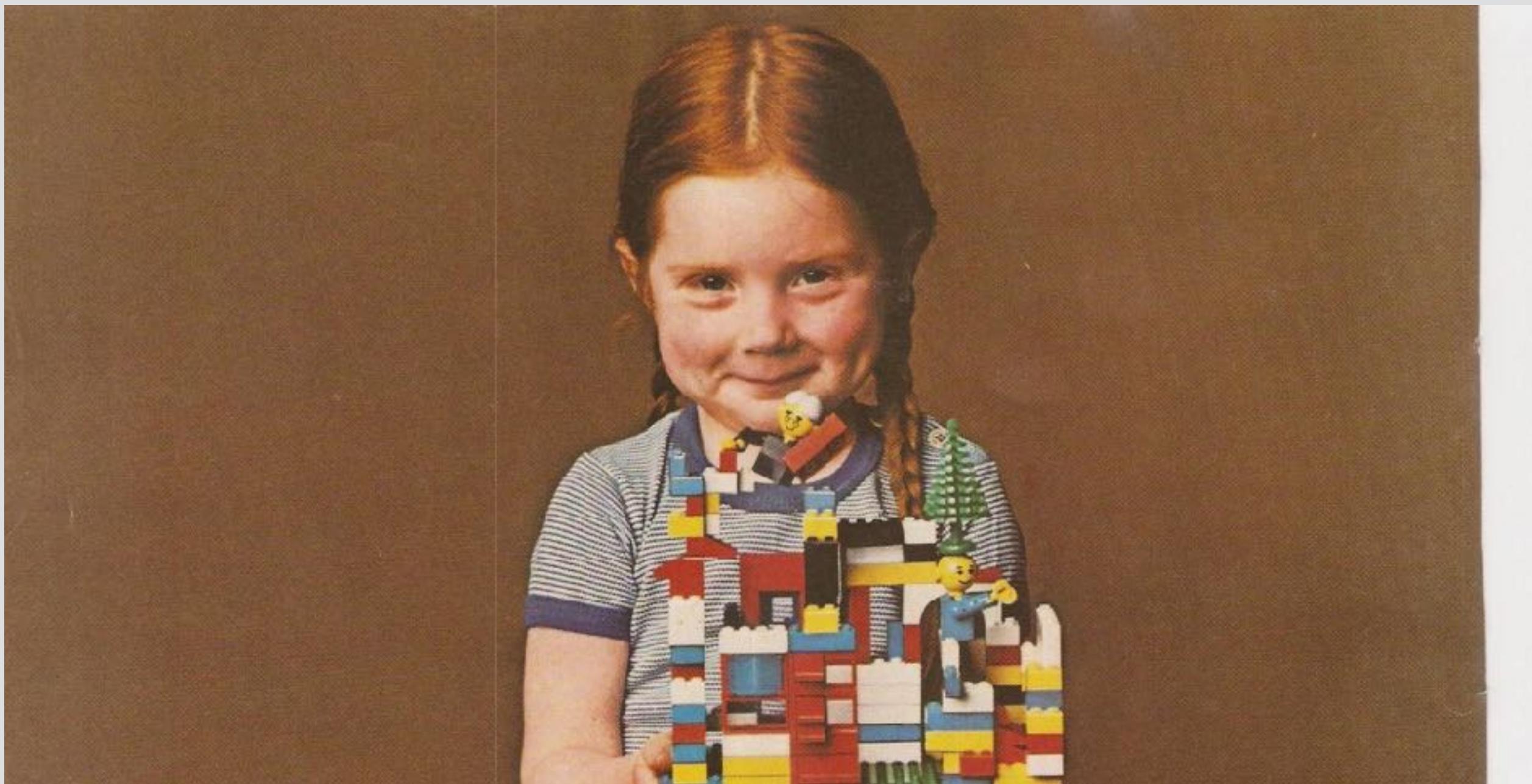


Creating levels.



Creating levels.

Procedural level generation.



Terraria





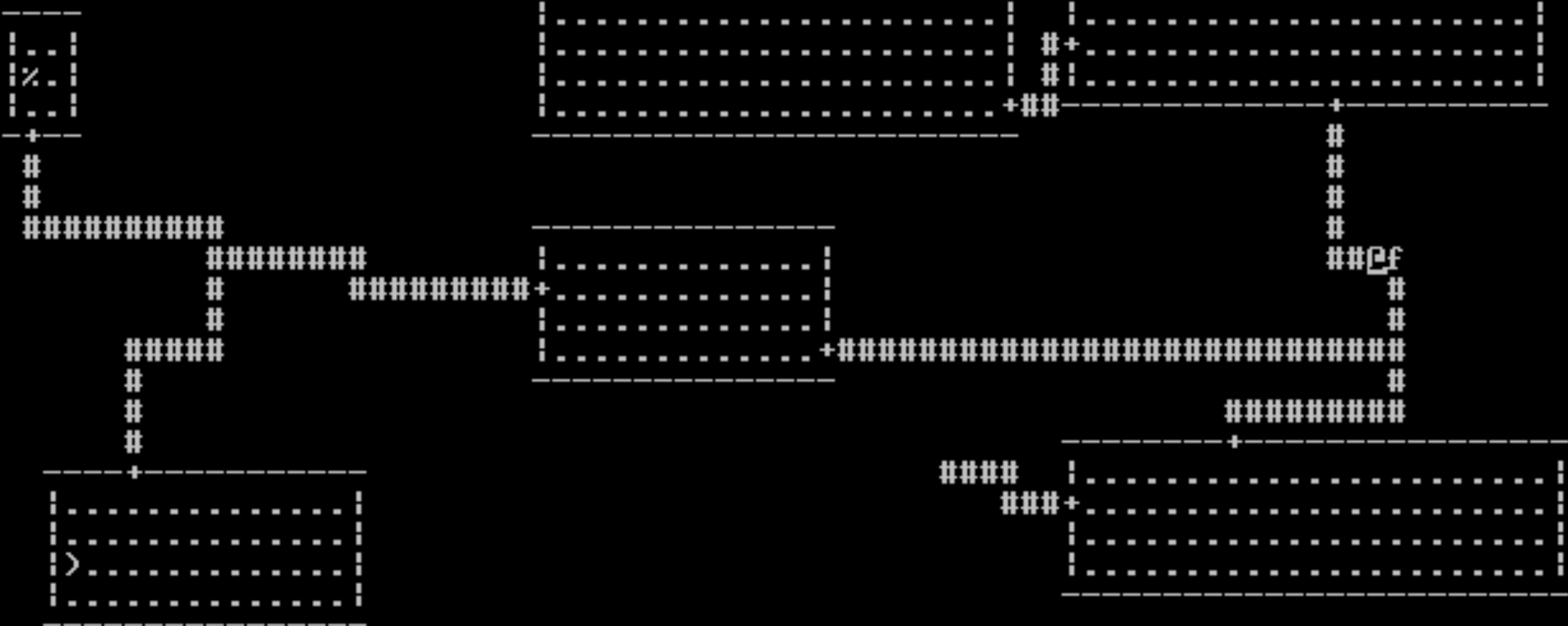
\$0







The killer frog hit.



Level: 3 Gold: 496 Hp: 32<37> Ac: 1 Exp: 4/47 Vol: 65%
Str: 11< 11> Dex: 14< 14> Wis: 12< 12> Con: 18< 18> Carry: 54<150>





An overview of procedural generation
examples.

Snake.

OKIA

P

G

-

A

1

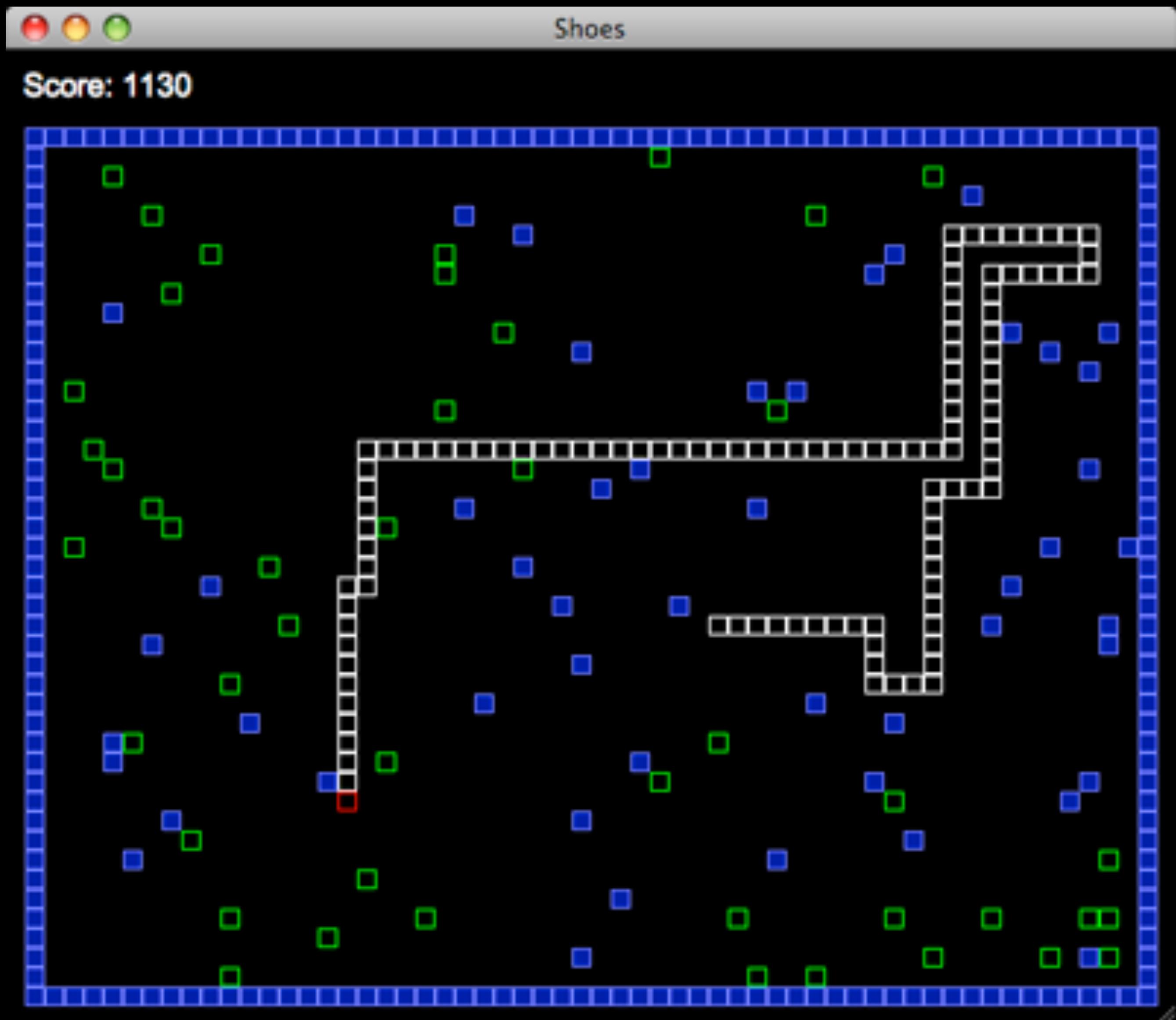
2

3

5

0

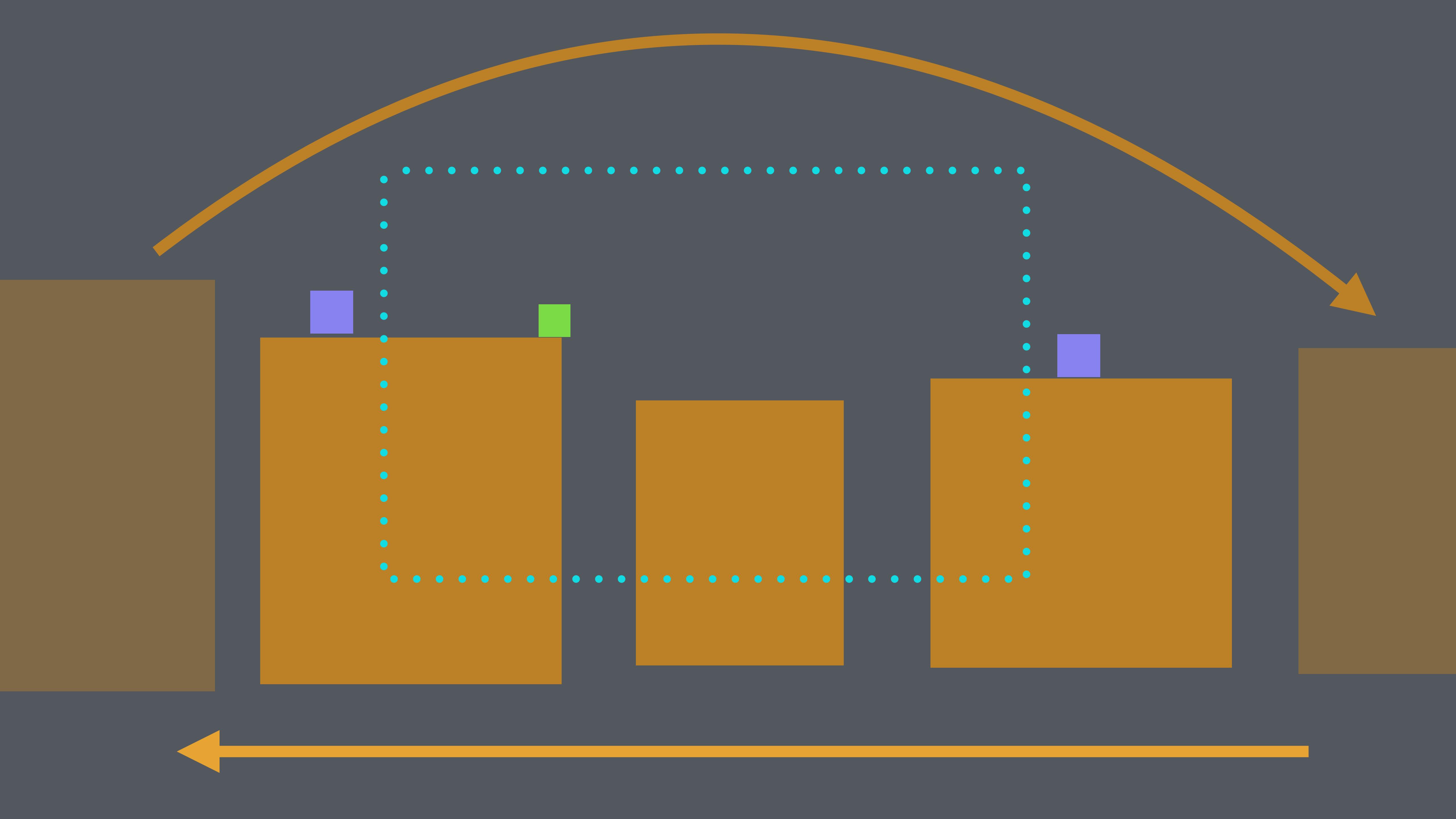




Canabalt.

151m







Tuning Canabalt

[http://www.gamasutra.com/blogs/AdamSaltsman/
20100929/88155/Tuning_Canabalt.php](http://www.gamasutra.com/blogs/AdamSaltsman/20100929/88155/Tuning_Canabalt.php)

Spelunky.

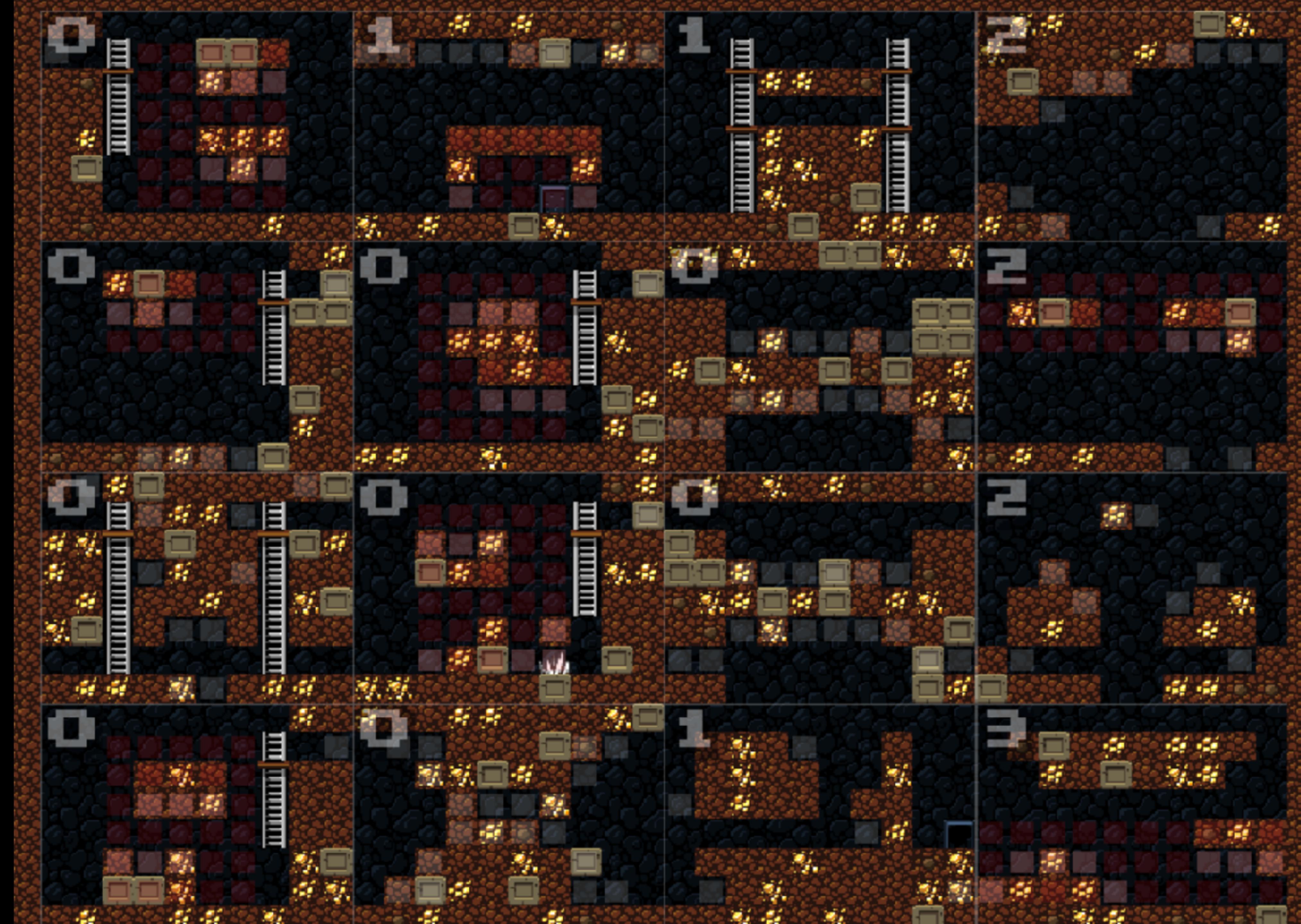


1
4
4

\$0







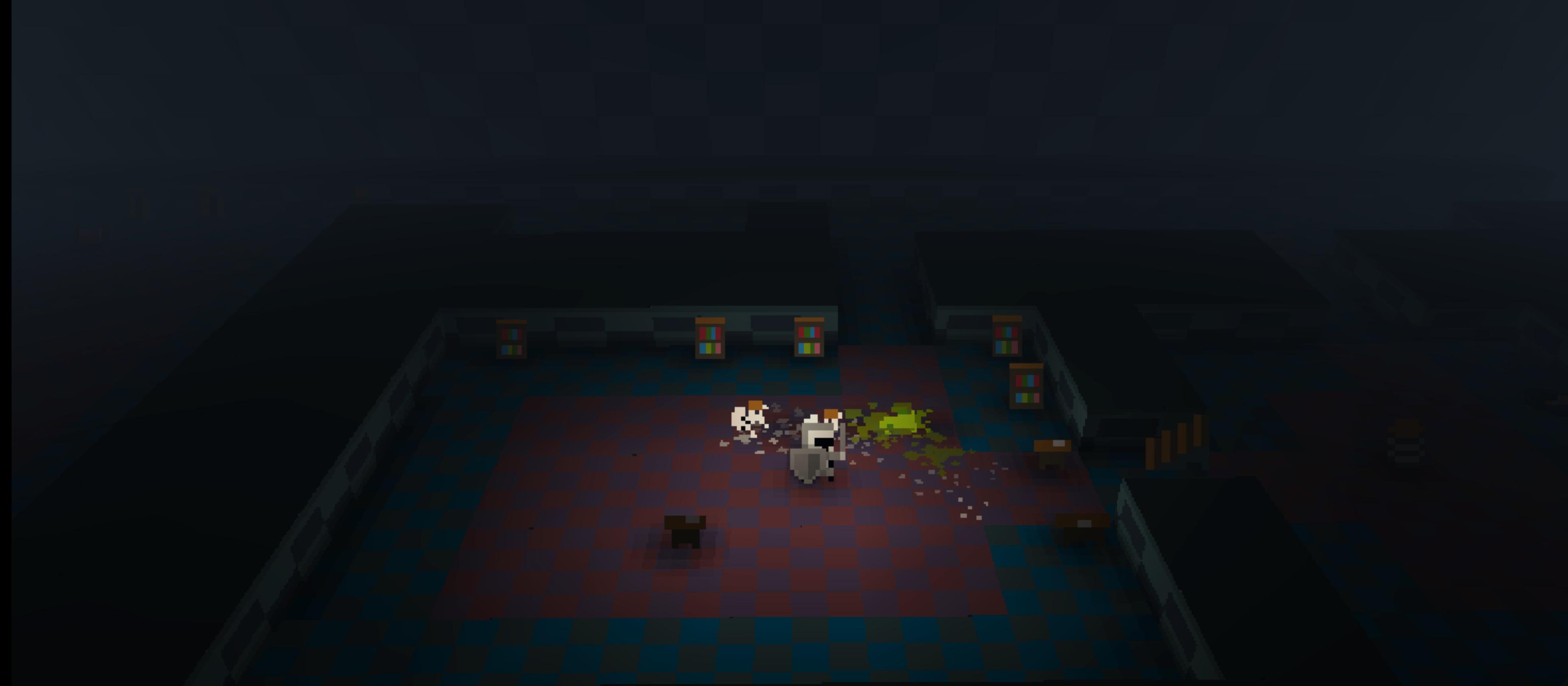


Level generation in Spelunky.

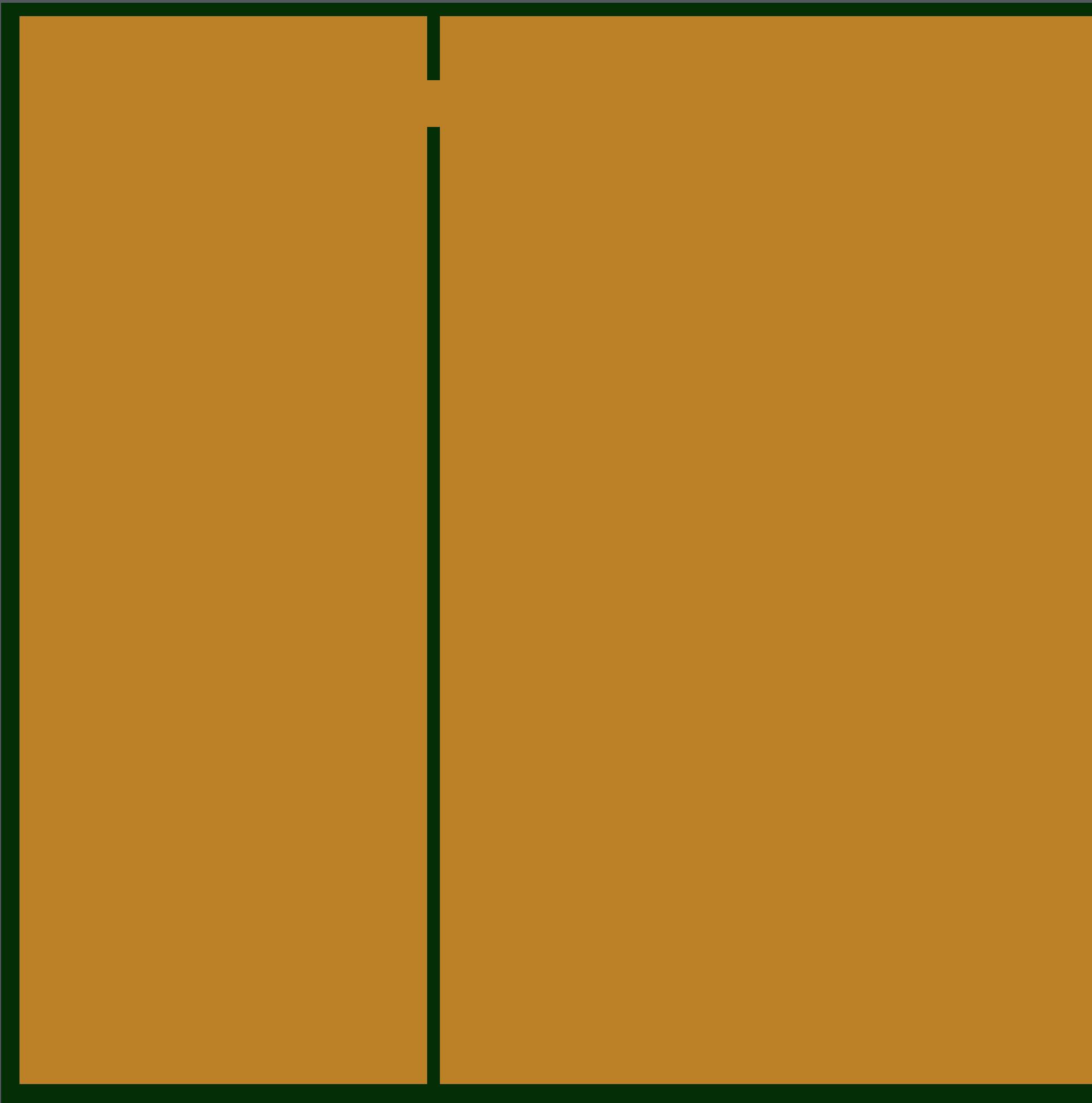
<http://tinysubversions.com/spelunkGen/>

Bitworld.

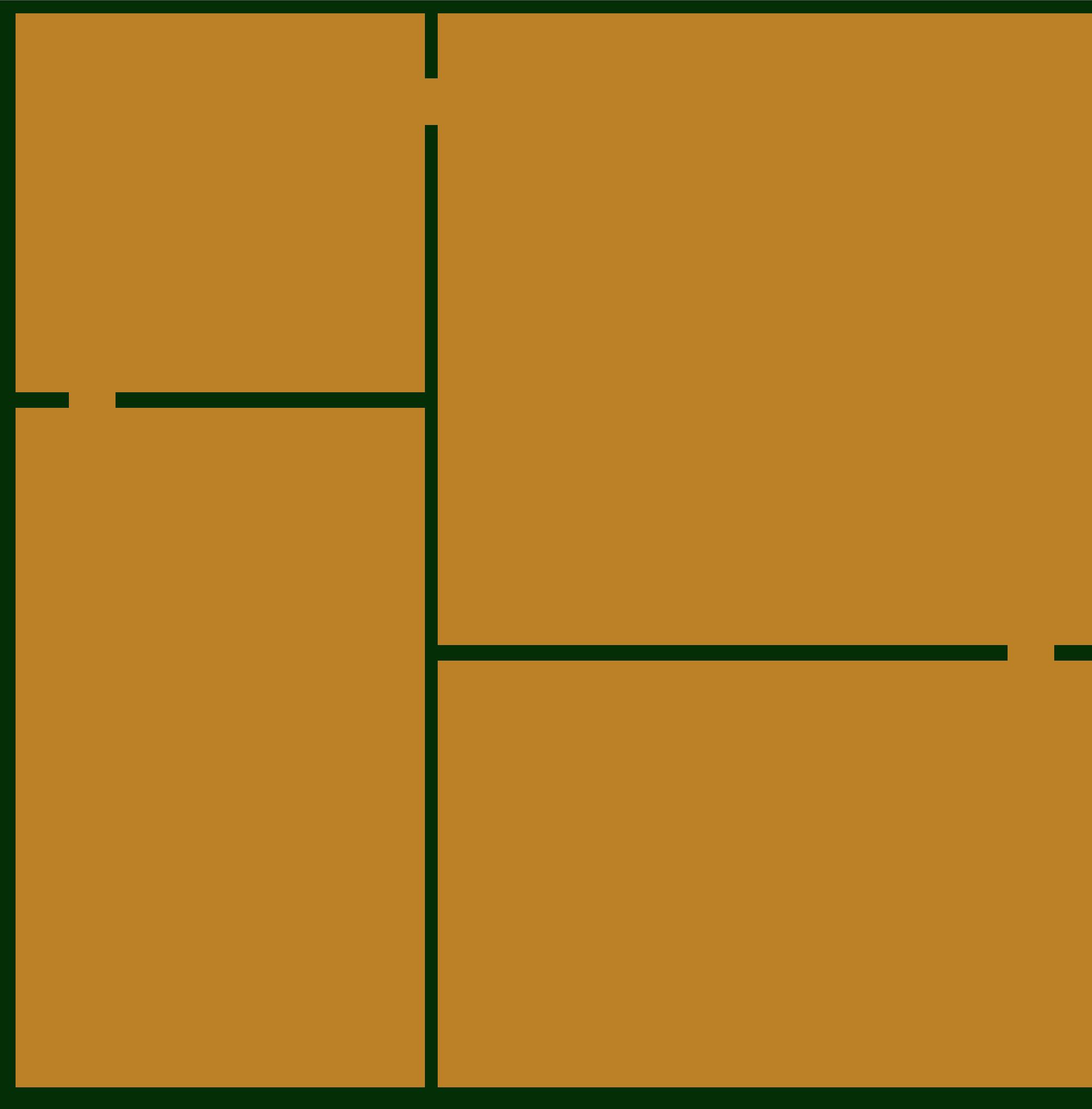
GOLDE



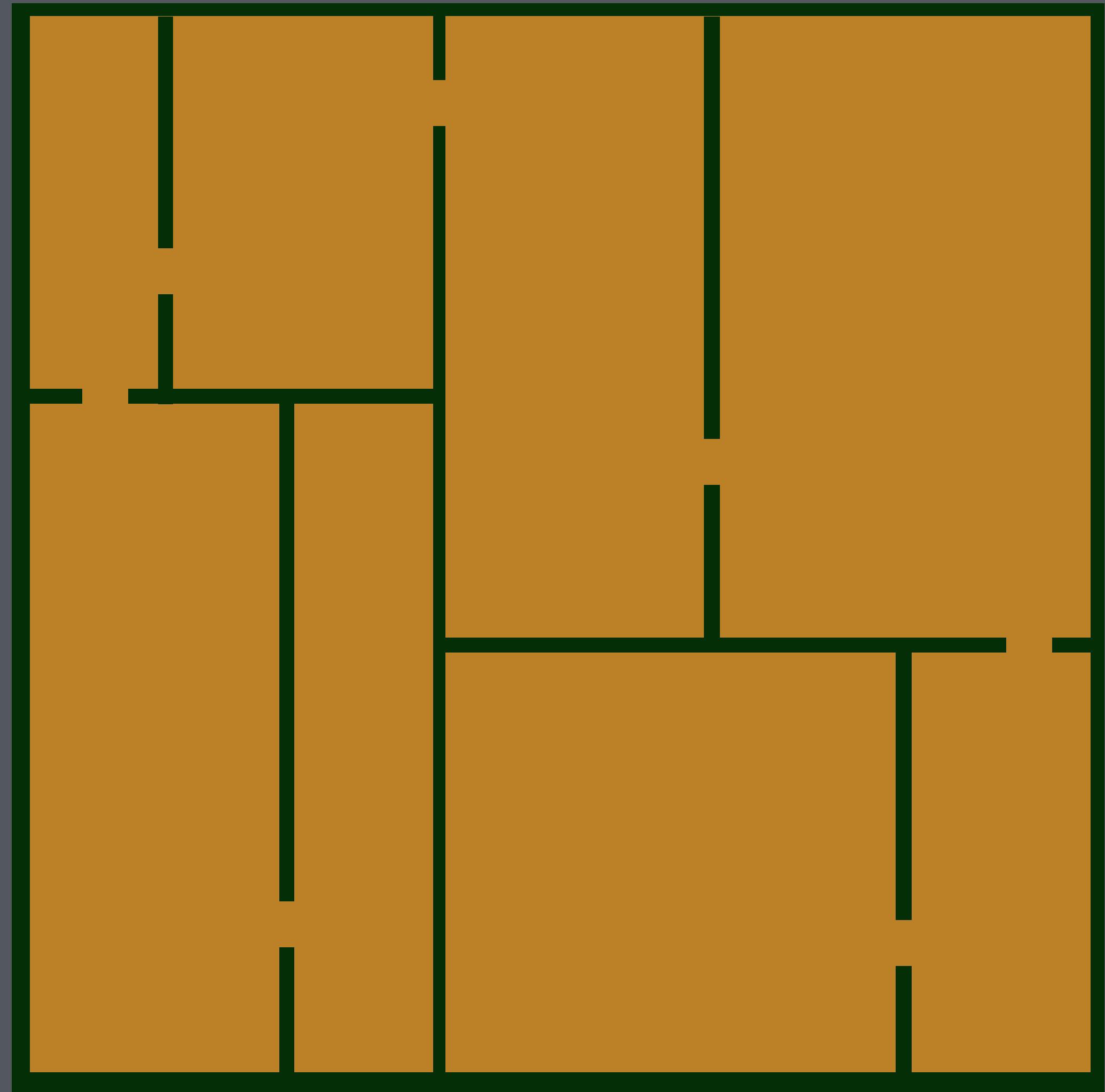




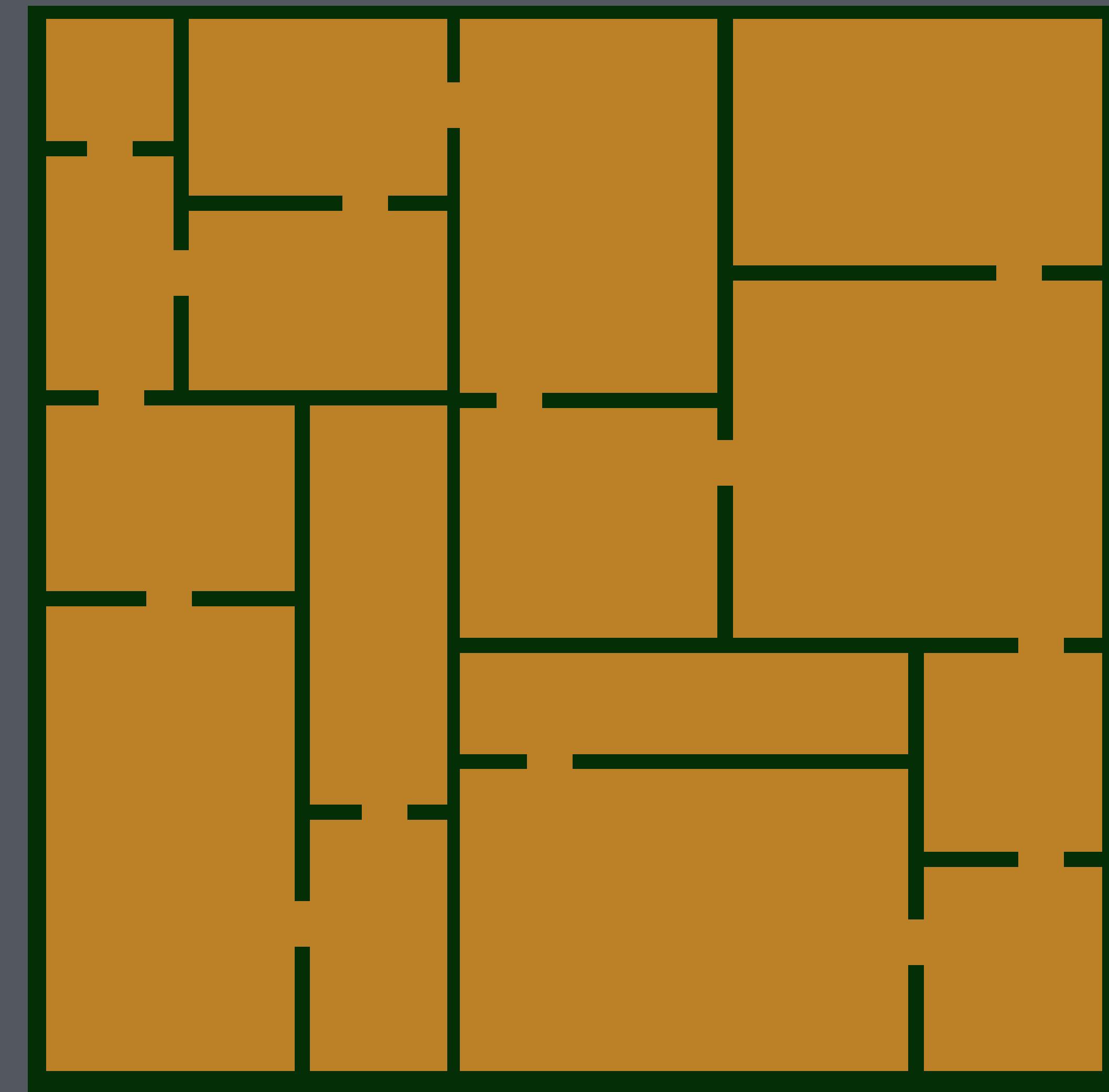
Divide into **two rooms** of random width and connect them together.



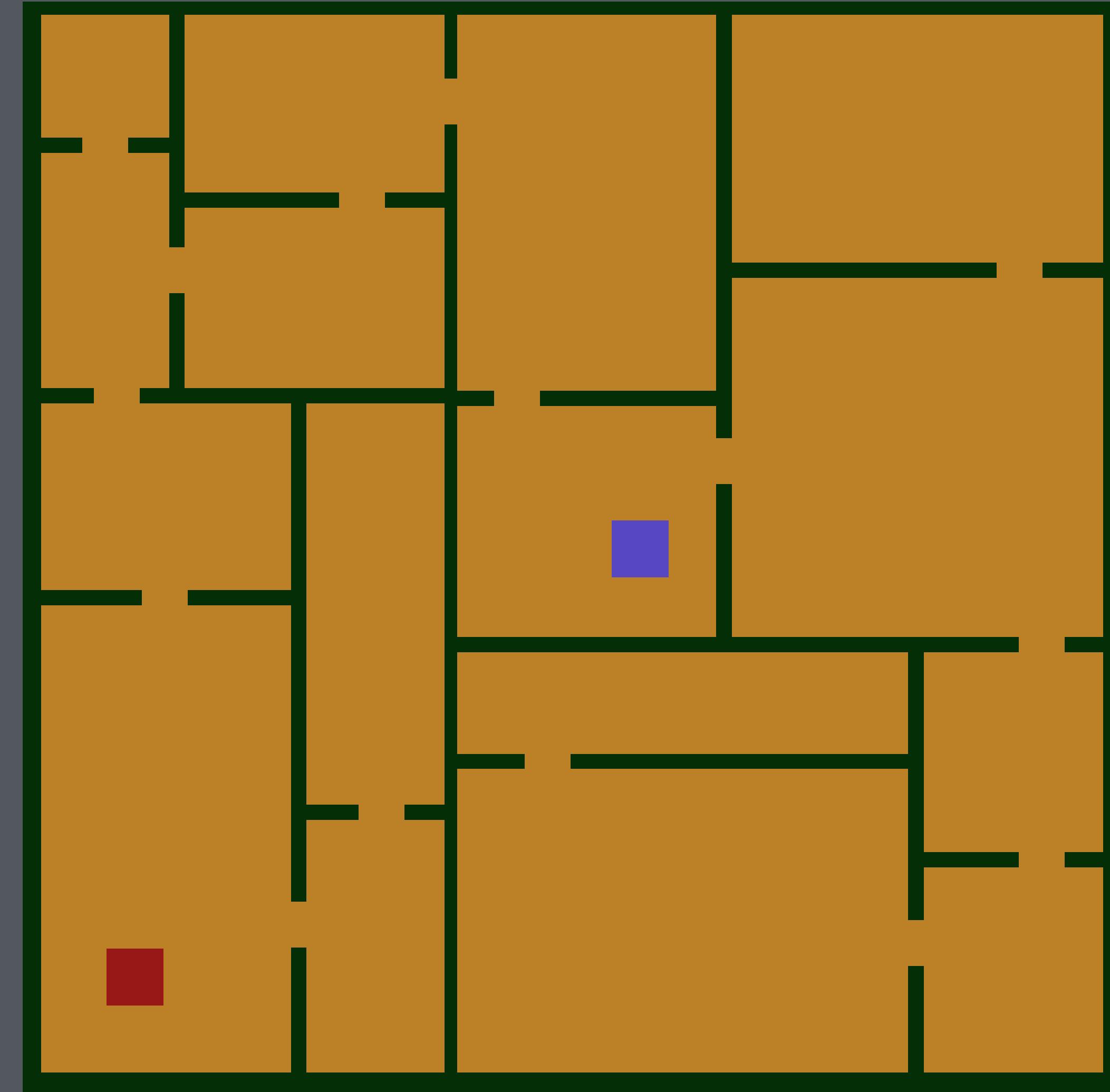
Do the same for the new rooms.



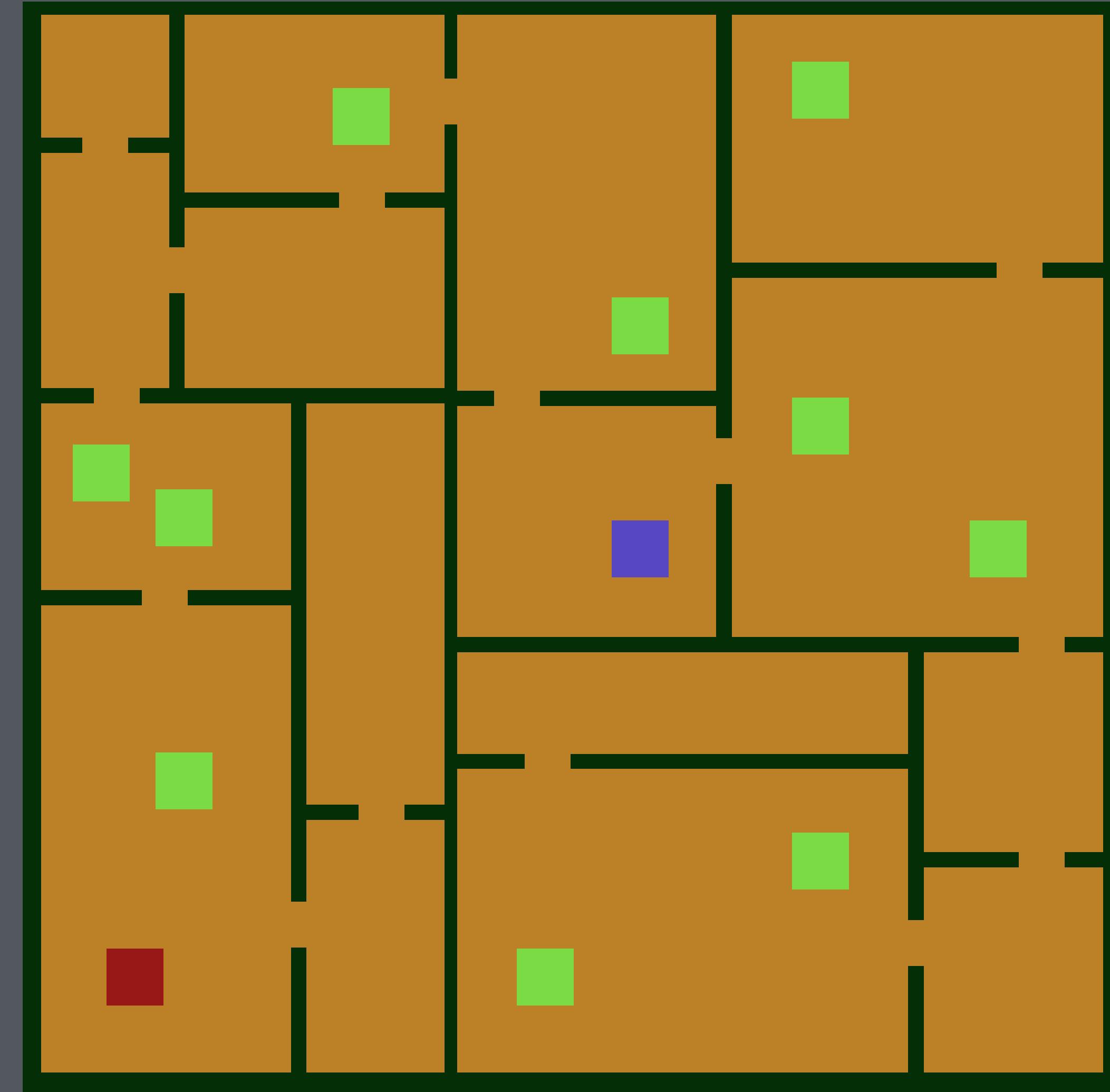
And again...



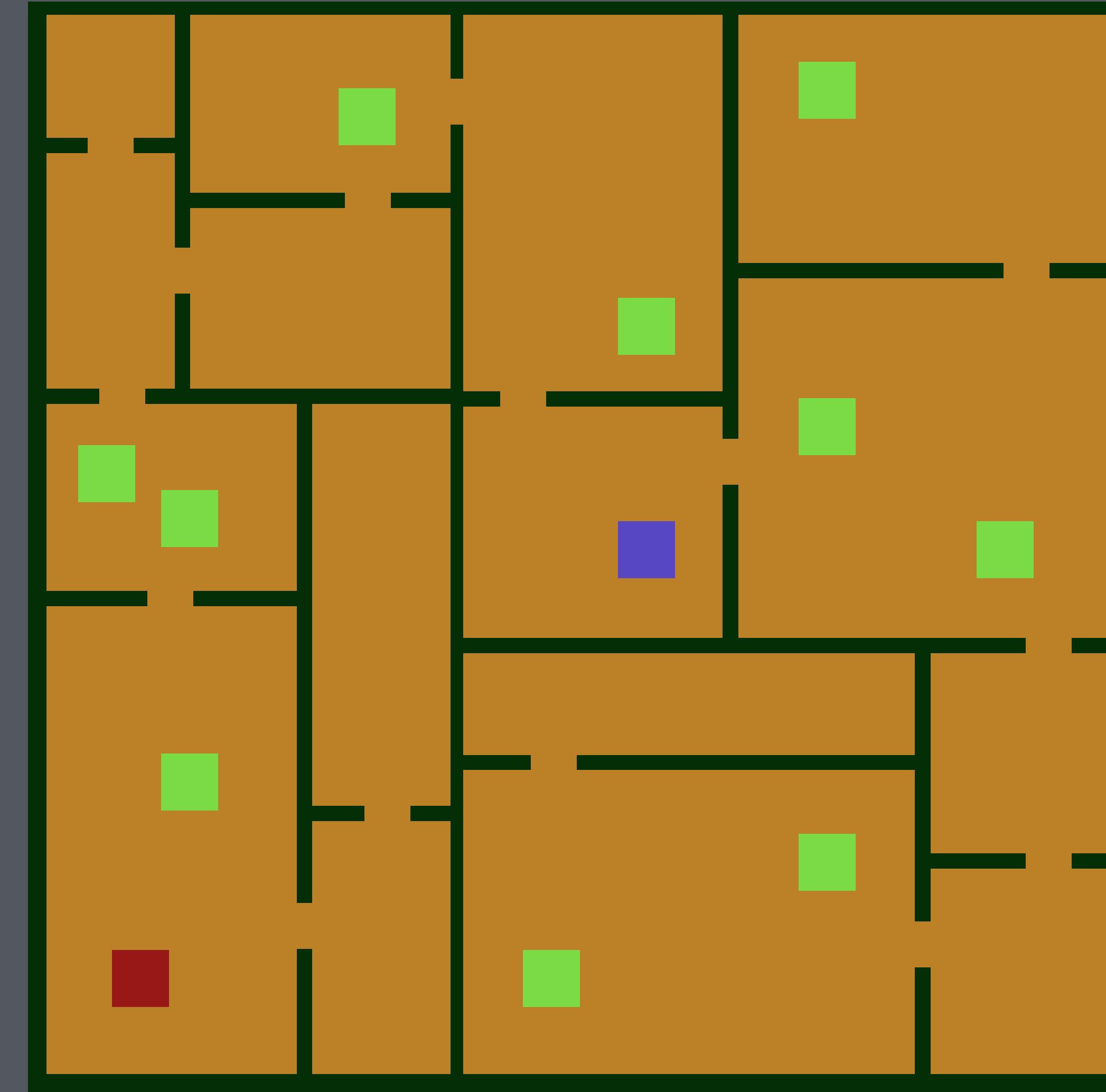
And again...



Place start and exit in a random tile.



Place enemies and other entities on random tiles.

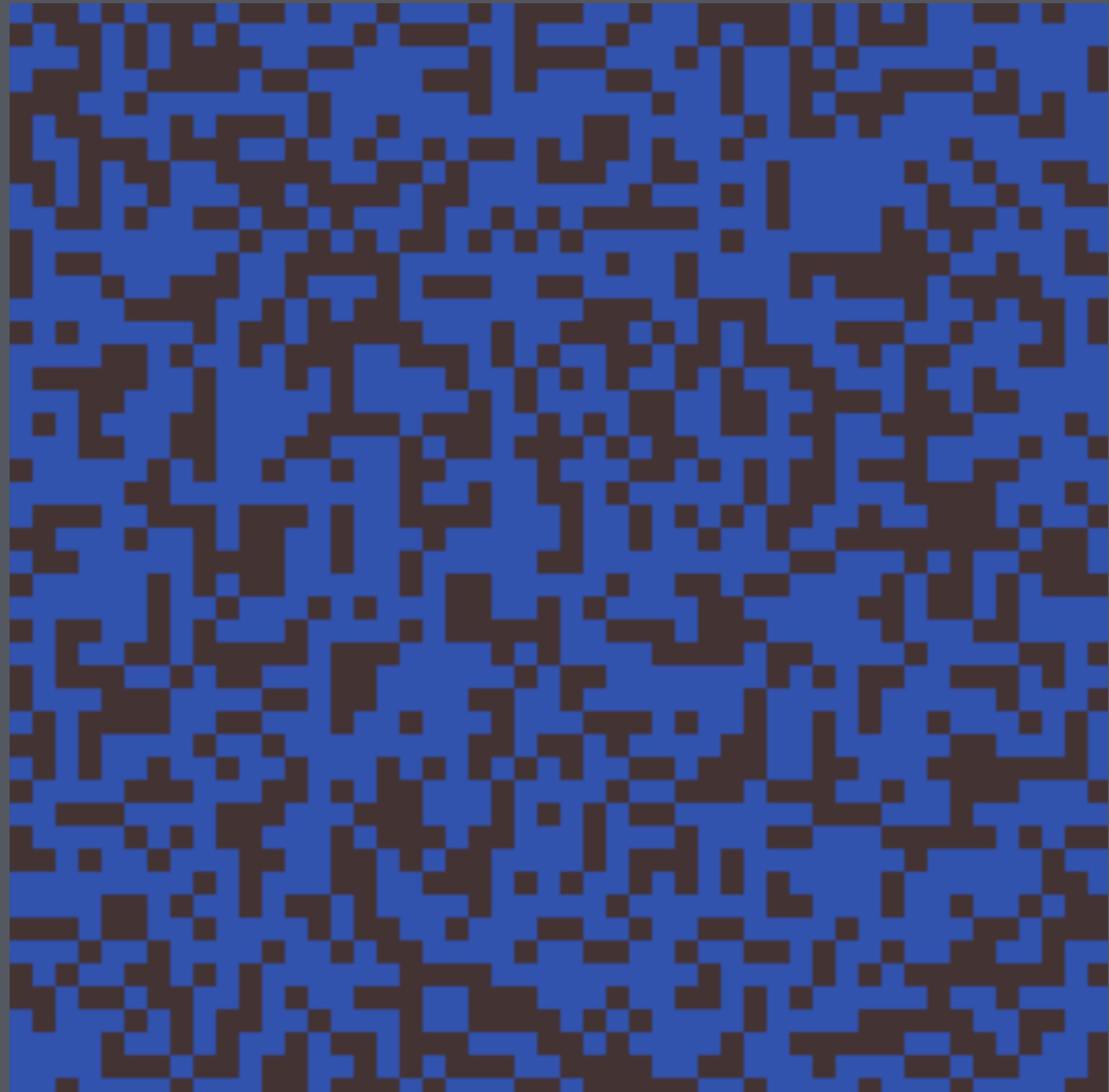


Procedural generation!

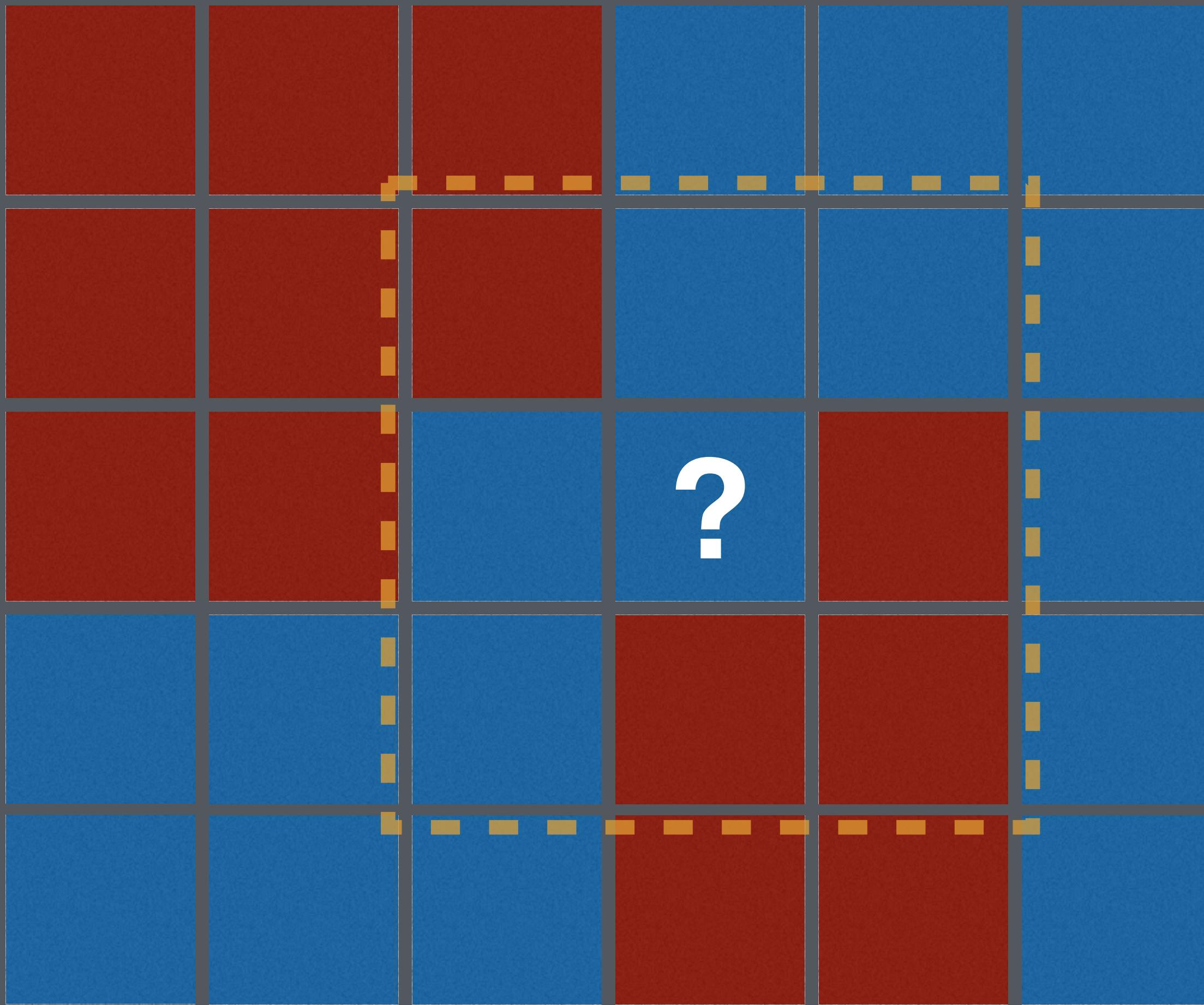
2D Caves using cellular automata.

Cellular automata.

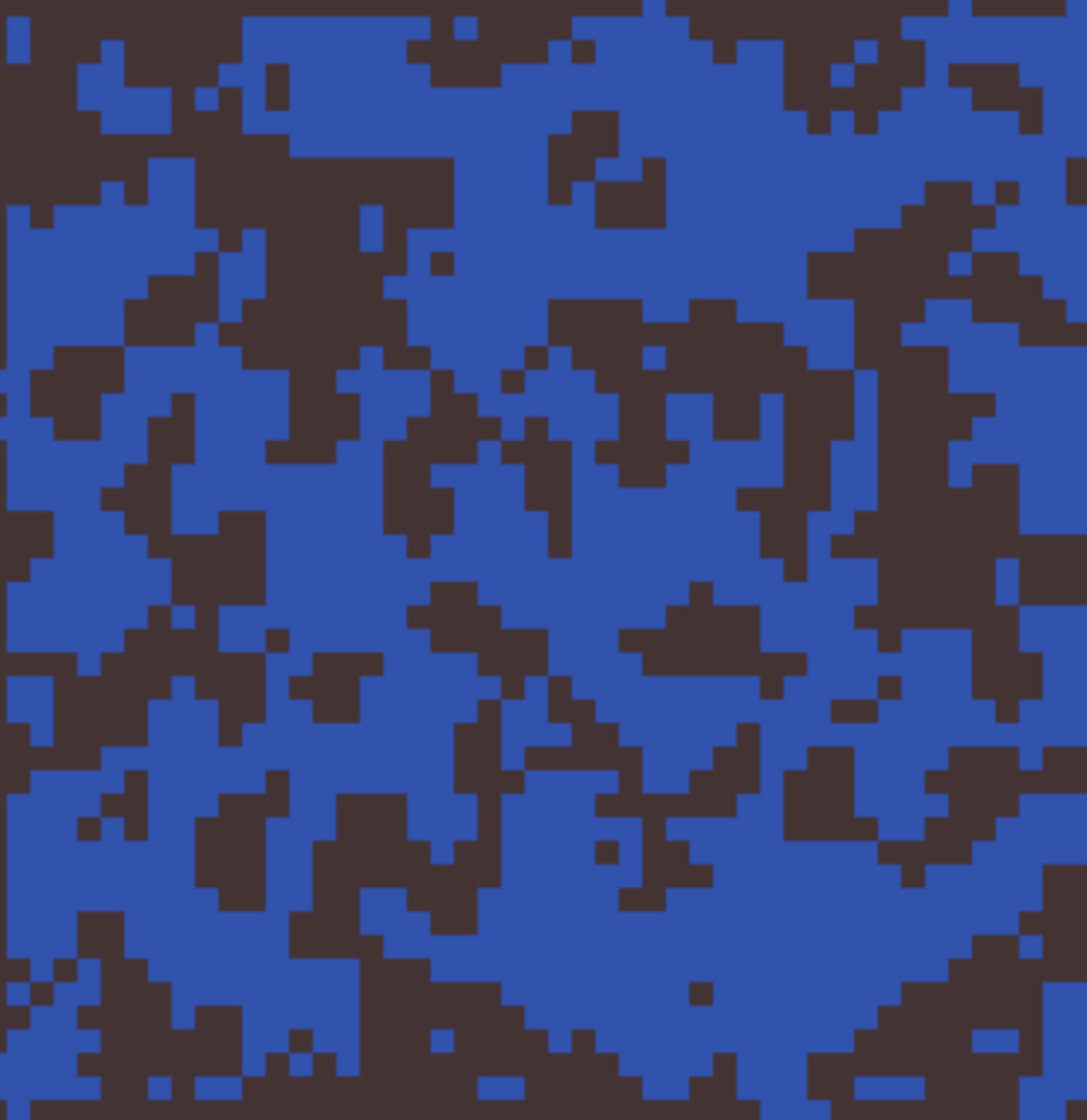




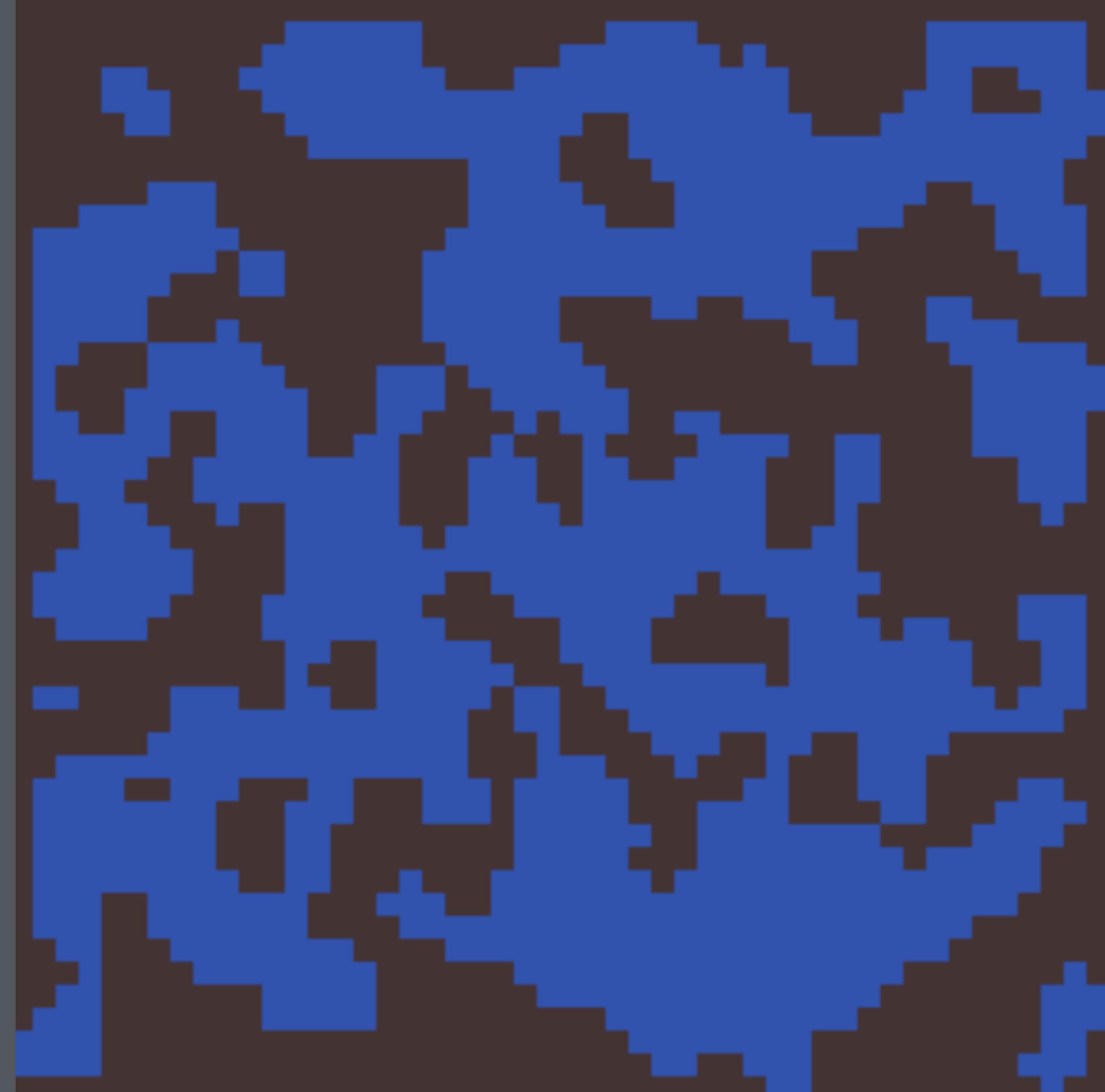
Fill tile map randomly.
(50% chance solid)



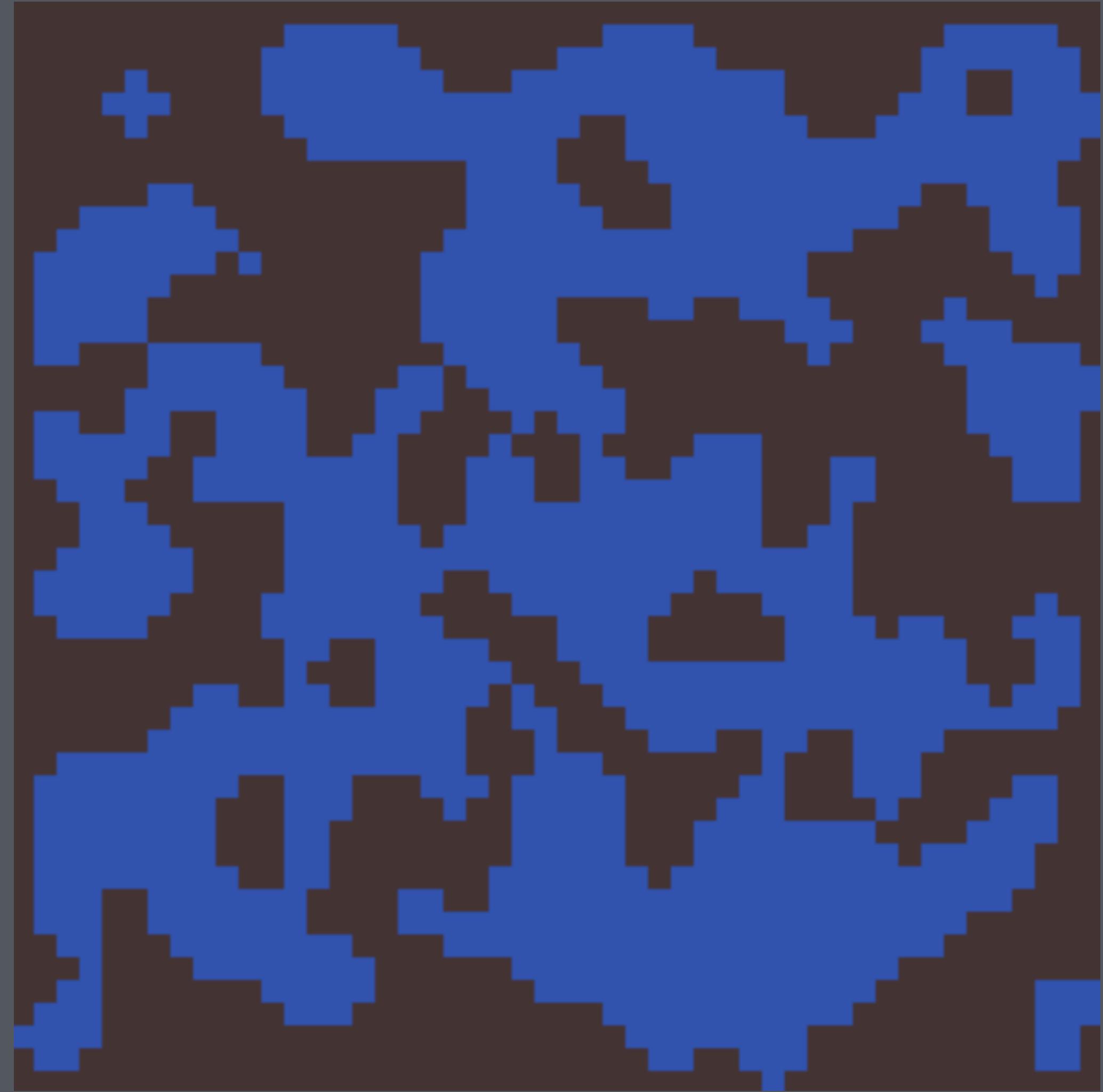
For every tile, count all of its neighbors, and if count is larger or lower than a certain threshold, create a new tile or kill the existing one.



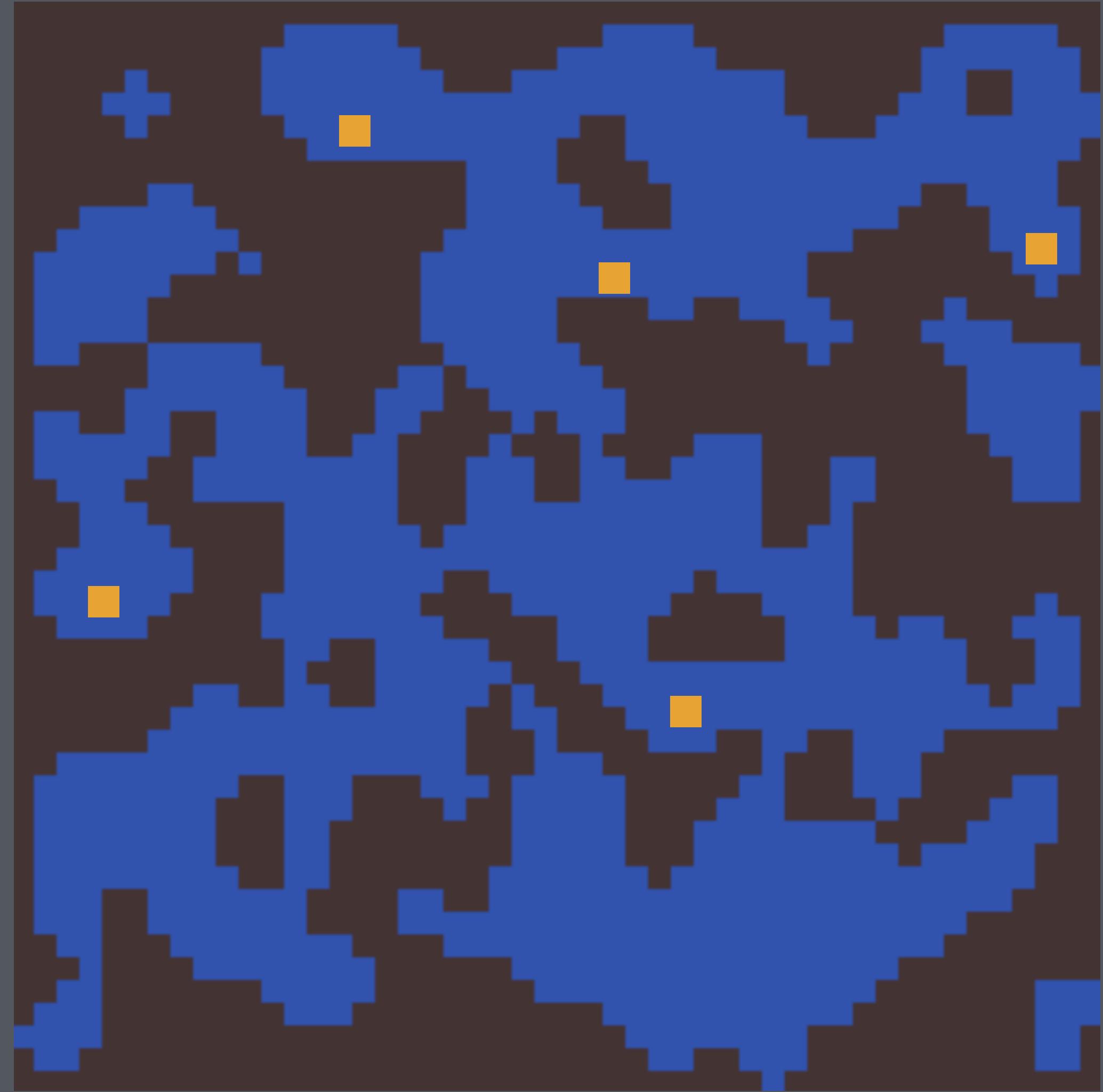
Do this for the entire tile map



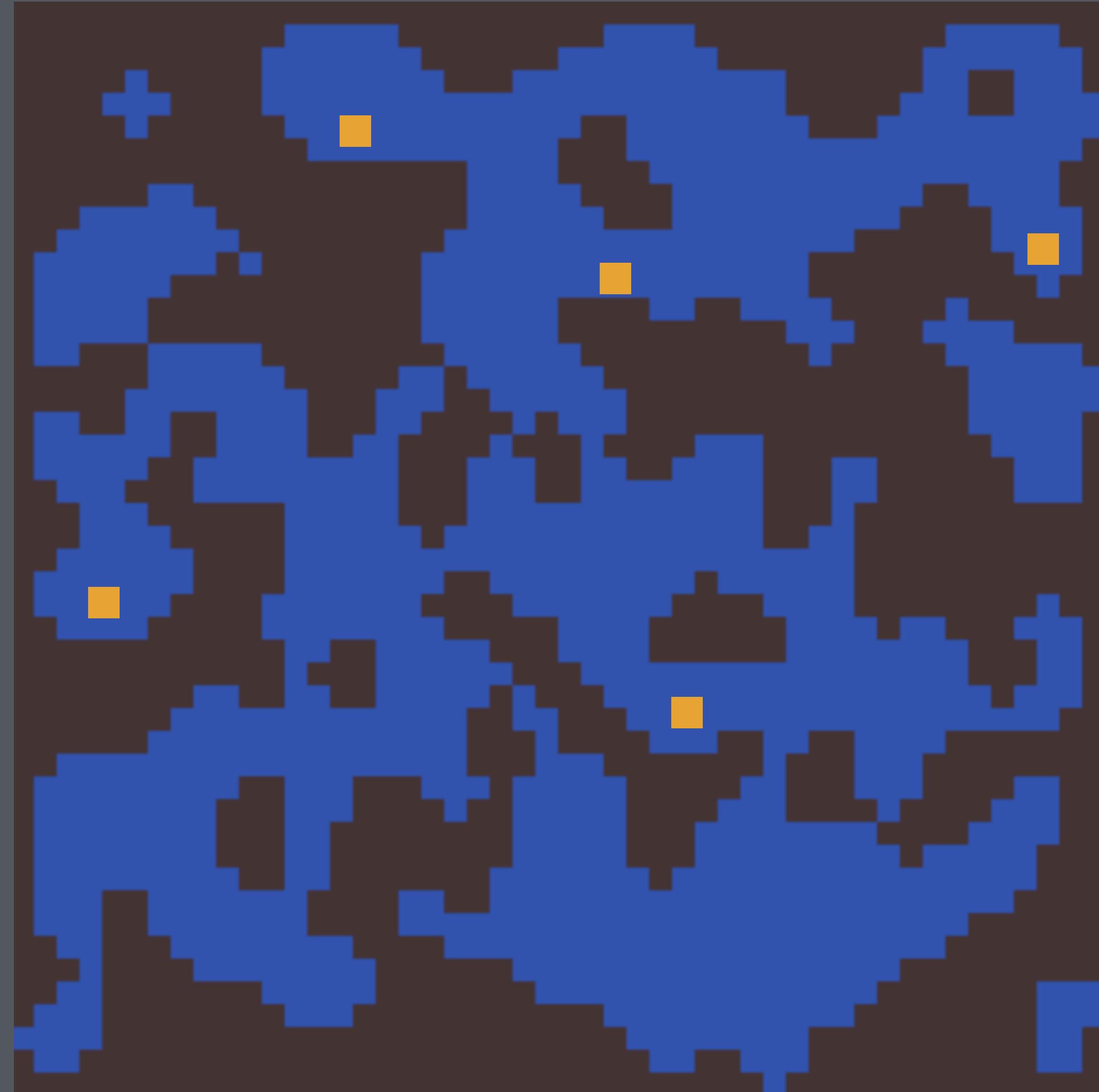
Repeat again.



And again.



Place entities.



Procedural generation!

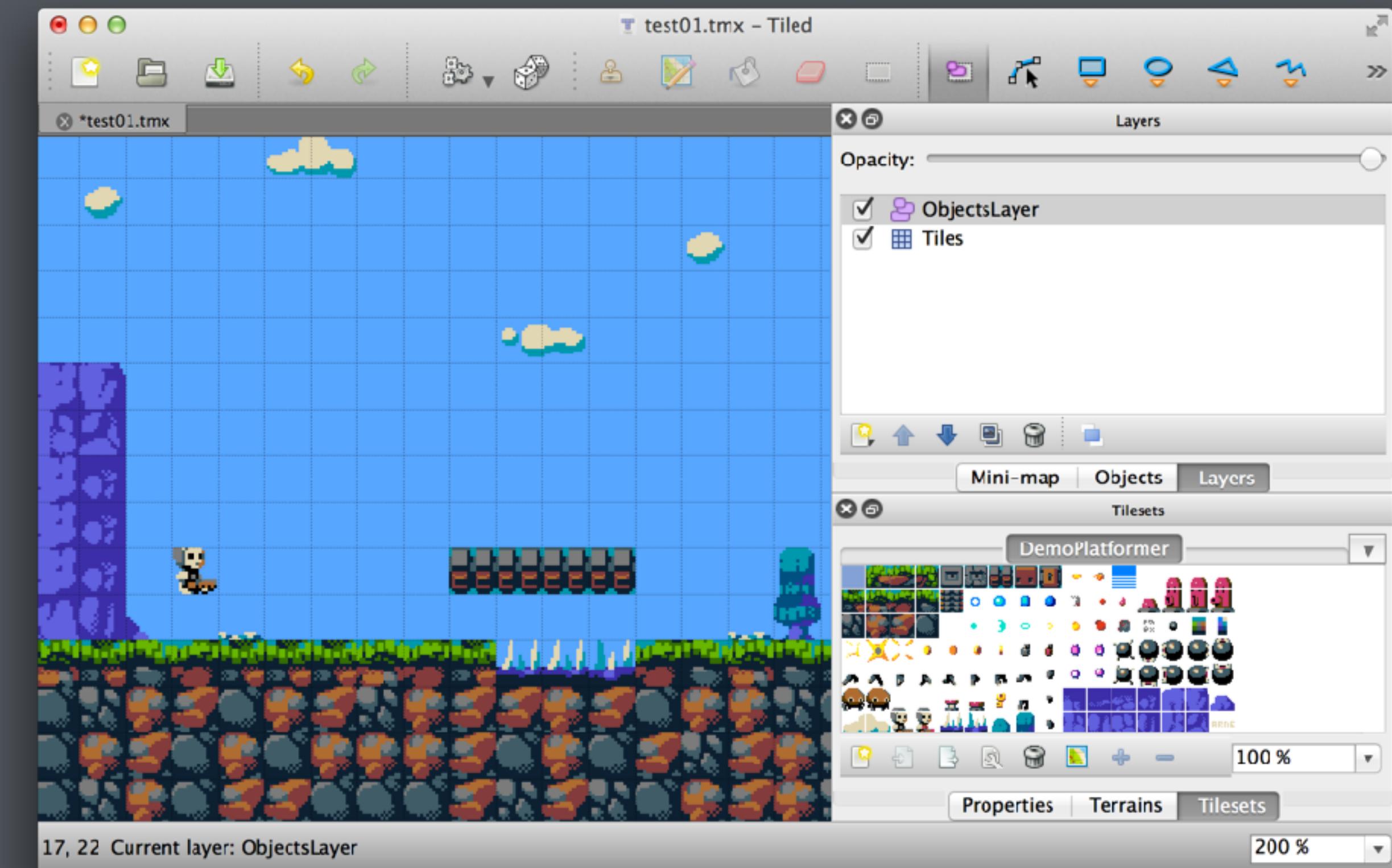


Generate Random Cave Levels Using Cellular Automata

<http://gamedevelopment.tutsplus.com/tutorials/generate-random-cave-levels-using-cellular-automata--gamedev-9664>

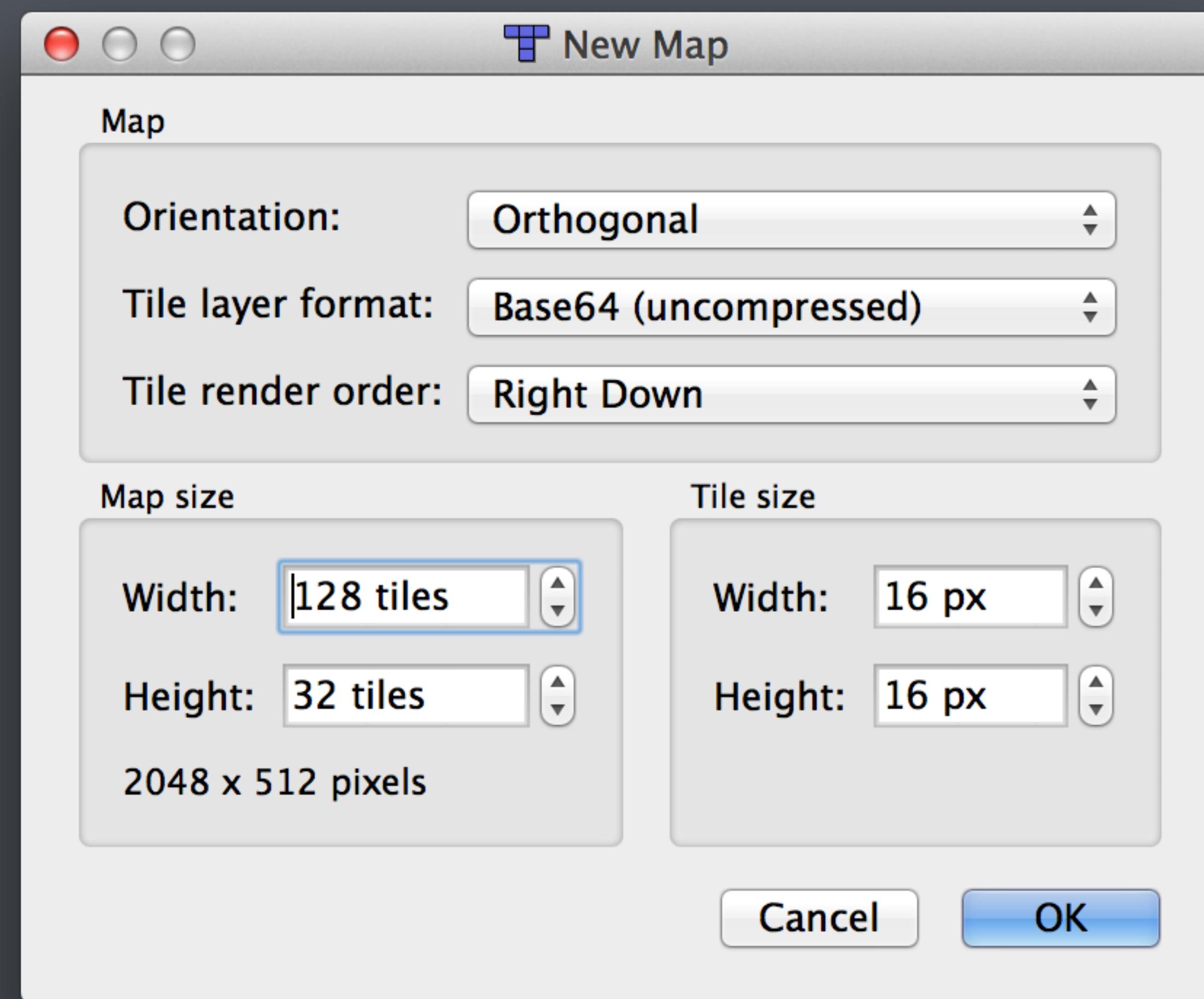
Using a map editor.

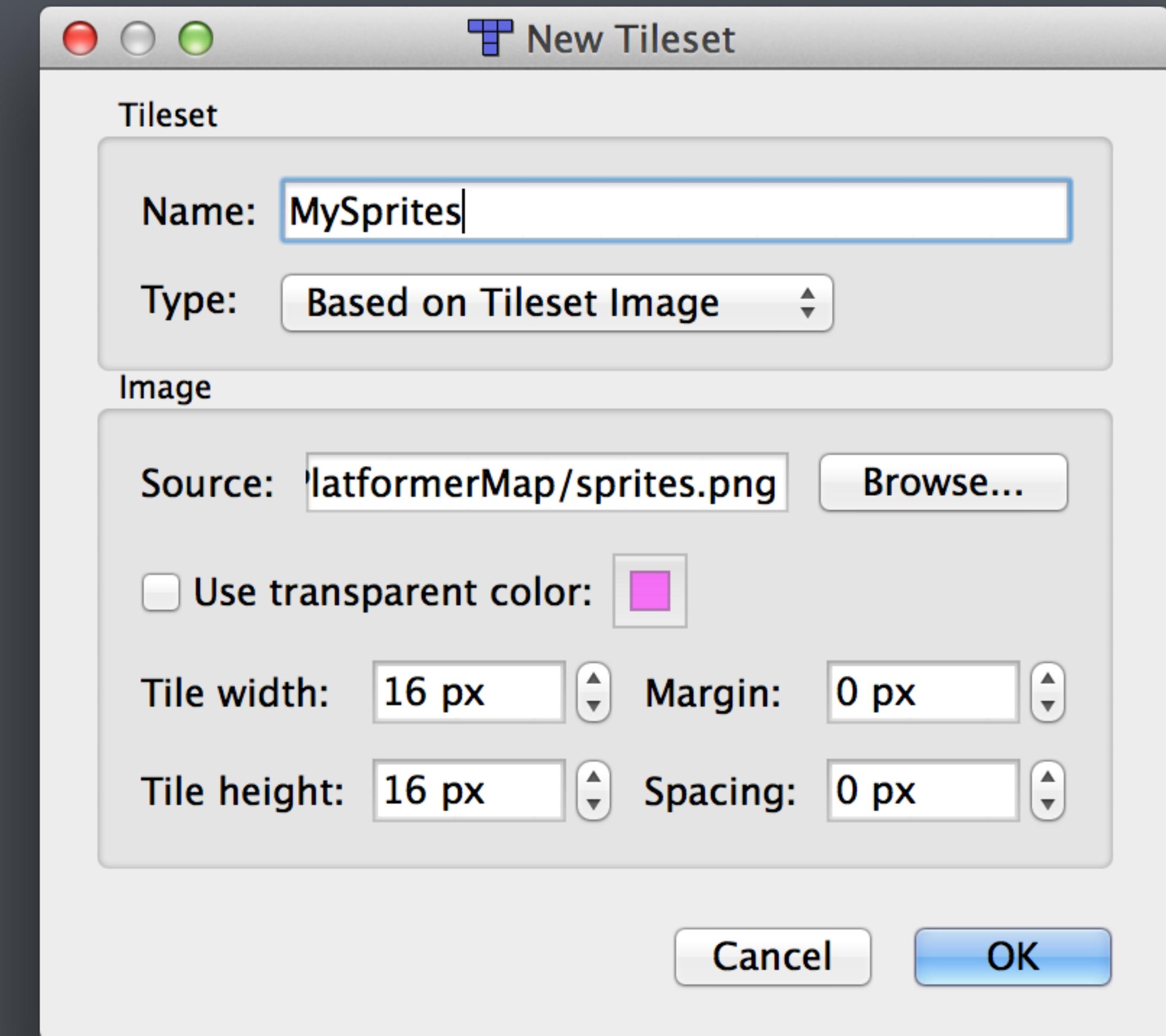
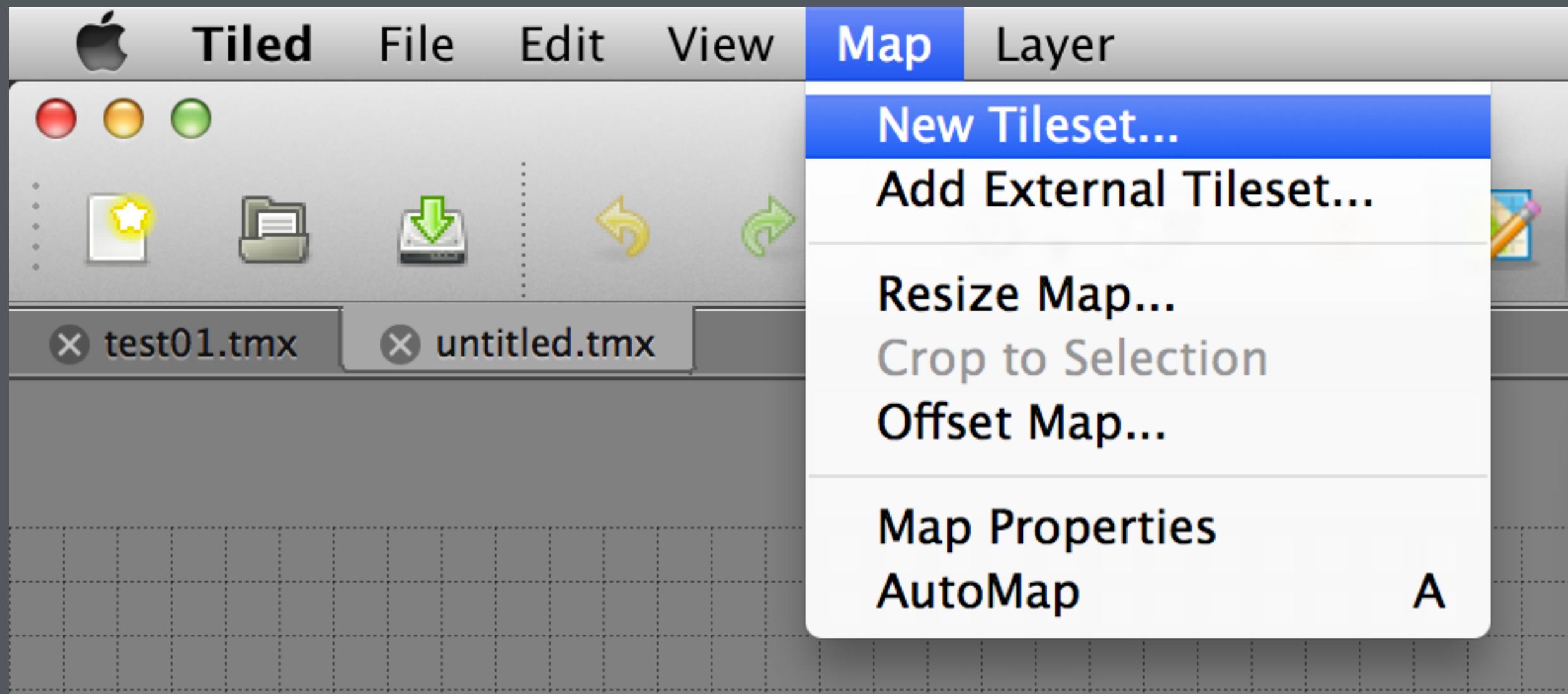
tiled



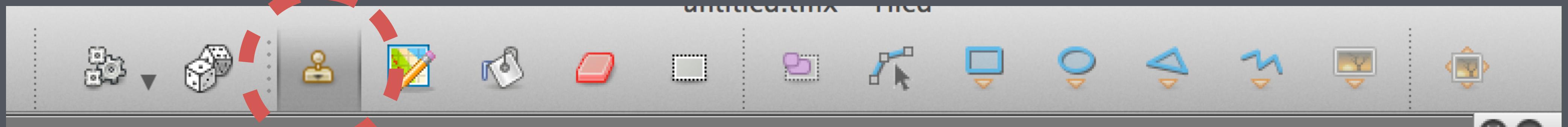
<http://www.mapeditor.org/>

Building a level with Tiled.

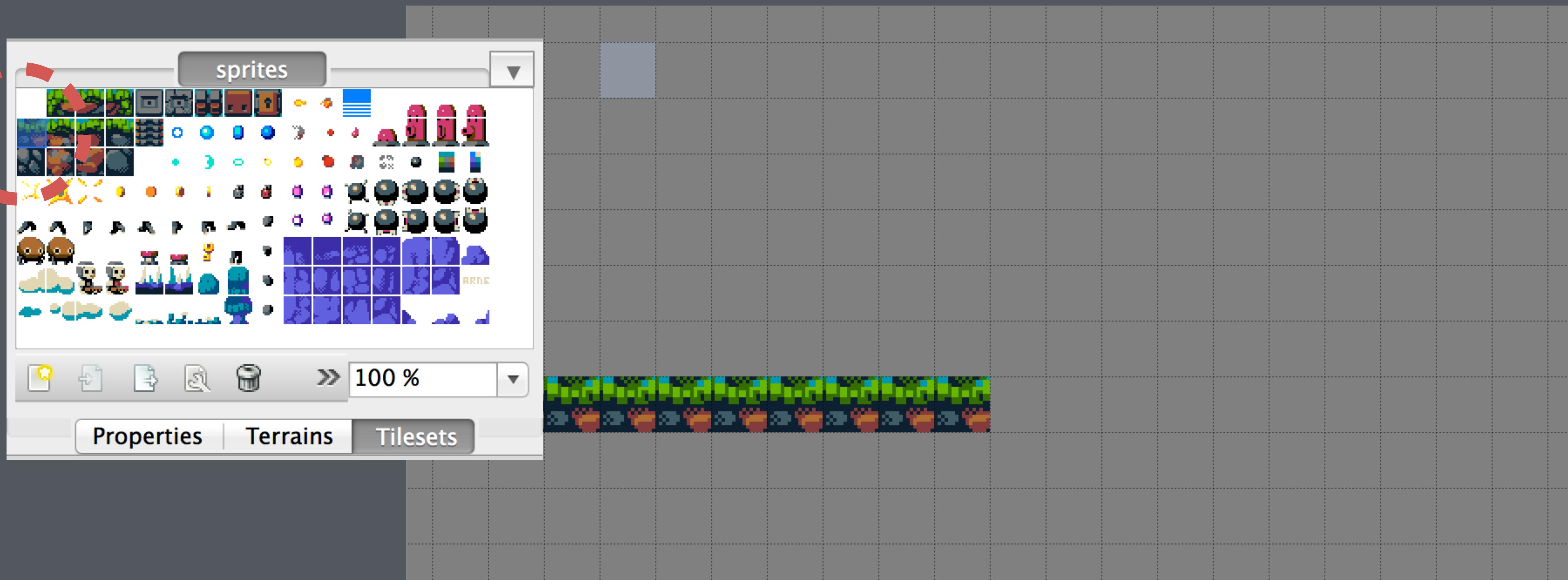




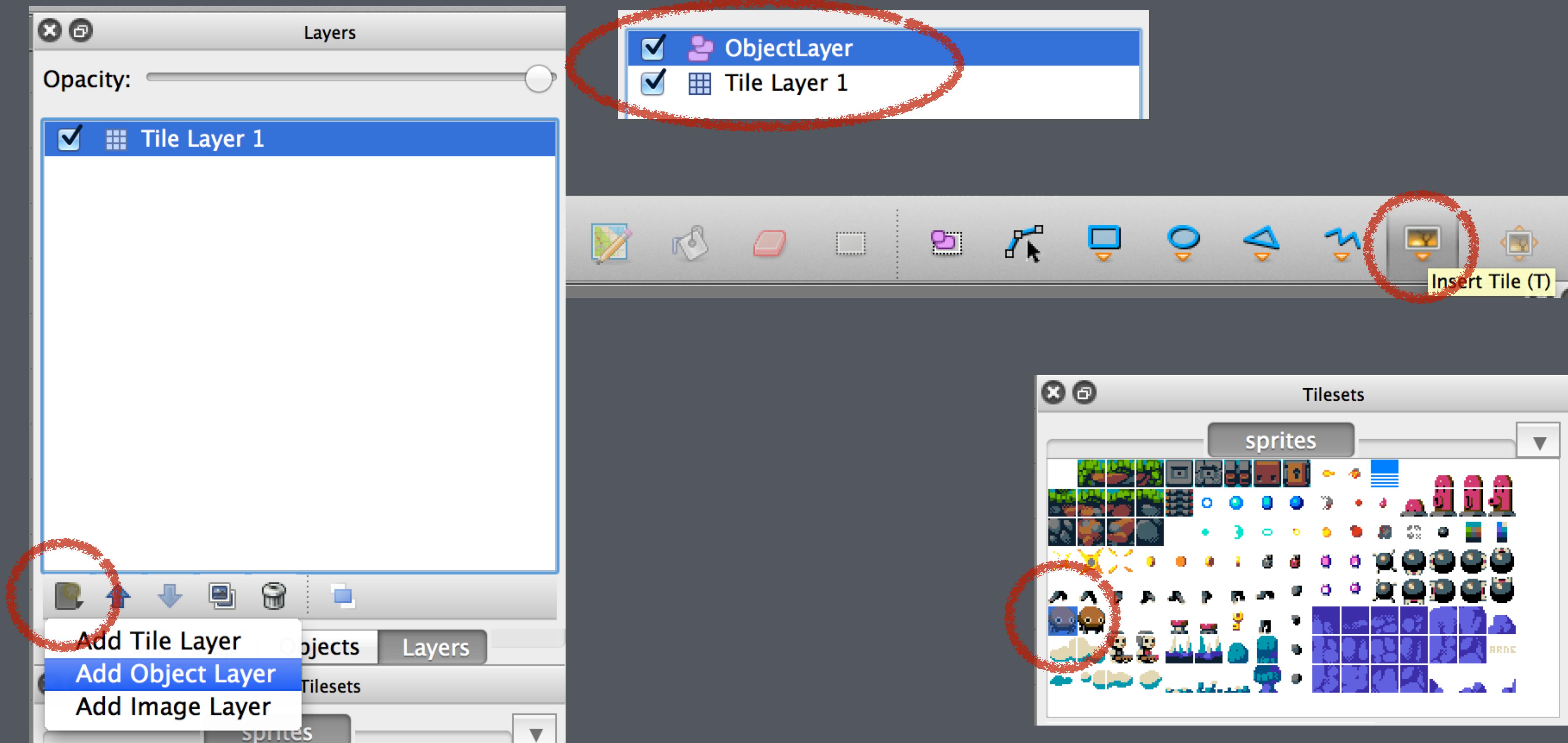
Drawing tiles



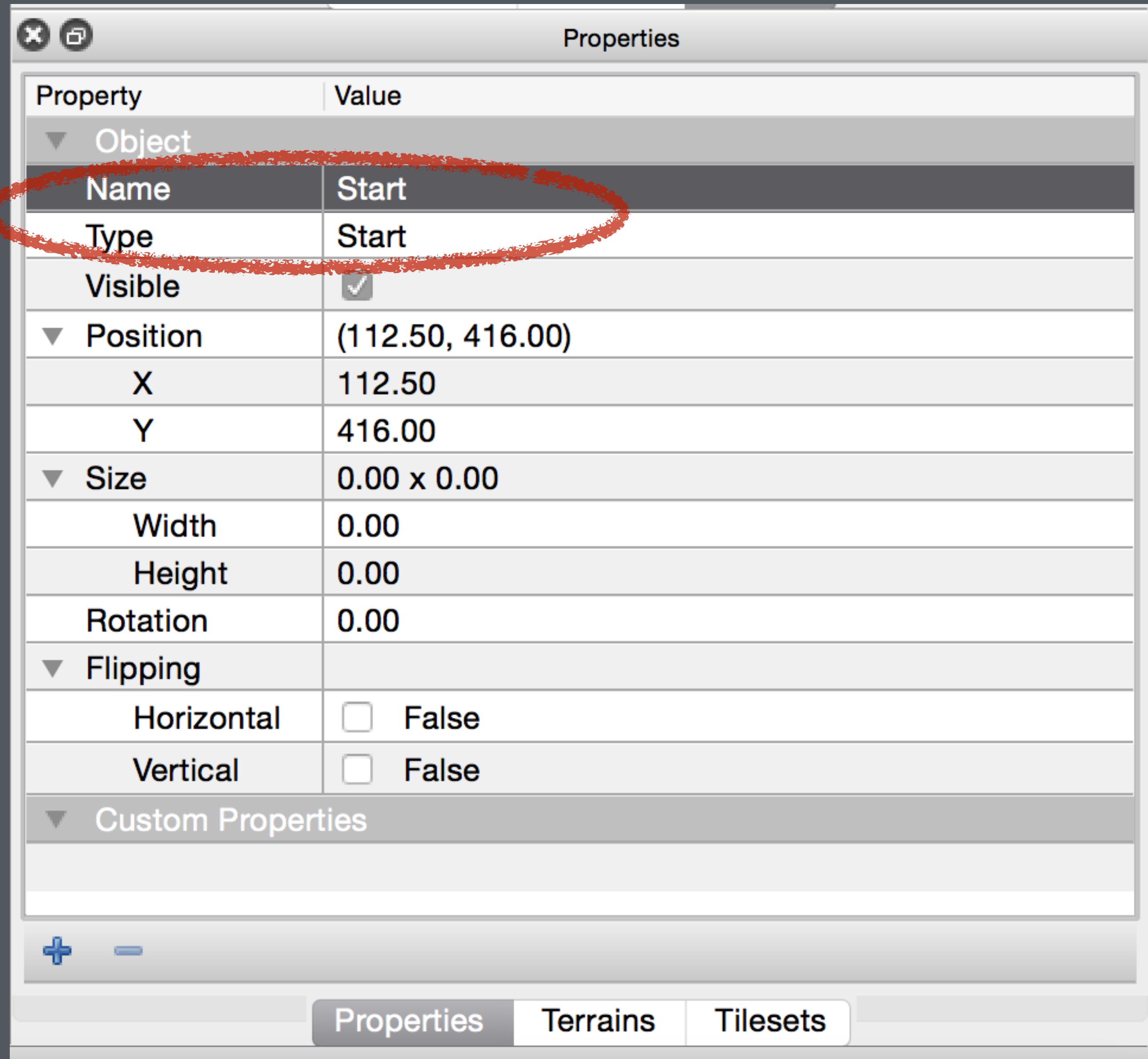
untitled.tmx File



Placing entities.

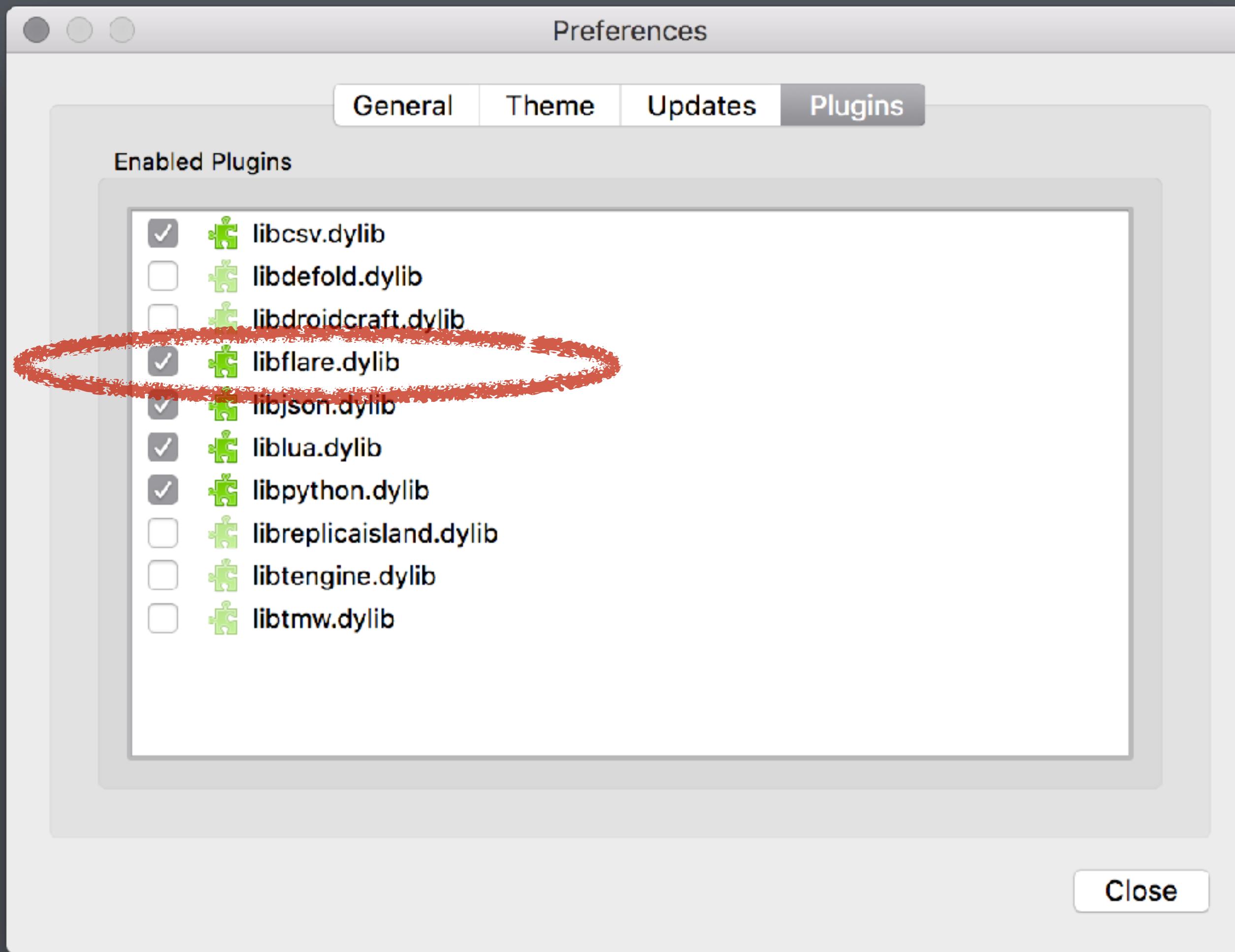


Make sure you
fill in the Name
and Type fields.

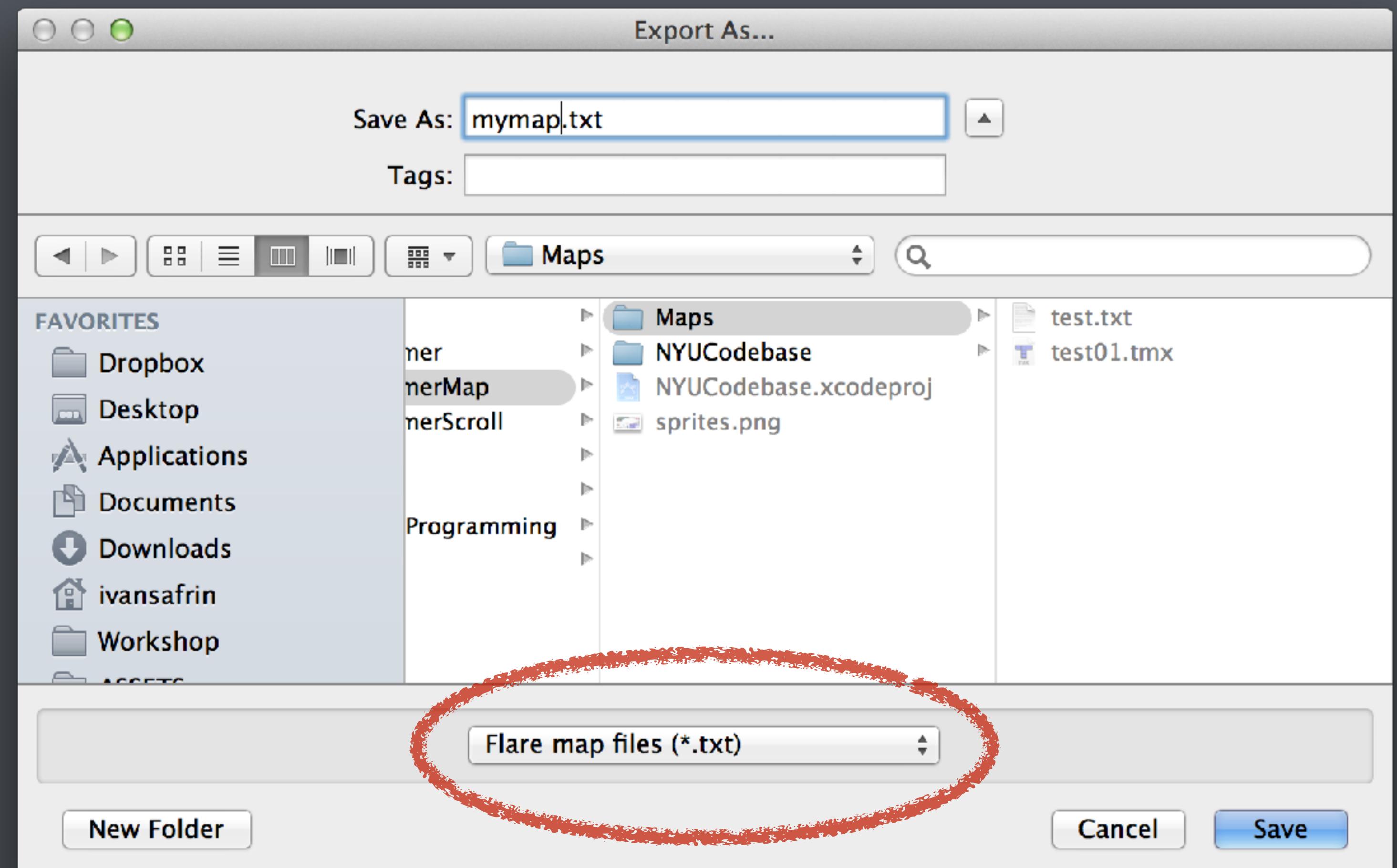
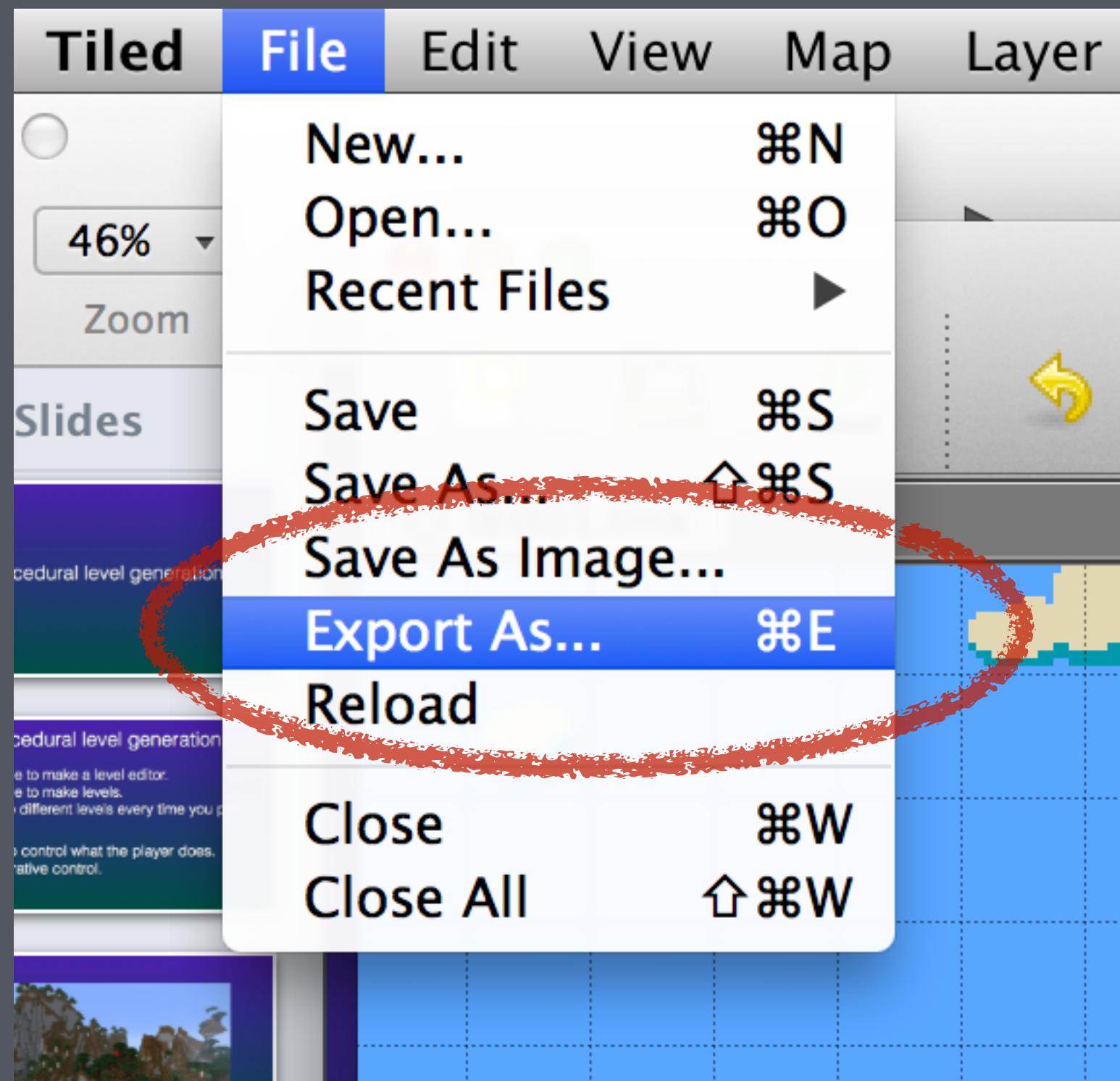


Loading Tiled levels in your game.

Export as Flare map file.



Export as Flare map file.



This is what it looks like

Parsing text from a file.

What we'll need...

```
#include <fstream>
#include <string>
#include <iostream>
#include <sstream>

using namespace std;
```

Reading a file **line by line**...

```
ifstream infile("file.txt");
string line;
while (getline(infile, line)) {
    // handle line
}
```

```
ifstream infile(levelFile);
string line;
while (getline(infile, line)) {

    if(line == "[header]") {
        if(!readHeader(infile)) {
            return;
        }
    } else if(line == "[layer]") {
        readLayerData(infile);
    } else if(line == "[ObjectsLayer]") {
        readEntityData(infile);
    }

}
```

```
[header]
width=128
height=32
tilewidth=16
tileheight=16

[layer]
type=Tiles
data=
17,0,0,0,0,0,0

[ObjectsLayer]
# Start
type=Start
location=11,41,0,0

[ObjectsLayer]
# Enemy1
type=Enemy
location=42,40,0,0
```

Keep in mind that **ObjectsLayer** is the name of our object layer in the editor, so you should check for whatever you named your object layer.

Reading the header.

Reading the **key=value** pairs.

```
istringstream sStream(line);
string key,value;
getline(sStream, key, '=');
getline(sStream, value);
```

Converting string to integer.

```
int intValue = atoi(value.c_str());
```

```

bool readHeader(std::ifstream &stream) {
    string line;
    mapWidth = -1;
    mapHeight = -1;
    while(getline(stream, line)) {
        if(line == "") { break; }

        istringstream sStream(line);
        string key,value;
        getline(sStream, key, '=');
        getline(sStream, value);

        if(key == "width") {
            mapWidth = atoi(value.c_str());
        } else if(key == "height"){
            mapHeight = atoi(value.c_str());
        }
    }

    if(mapWidth == -1 || mapHeight == -1) {
        return false;
    } else { // allocate our map data
        levelData = new unsigned char*[mapHeight];
        for(int i = 0; i < mapHeight; ++i) {
            levelData[i] = new unsigned char[mapWidth];
        }
    }
    return true;
}

```

[header]
width=128
height=32
tilewidth=16
tileheight=16

[layer]
type=Tiles
data=
17,0,0,0,0,0,0

[ObjectsLayer]
Start
type=Start
location=11,41,0,0

[ObjectsLayer]
Enemy1
type=Enemy
location=42,40,0,0

Reading the **tile** data.

```

bool readLayerData(std::ifstream &stream) {
    string line;
    while(getline(stream, line)) {
        if(line == "") { break; }
        istringstream sStream(line);
        string key,value;
        getline(sStream, key, '=');
        getline(sStream, value);
        if(key == "data") {
            for(int y=0; y < mapHeight; y++) {
                getline(stream, line);
                istringstream lineStream(line);
                string tile;

                for(int x=0; x < mapWidth; x++) {
                    getline(lineStream, tile, ',');
                    unsigned char val = (unsigned char)atoi(tile.c_str());
                    if(val > 0) {
                        // be careful, the tiles in this format are indexed from 1 not 0
                        levelData[y][x] = val-1;
                    } else {
                        levelData[y][x] = 0;
                    }
                }
            }
        }
    }
    return true;
}

```

[header]
width=128
height=32
tilewidth=16
tileheight=16

[layer]
type=Tiles
data=
17,0,0,0,0,0,0
0,0,0,0,0,0

[ObjectsLayer]
Start
type=Start
location=11,41,0,0

[ObjectsLayer]
Enemy1
type=Enemy
location=42,40,0,0

Reading the entity data.

```

bool readEntityData(std::ifstream &stream) {
    string line;
    string type;

    while(getline(stream, line)) {
        if(line == "") { break; }

        istringstream sStream(line);
        string key,value;
        getline(sStream, key, '=');
        getline(sStream, value);

        if(key == "type") {
            type = value;
        } else if(key == "location") {

            istringstream lineStream(value);
            string xPosition, yPosition;
            getline(lineStream, xPosition, ',' );
            getline(lineStream, yPosition, ',' );

            float placeX = atoi(xPosition.c_str())*TILE_SIZE;
            float placeY = atoi(yPosition.c_str())*-TILE_SIZE;

            placeEntity(type, placeX, placeY);
        }
    }
    return true;
}

```

[header]
width=128
height=32
tilewidth=16
tileheight=16

[layer]
type=Tiles
data=
17,0,0,0,0,0,0
0,0,0,0,0,0

[ObjectsLayer]
Start
type=Start
location=11,41,0,0

[ObjectsLayer]
Enemy1
type=Enemy
location=42,40,0,0

placeEntity is a function that you implement
that places the entity at the position.

Assignment.

- Make a simple scrolling platformer game demo.
- It must use a tilemap or static/dynamic entities.
- Must have a controllable player character that interacts with at least one other dynamic entity (enemy or item)
- It must scroll to follow your player with the camera.
- You have two weeks.