Creating worlds.

Part 2

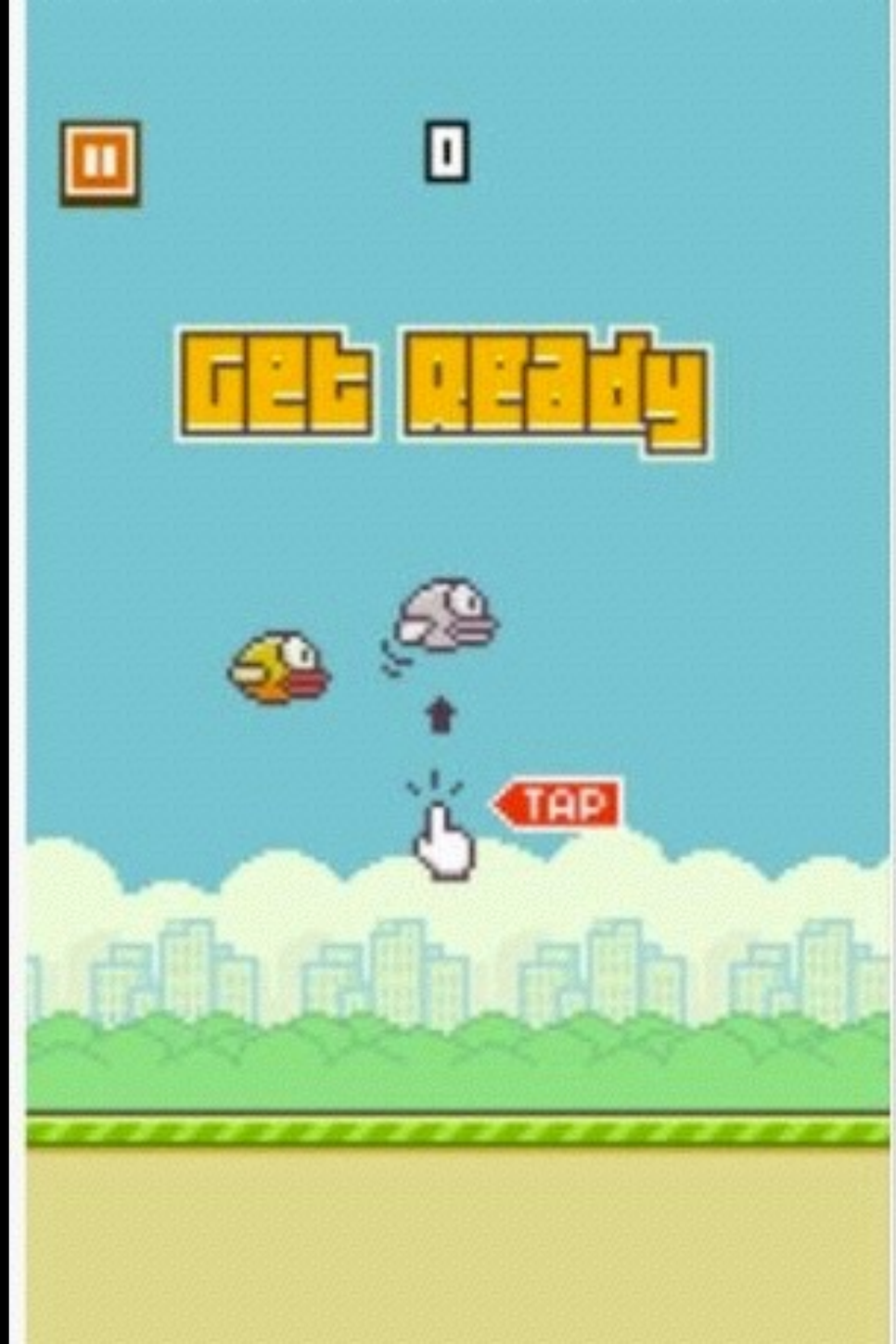
Creating **levels**.

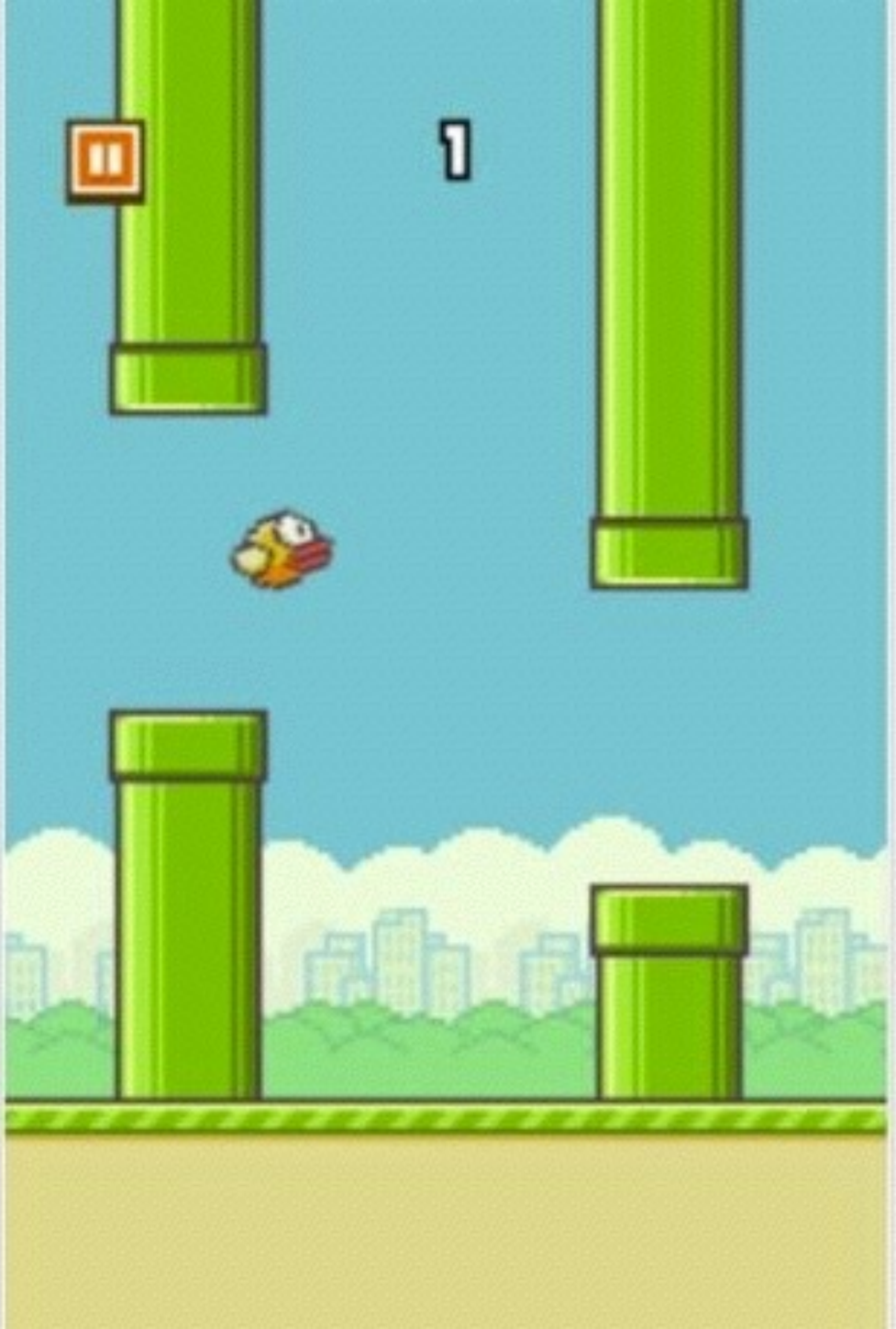
Procedural level generation.

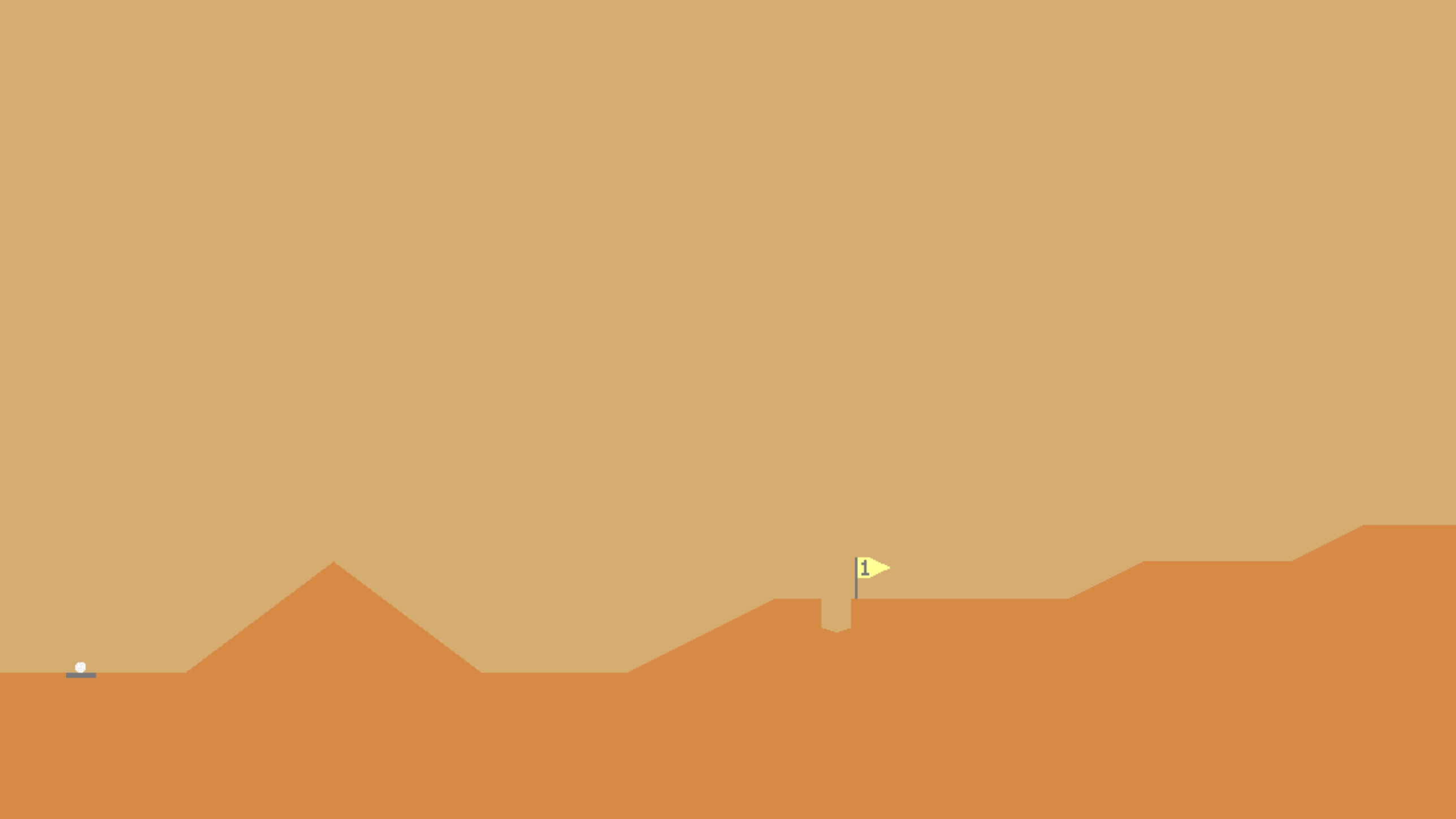

Terraria


1
4
4
0

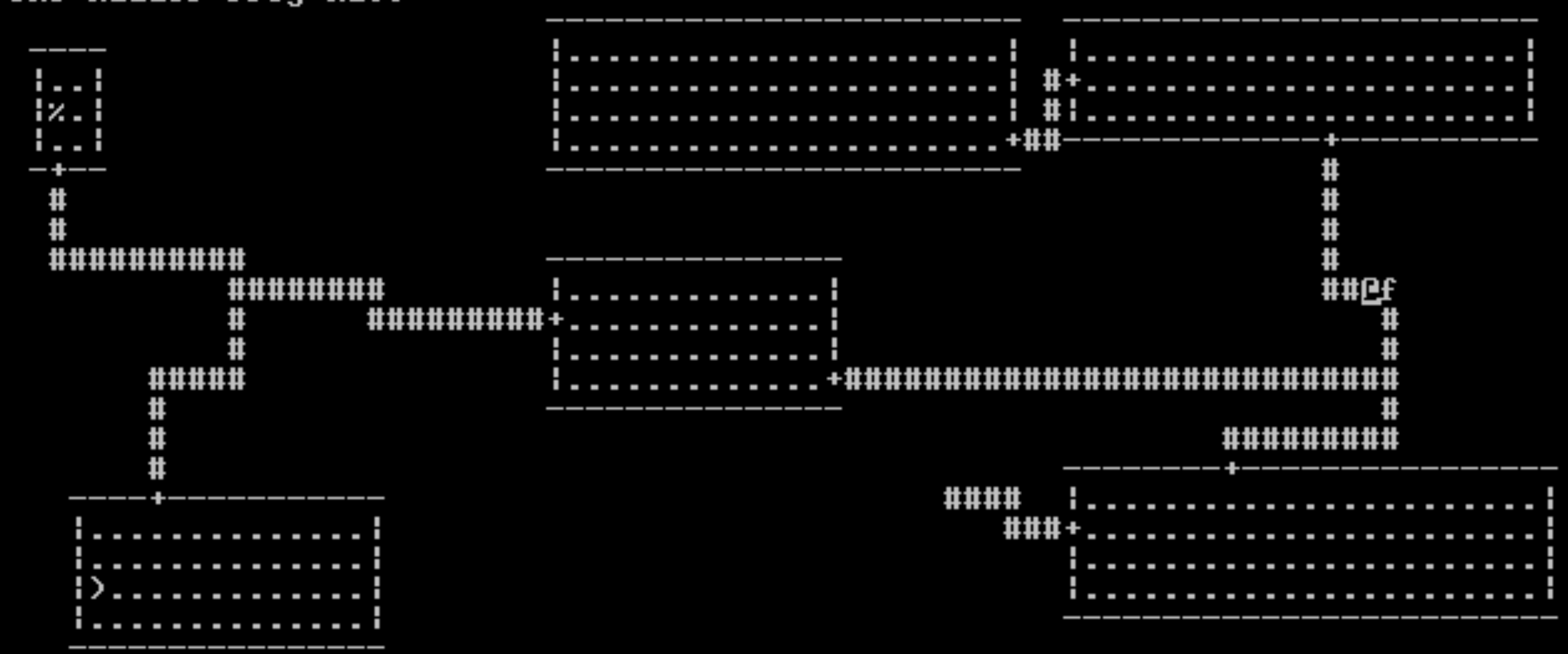

151m


0
Get Ready
TAP


1


1

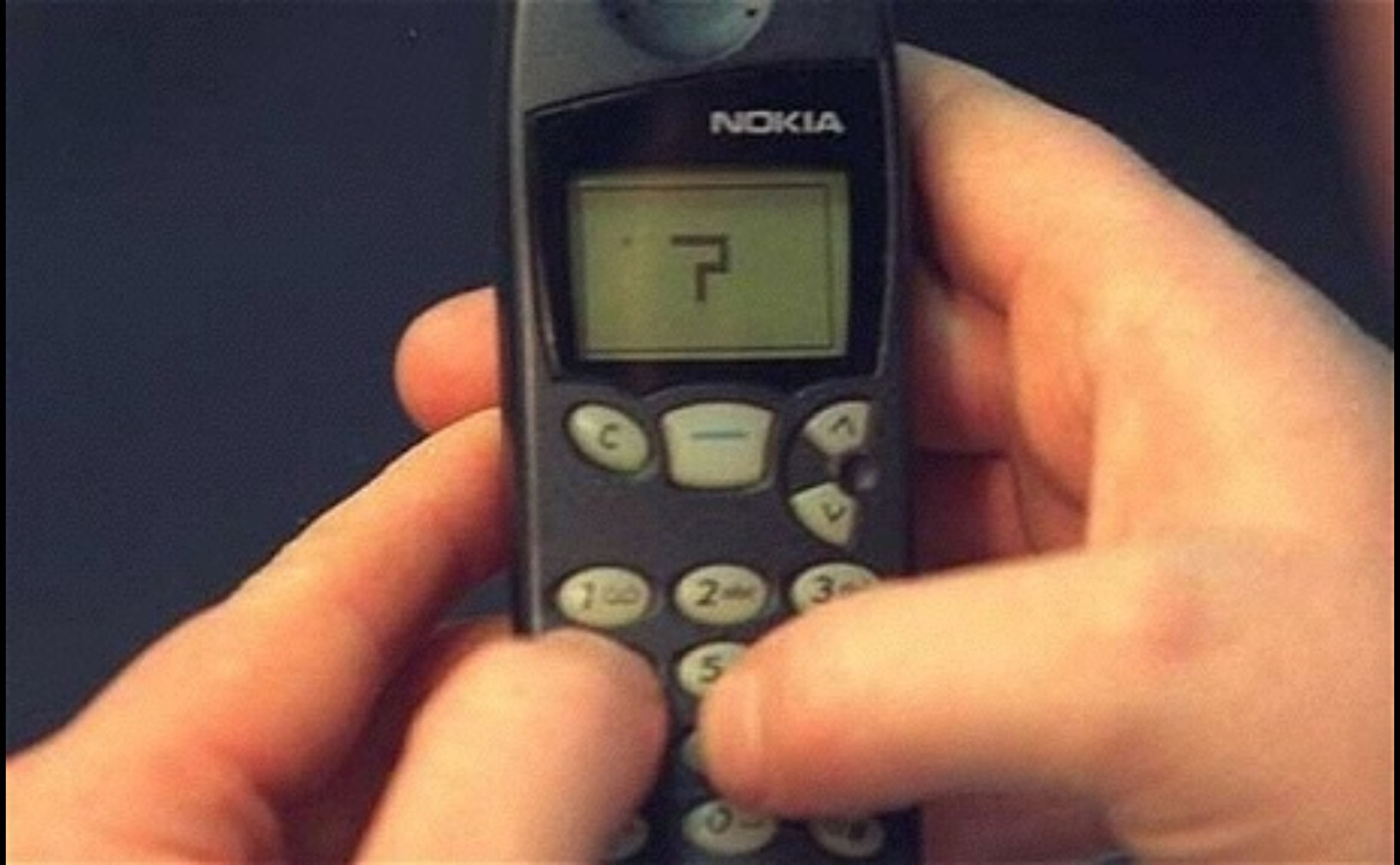
The killer frog hit.

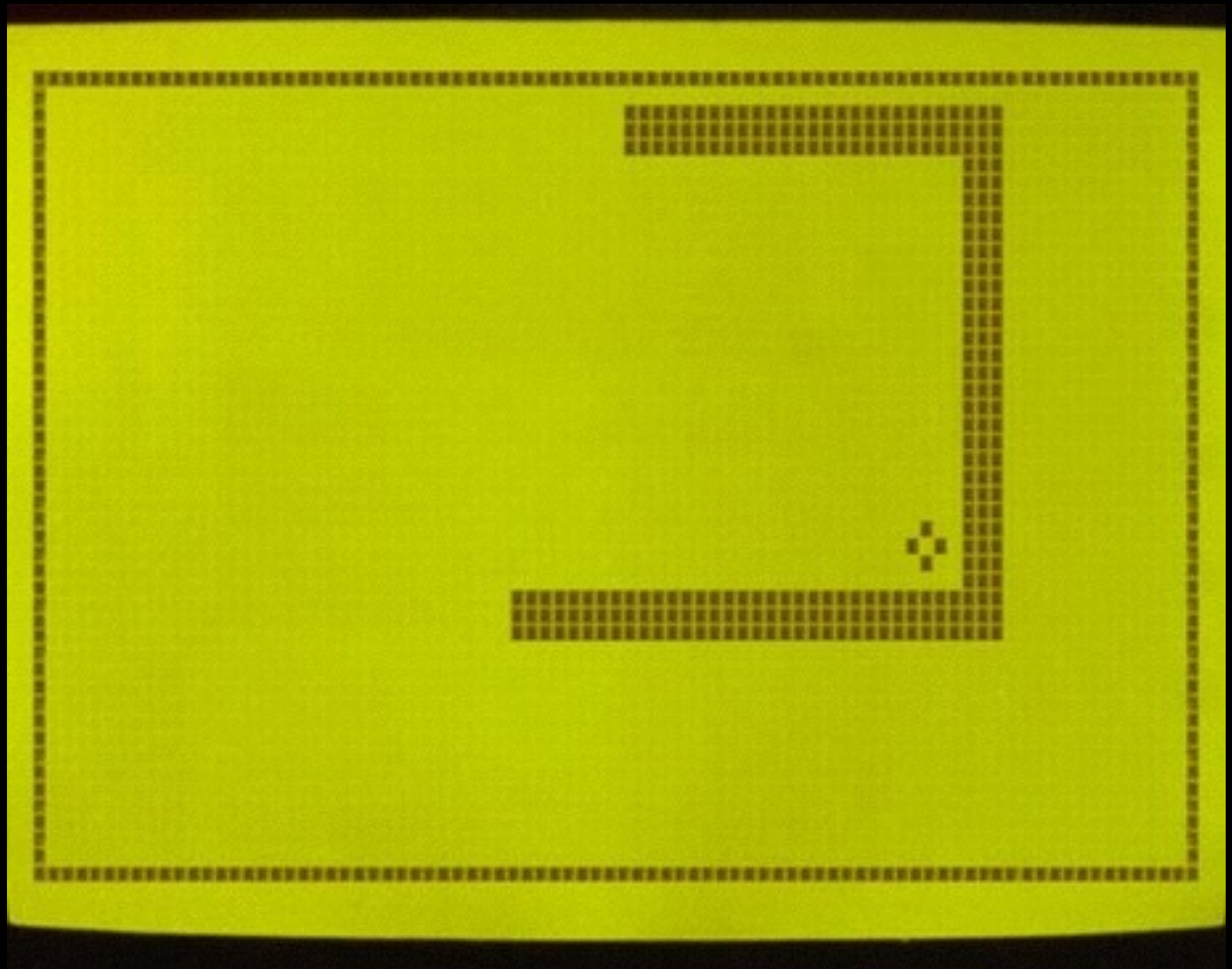


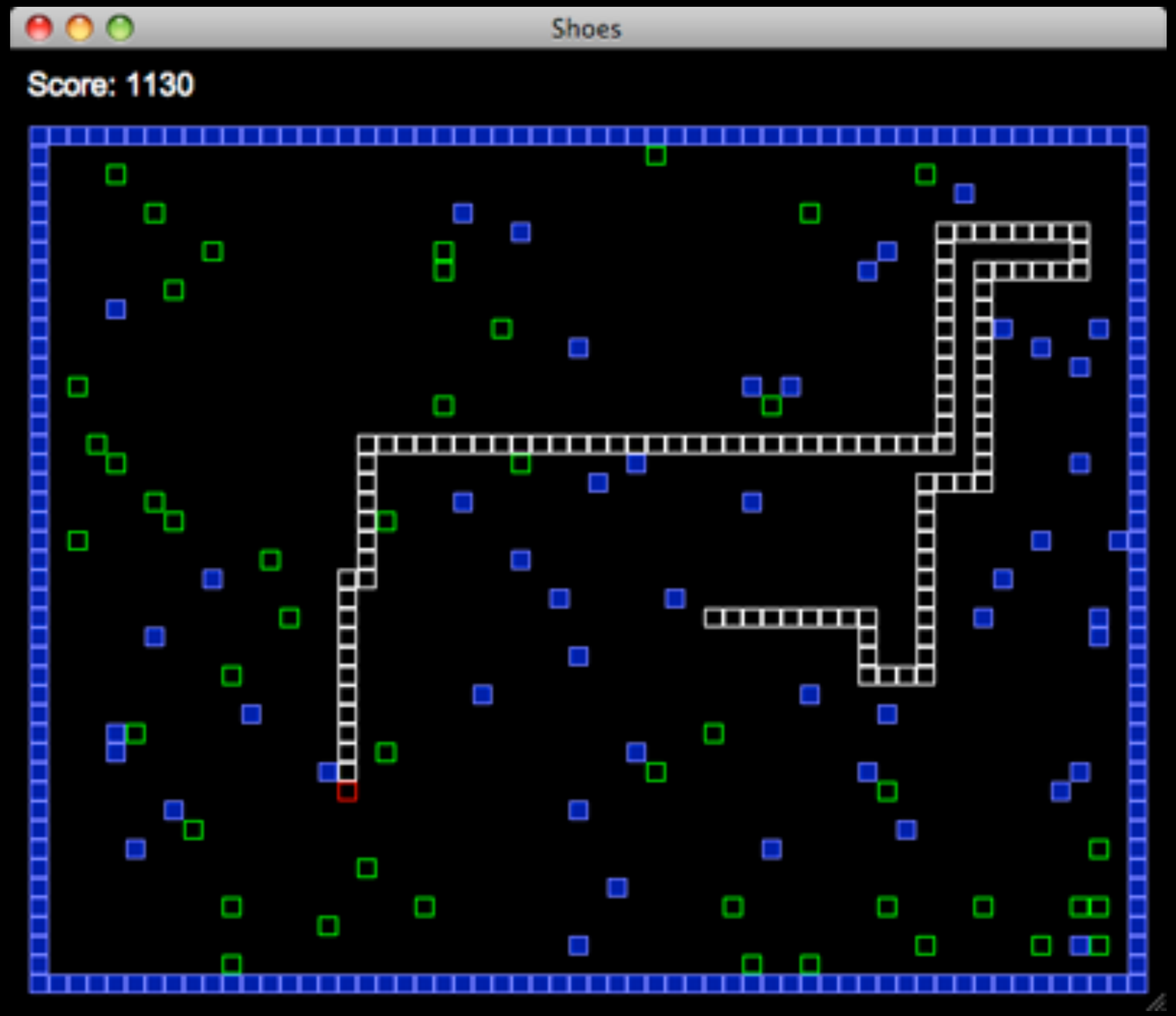
Level: 3 Gold: 496 Hp: 32(37) Ac: 1   Exp: 4/47 Vol: 65%
Str: 11(11) Dex: 14(14) Wis: 12(12) Con: 18(18) Carry: 54(150)

An overview of procedural generation **examples.**

Snake.

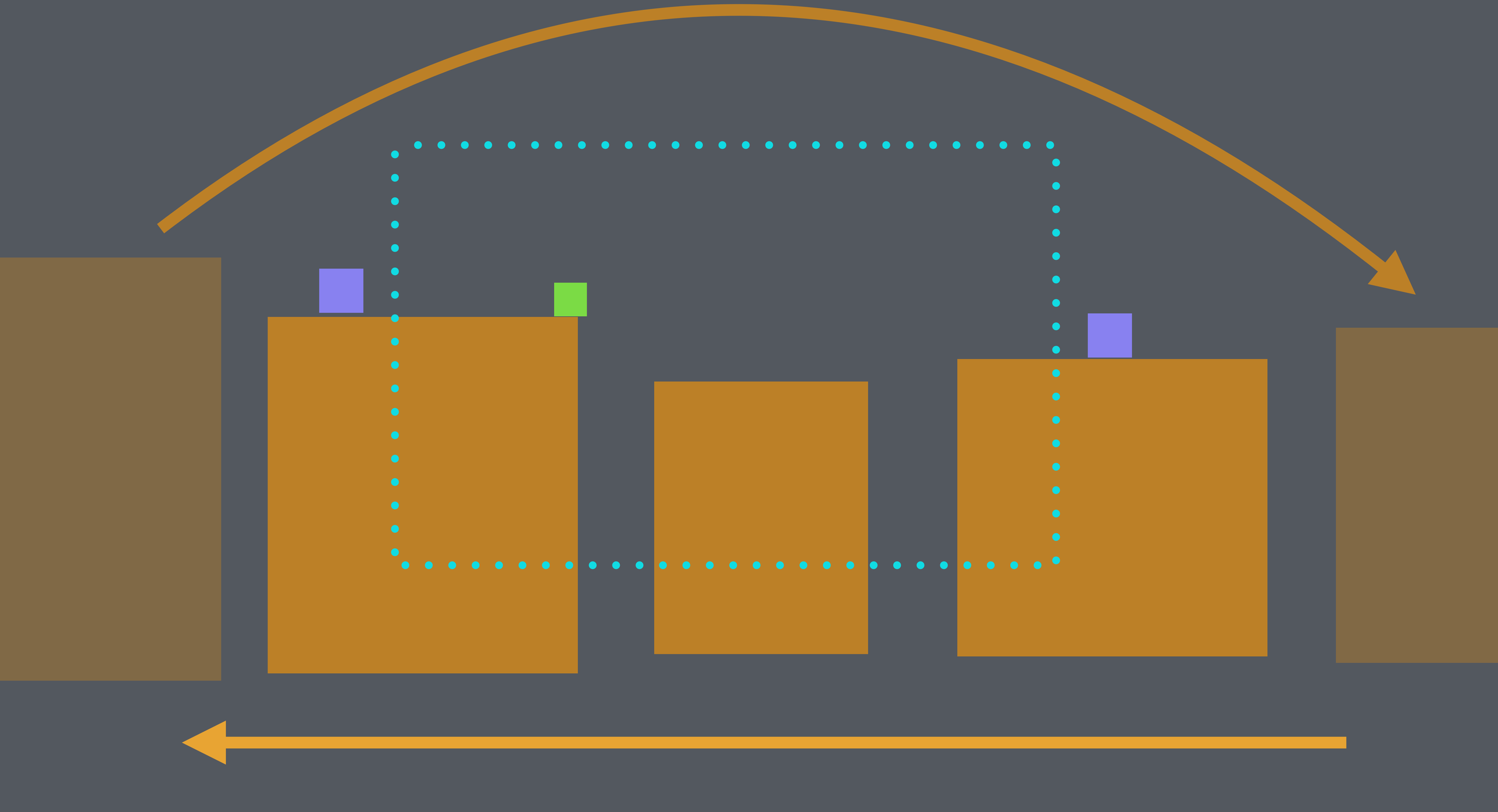

NOKIA




Shoes
Score: 1130

Canabalt.


151m

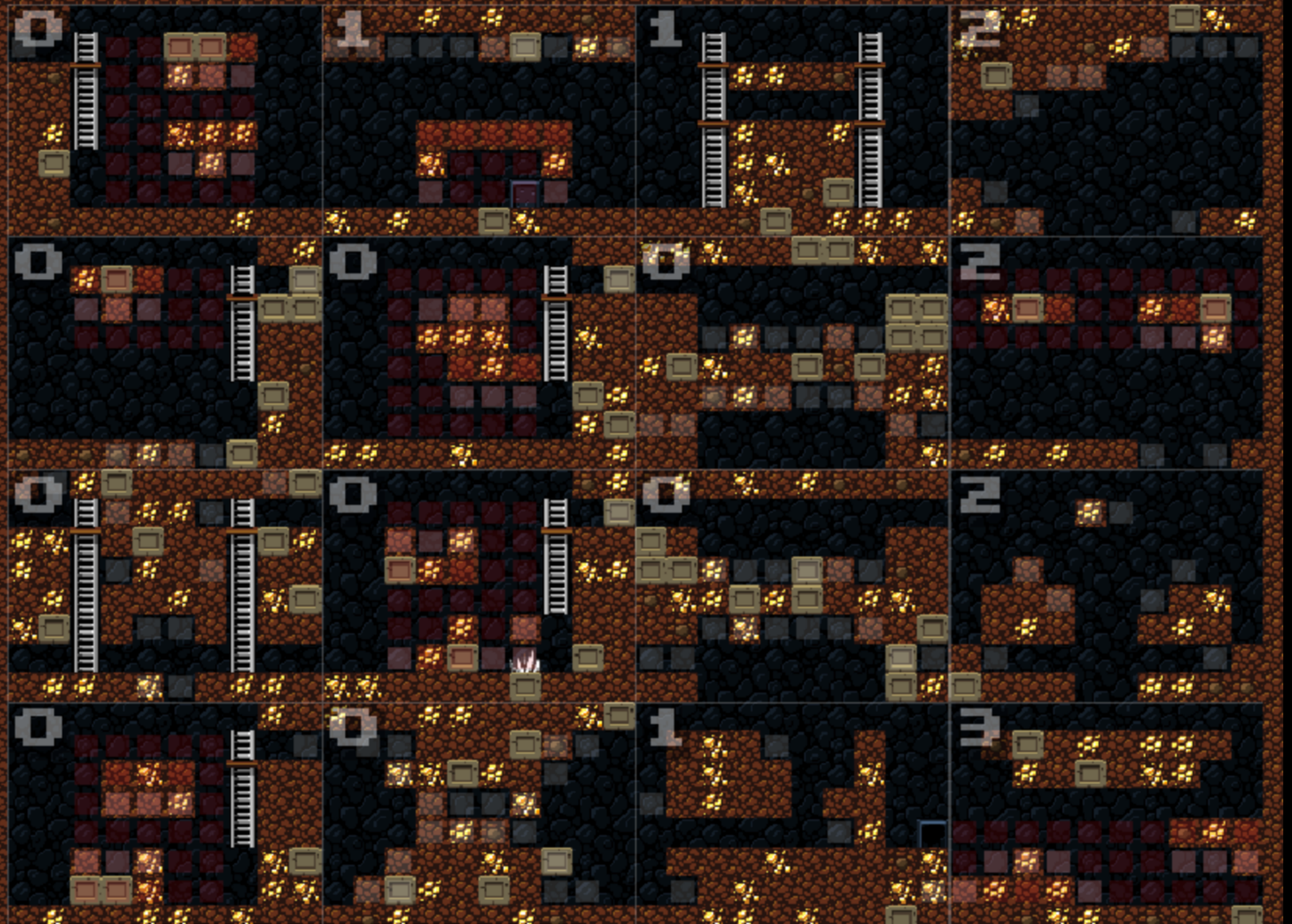


Tuning Canabalt

http://www.gamasutra.com/blogs/AdamSaltsman/20100929/88155/Tuning_Canabalt.php

Spelunky.


1
4
4
$
0

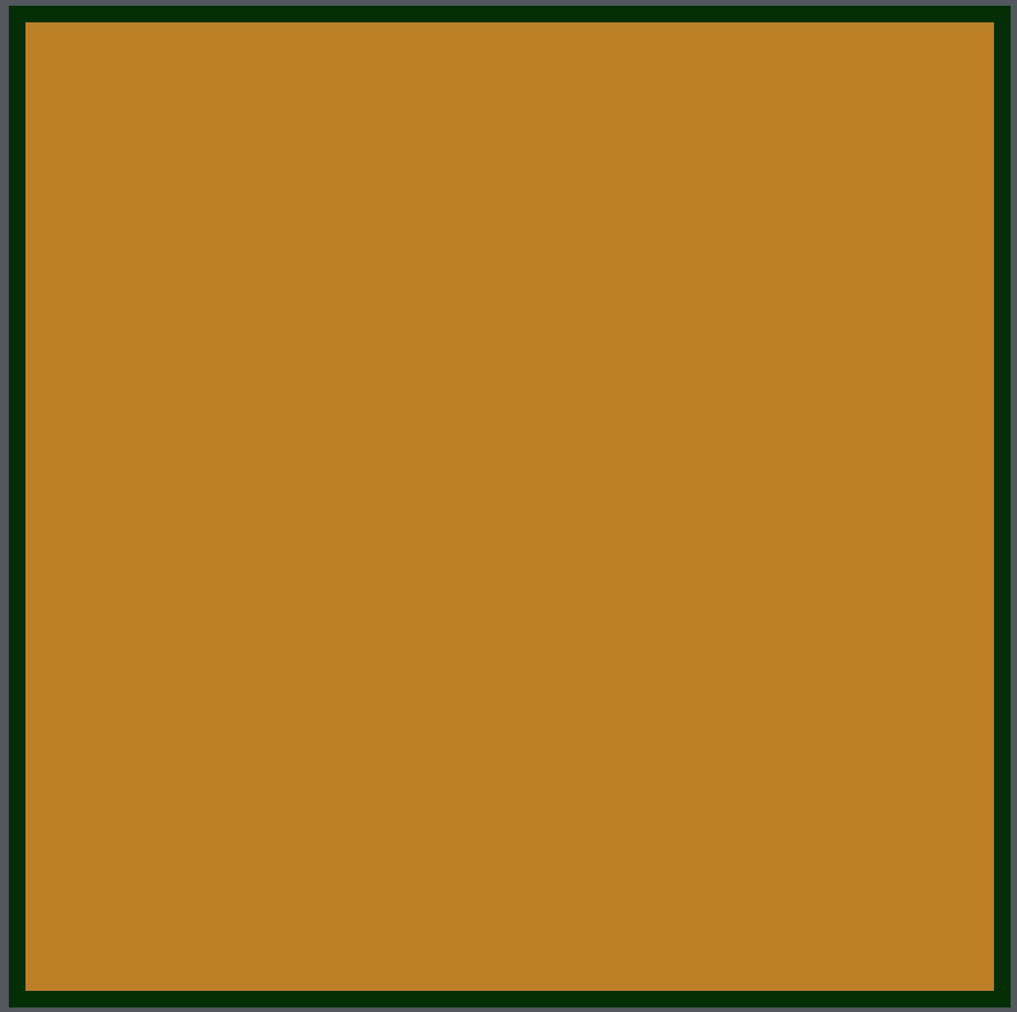

0
1
1
2
0
0
0
2
0
0
0
2
0
0
1
3

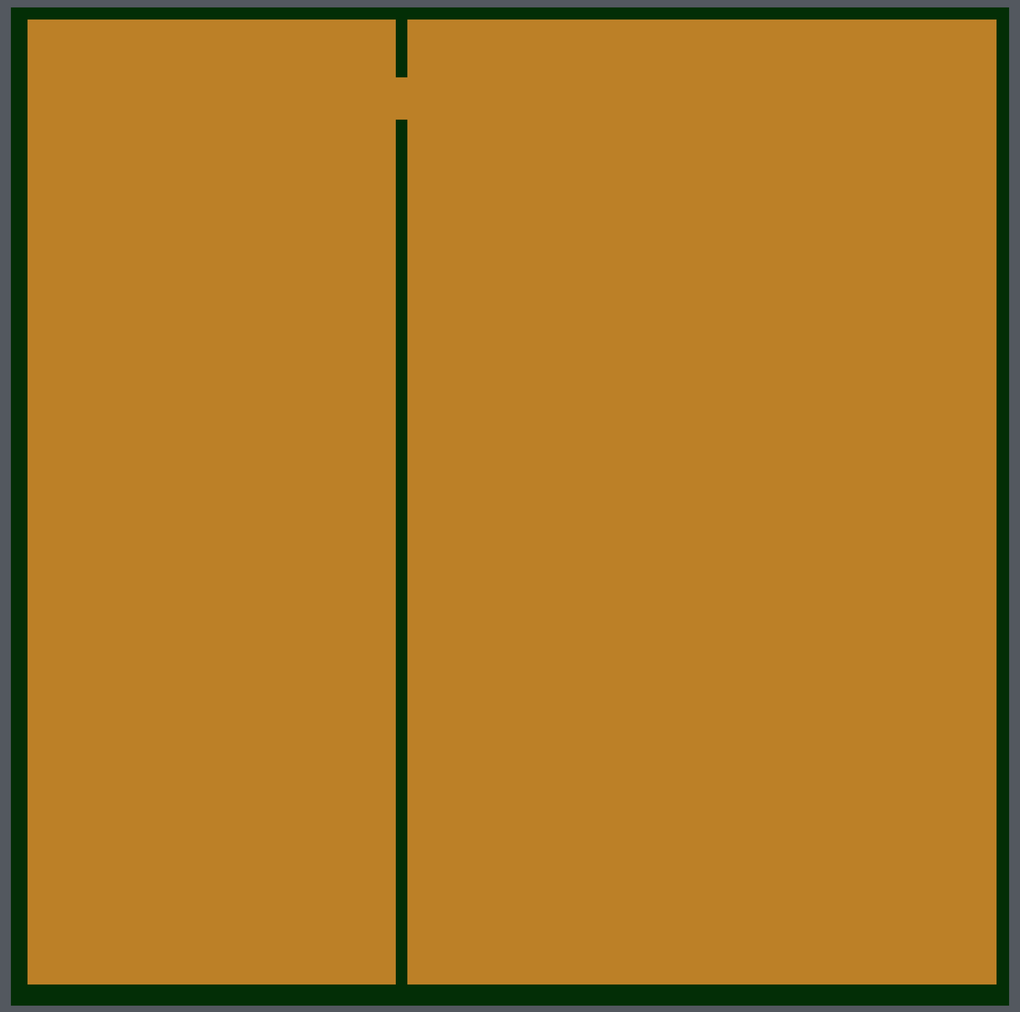
Level generation in **Spelunky**.

http://tinysubversions.com/spelunkyGen/

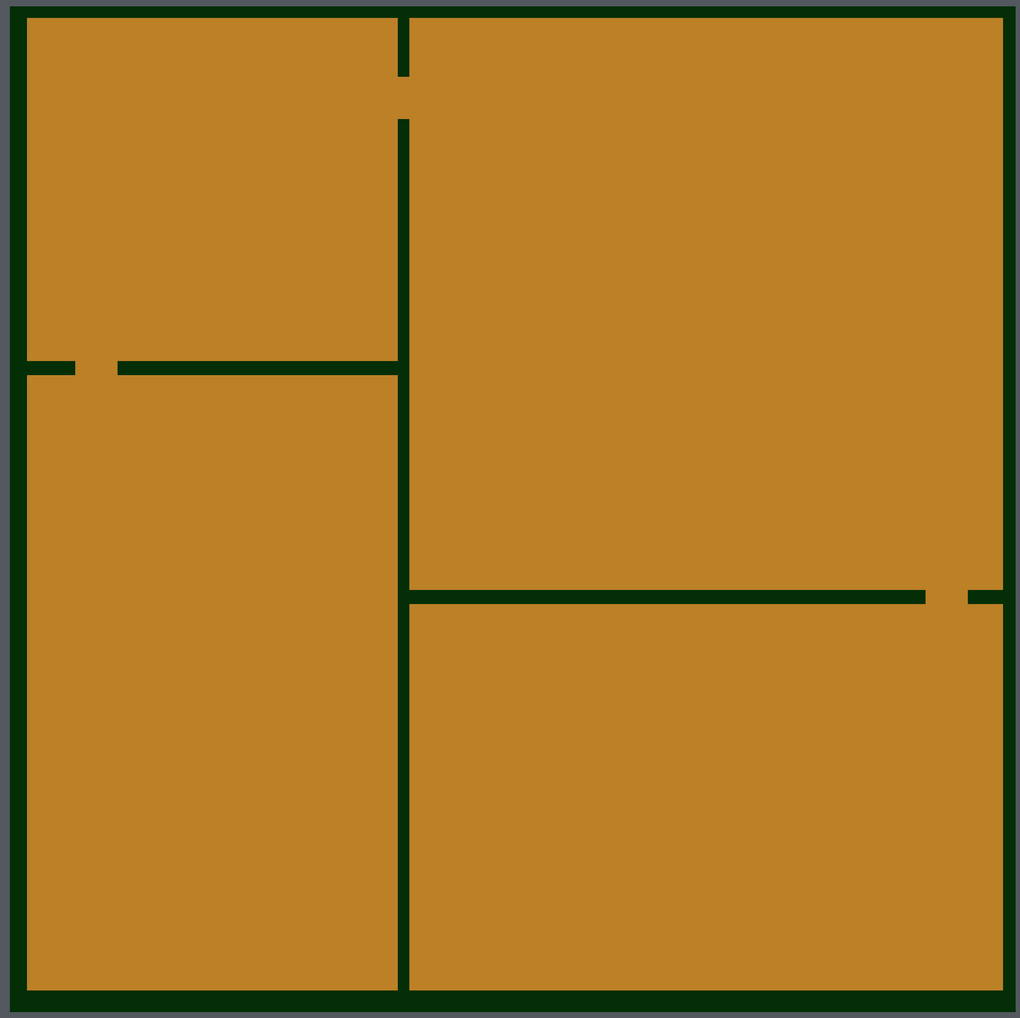
Bitworld.


GOLD:10

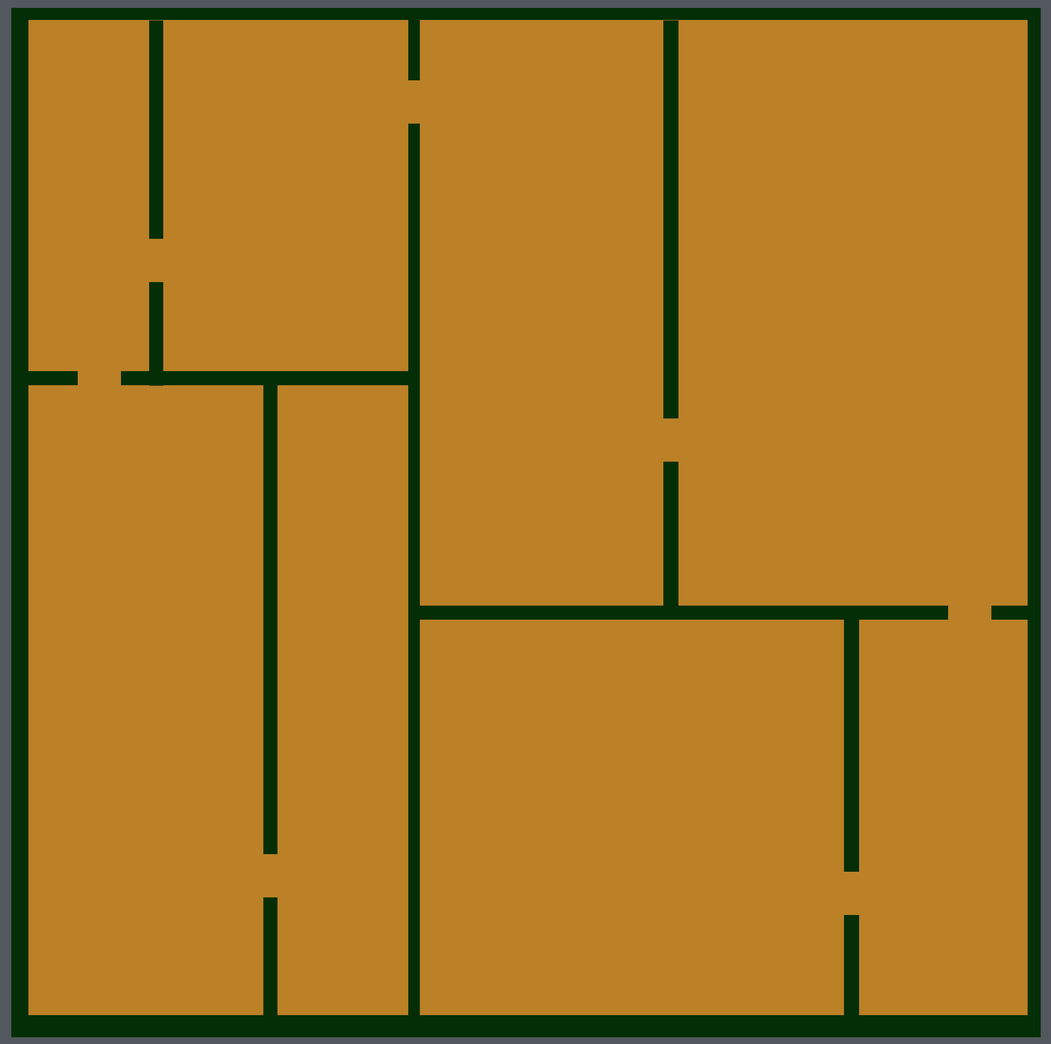




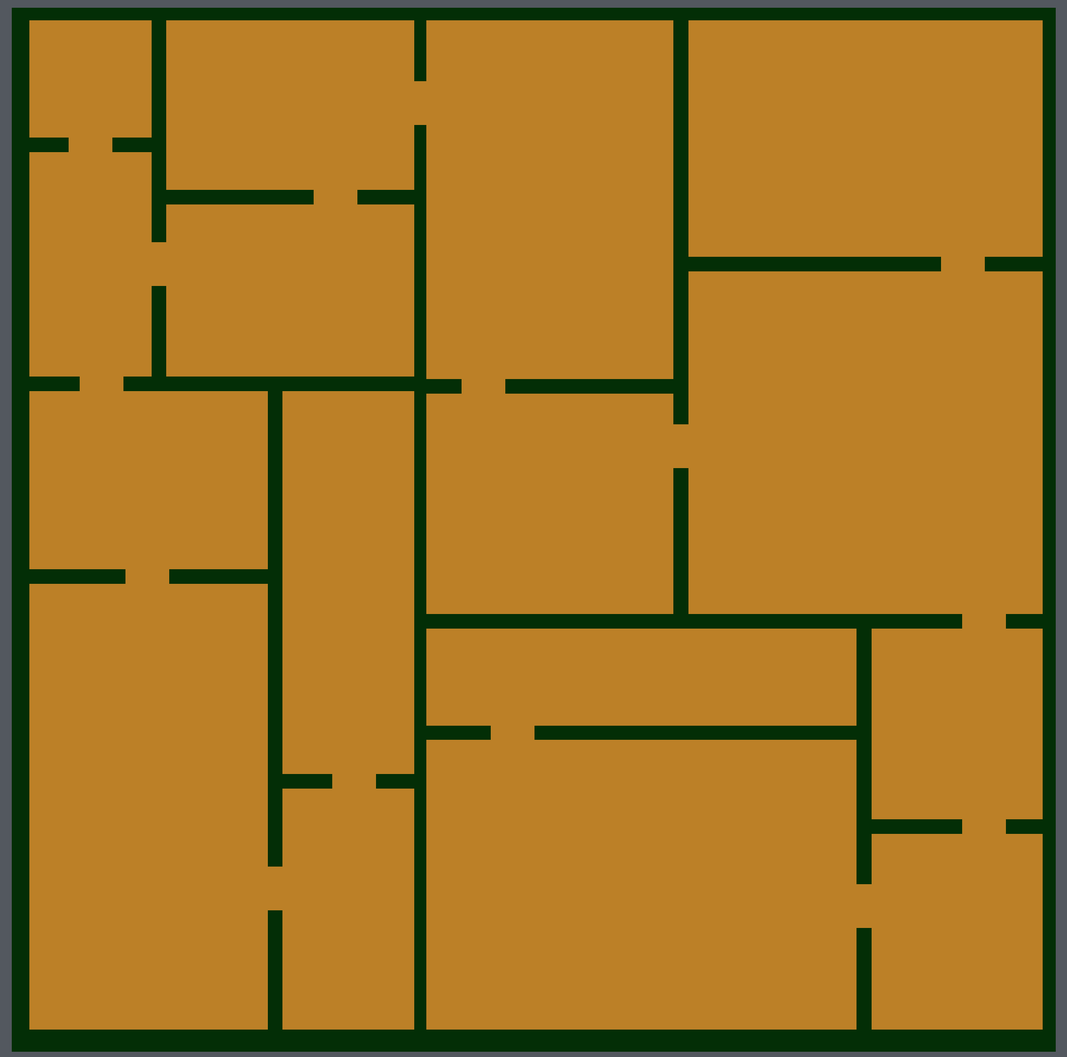
Divide into **two rooms** of random width and connect them together.



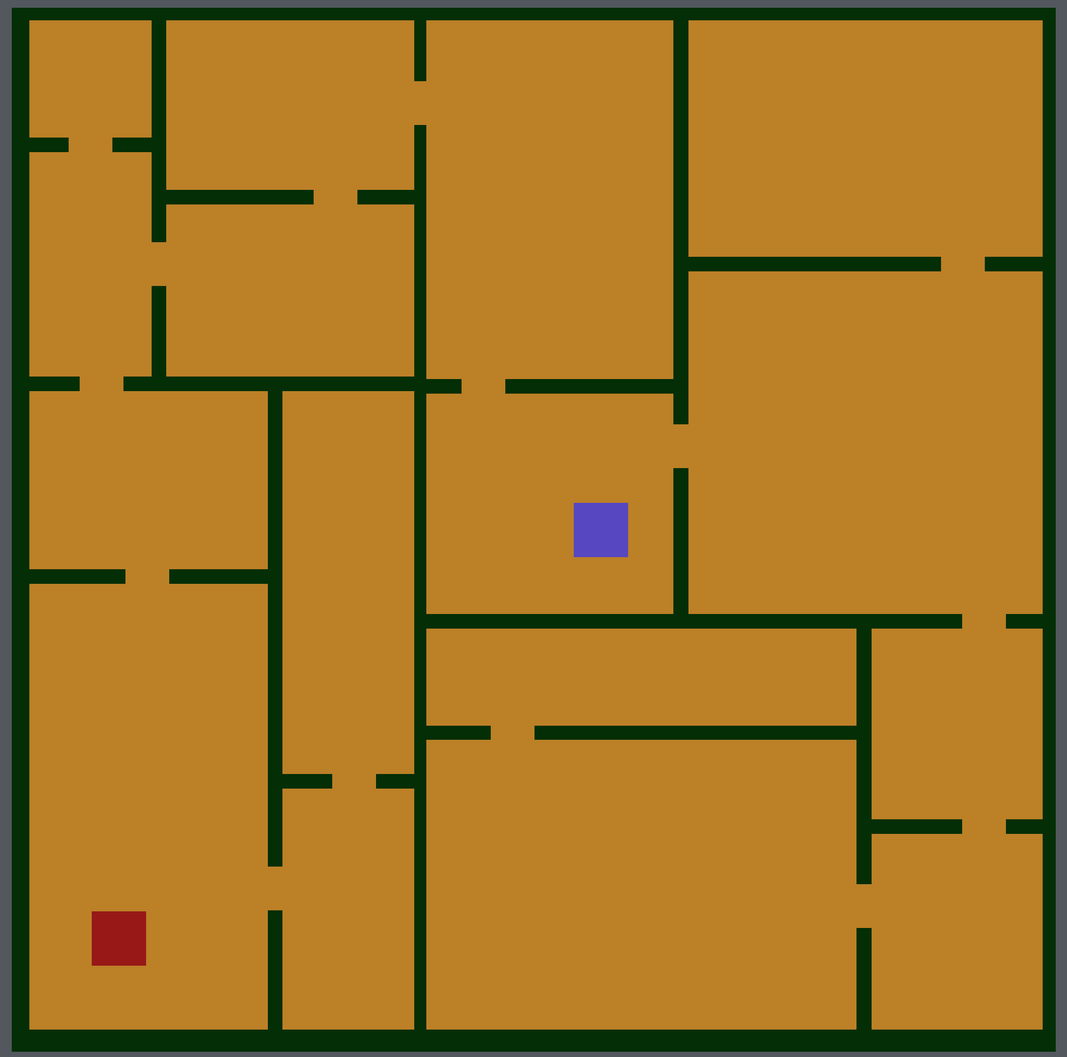
Do the same for the new rooms.



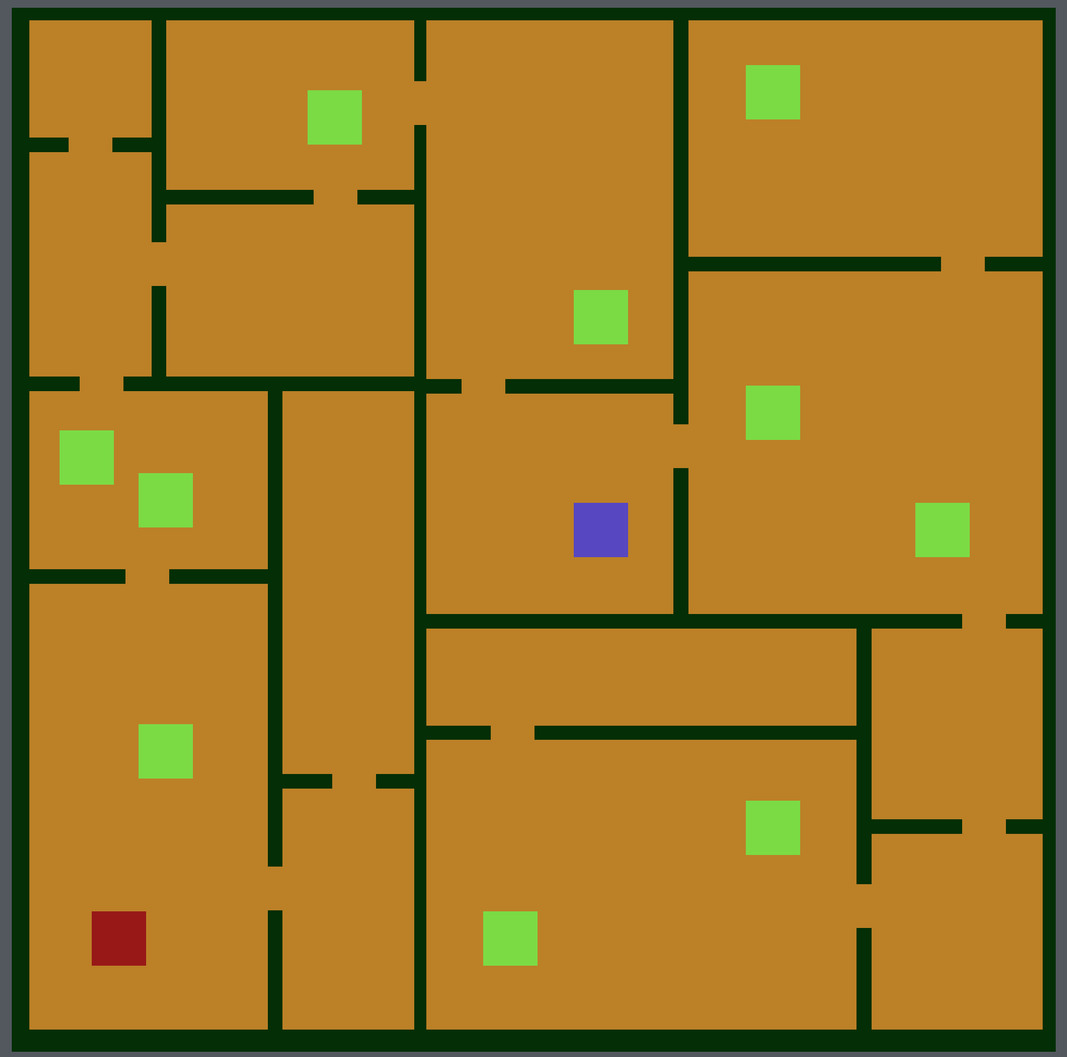
And again…



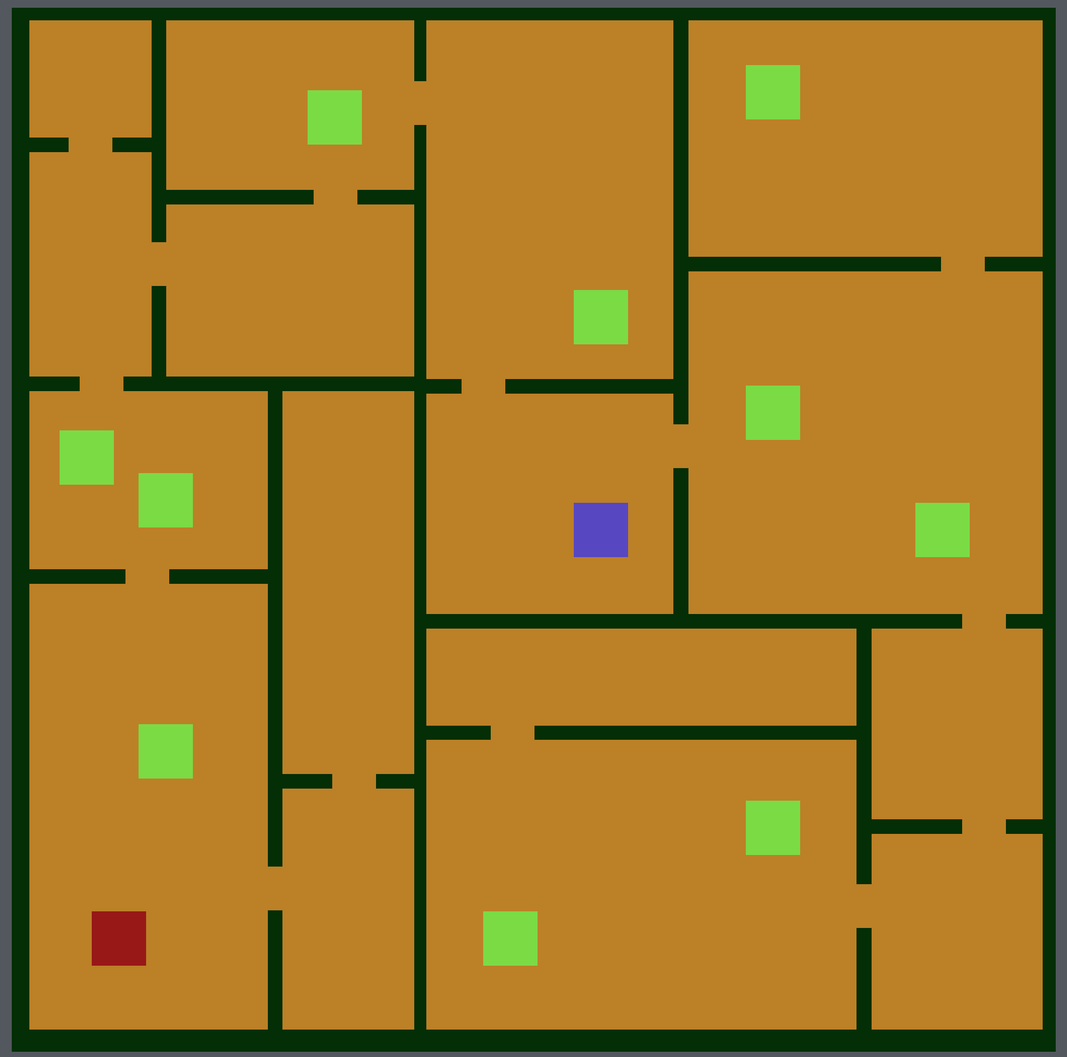
And again…



Place start and exit in a random tile.



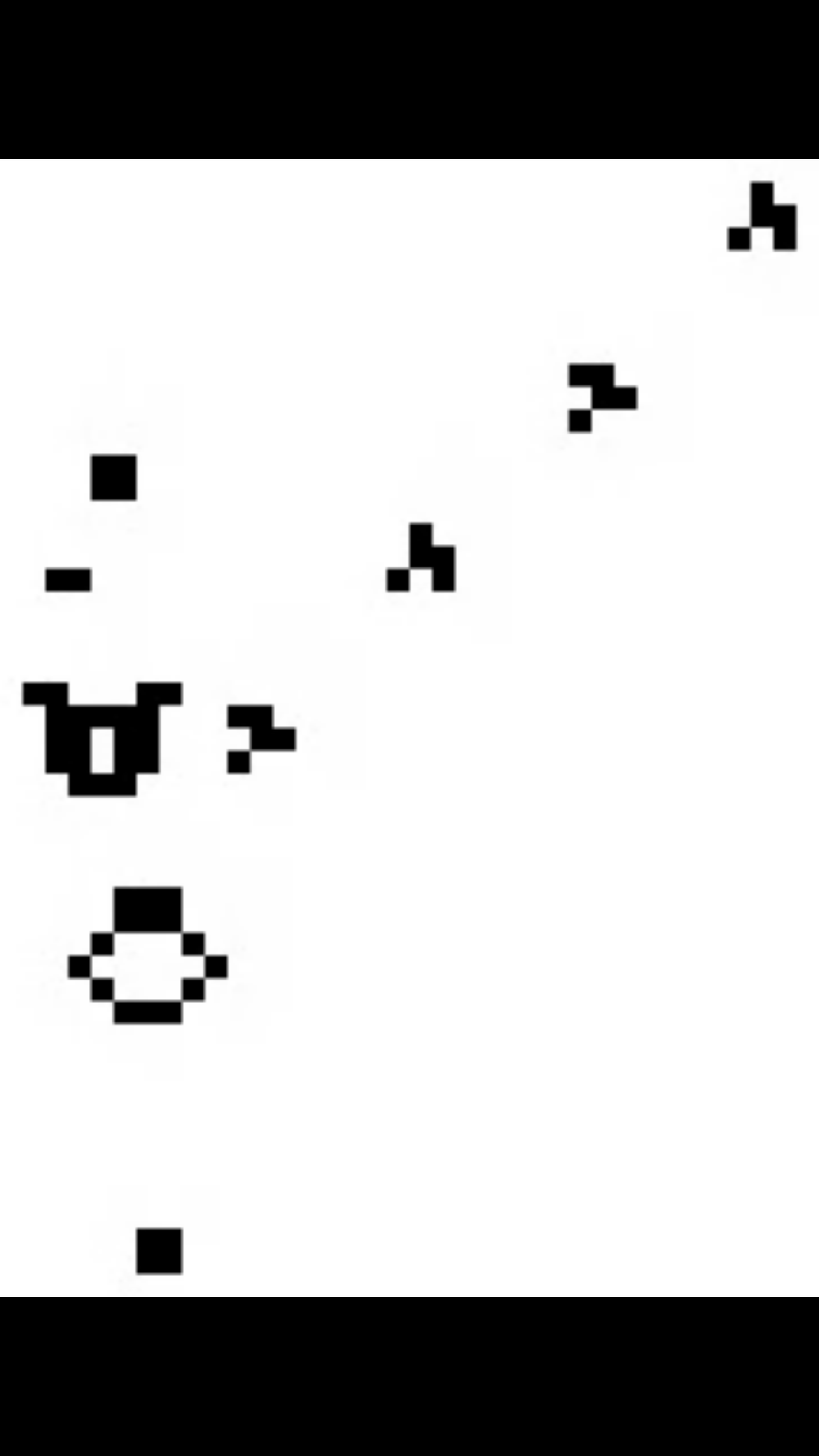
Place enemies and other entities on random tiles.

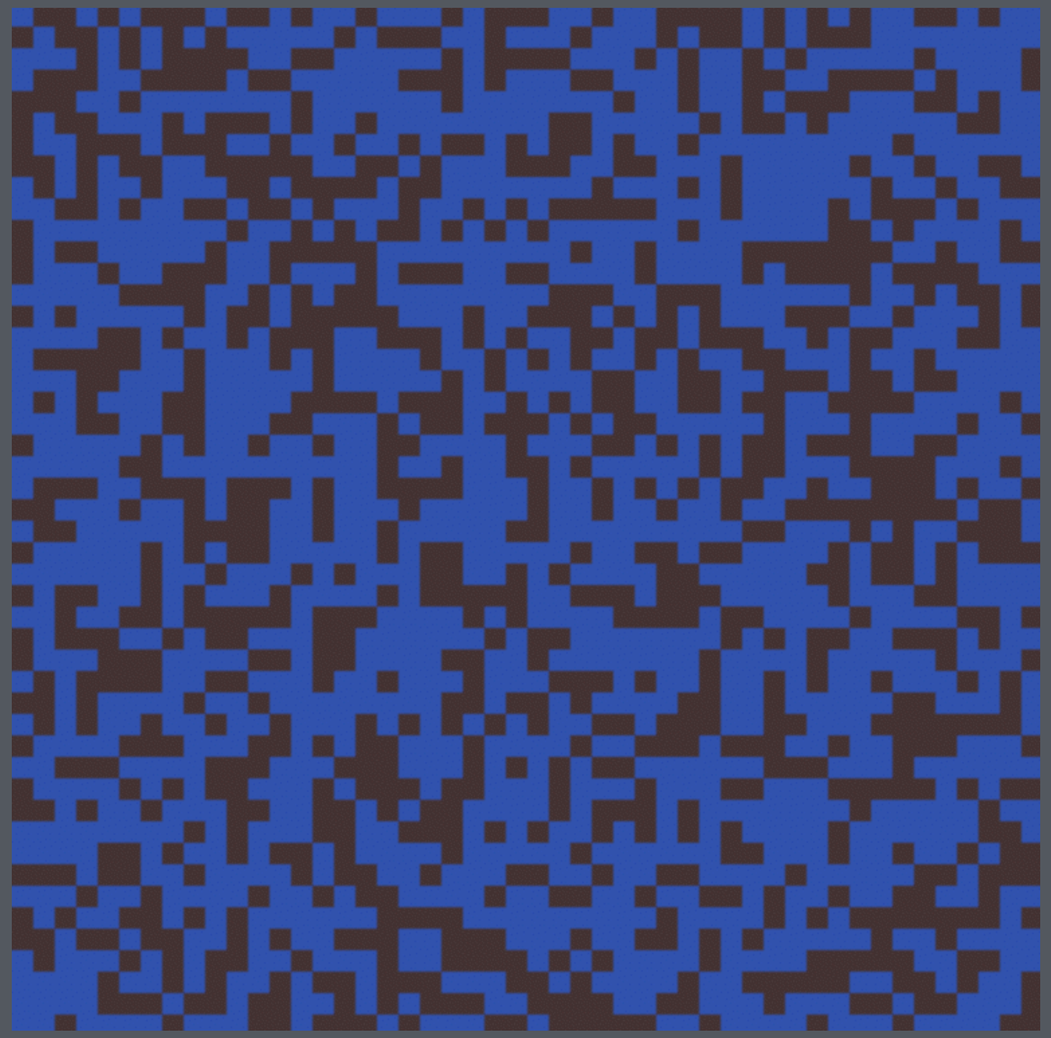


Procedural generation!

2D Caves using cellular automata.

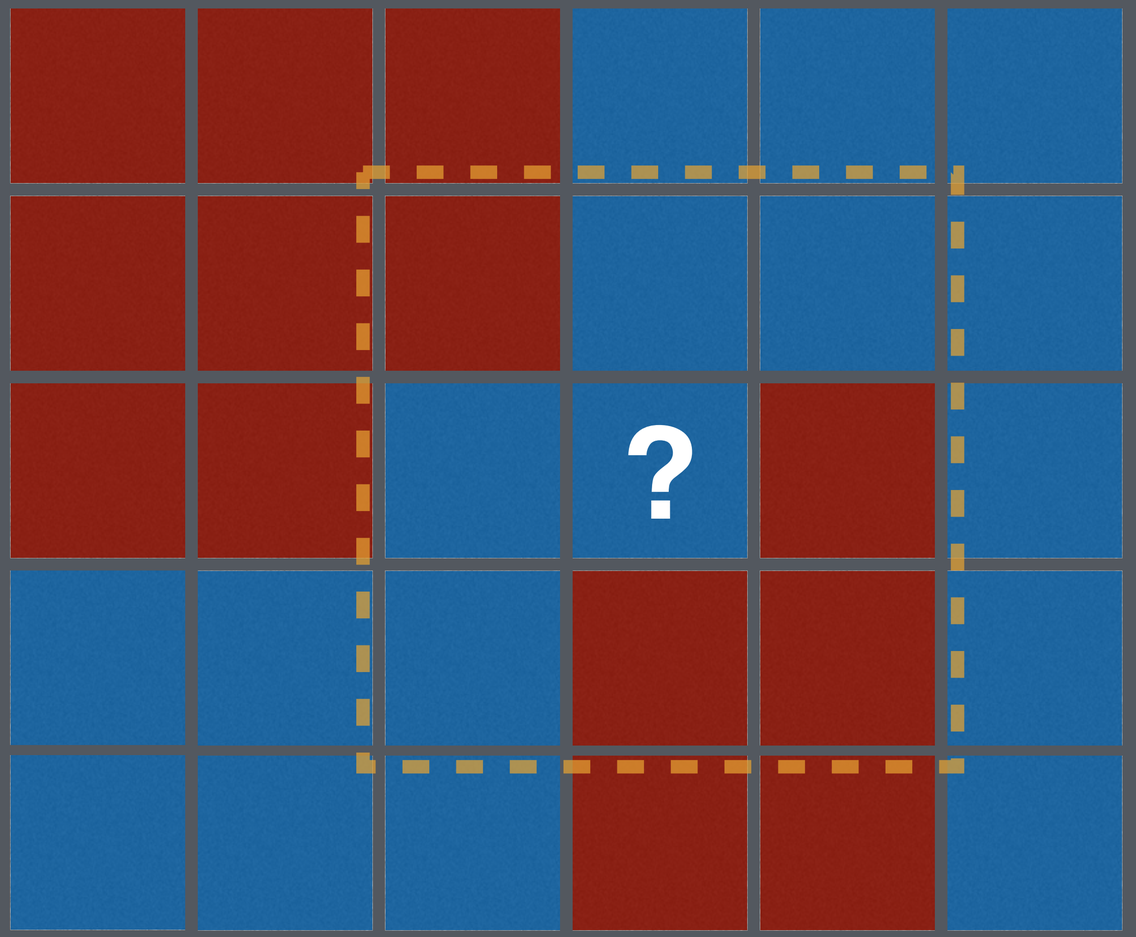
Cellular automata.



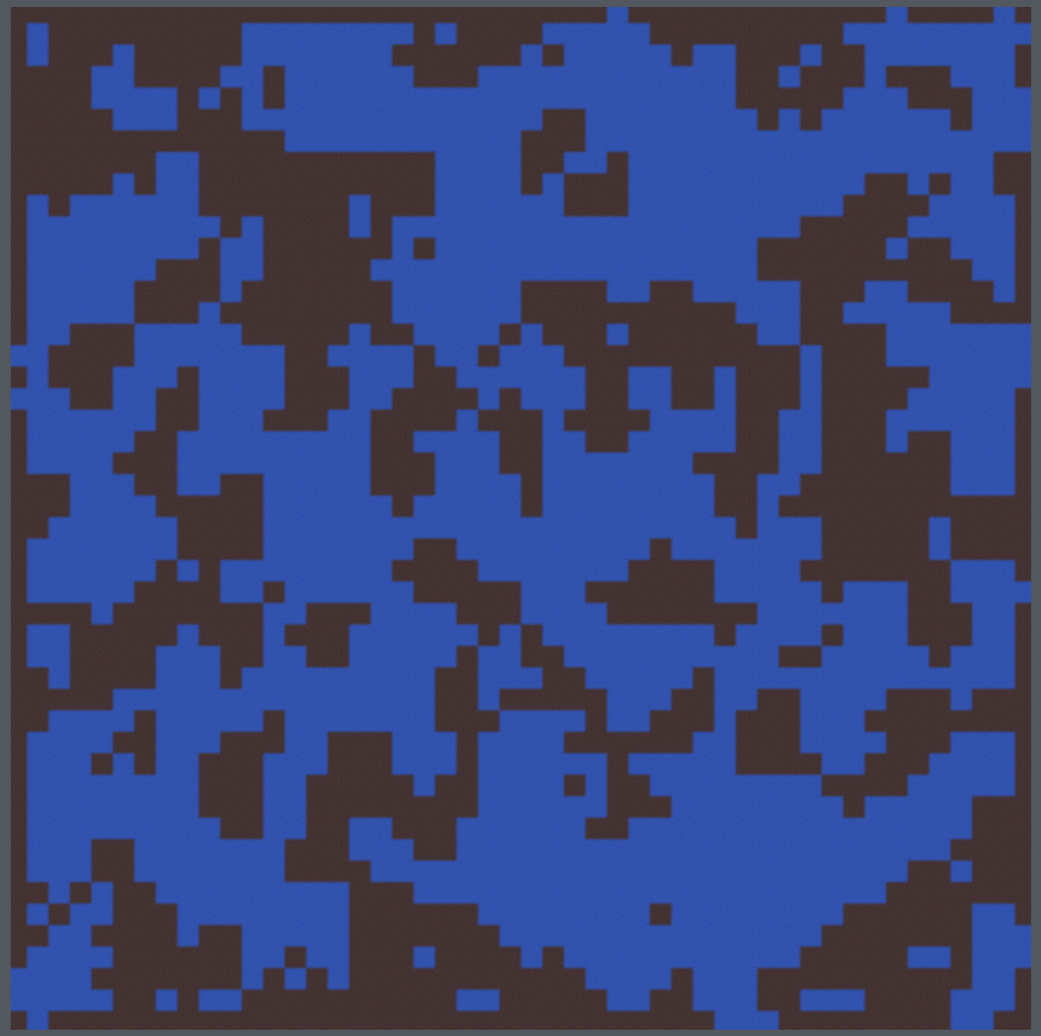


Fill tile map **randomly**.

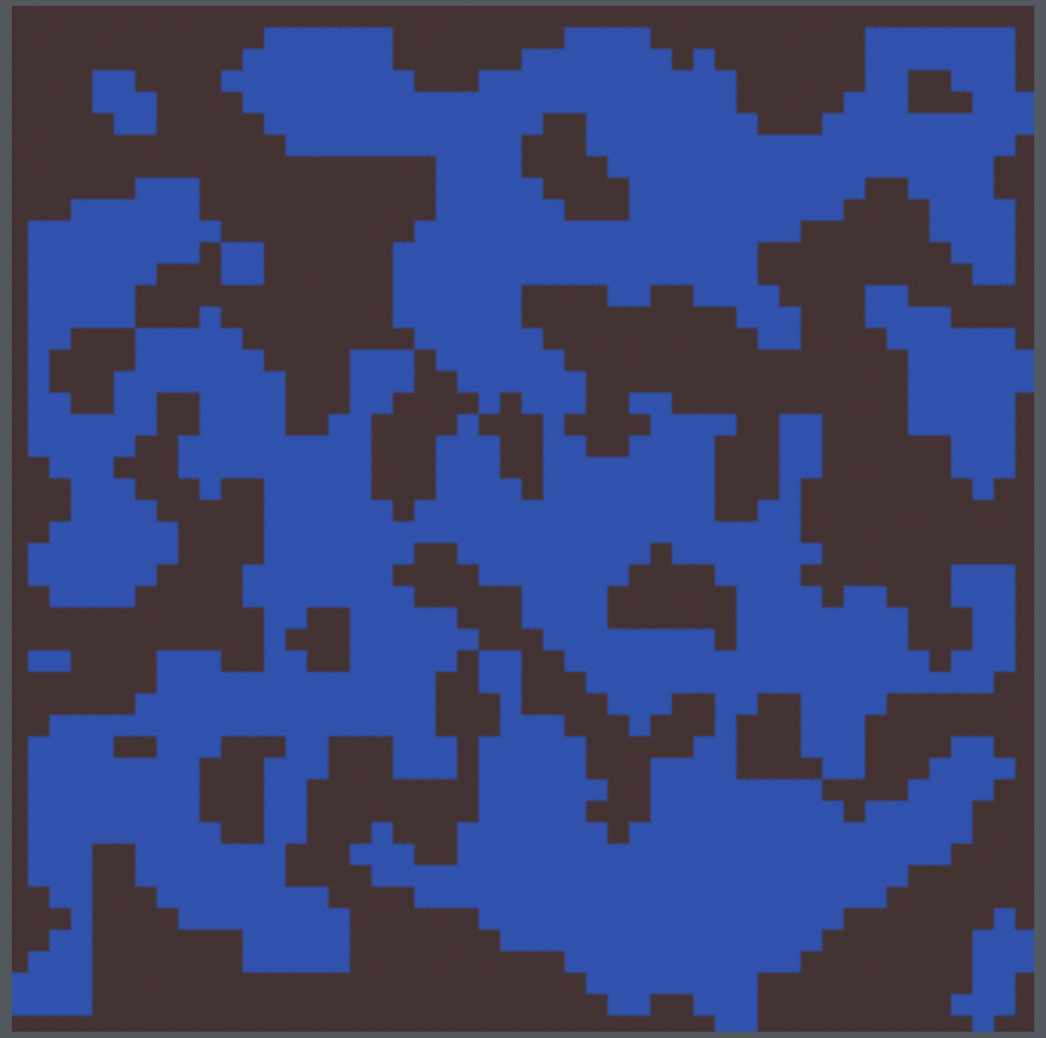
(50% chance solid)



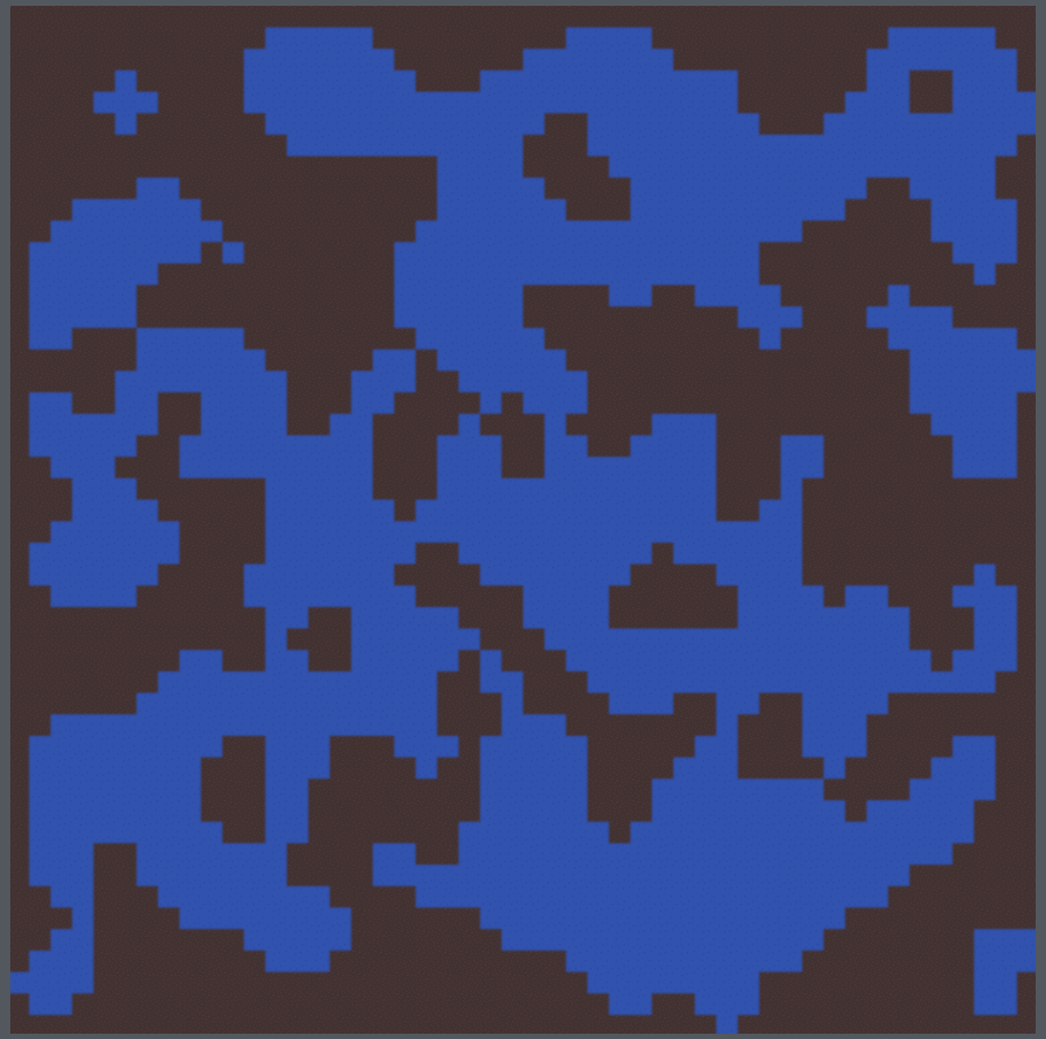
For every tile, **count all of its neighbors**, and if count is **larger** or **lower** than a certain **threshold**, **create a new tile** or **kill the existing one**.



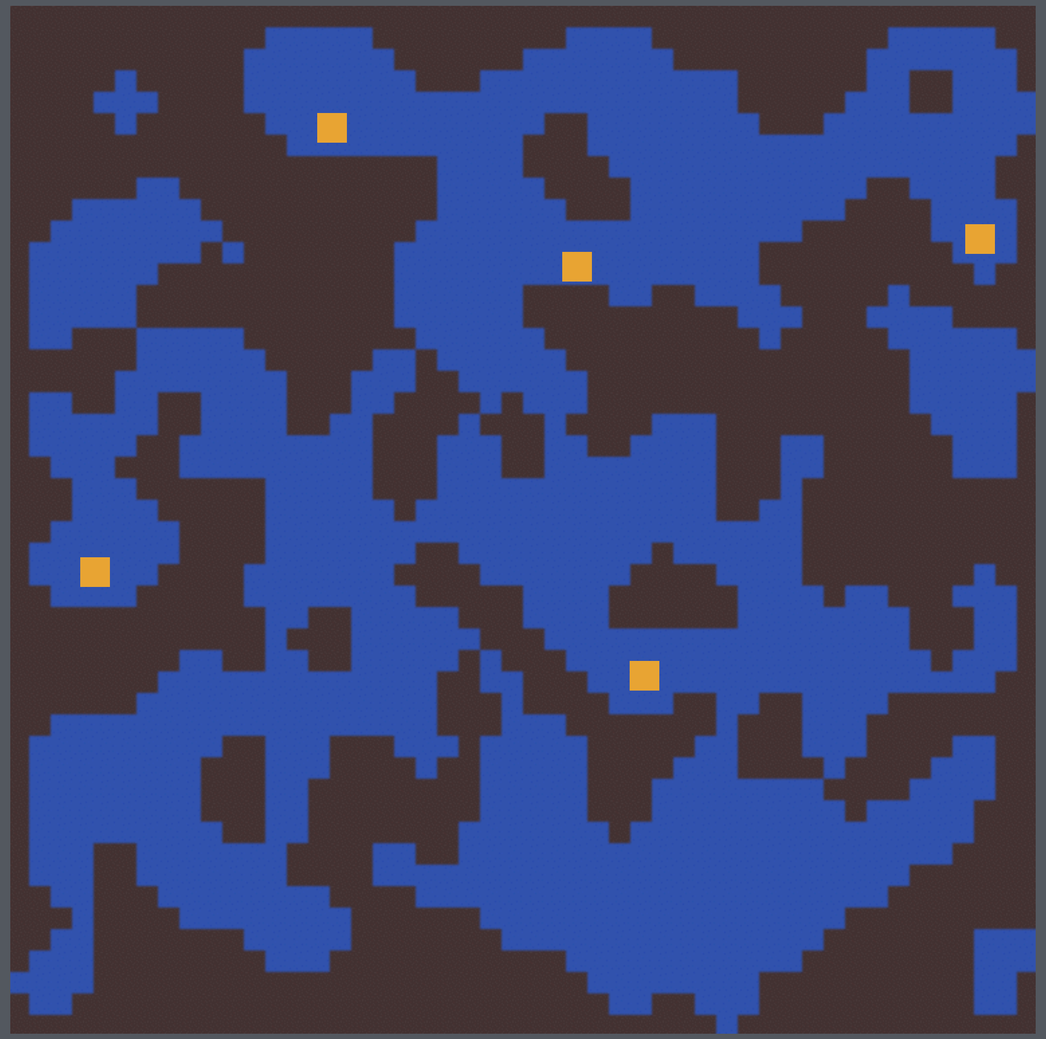
Do this for the entire tile map



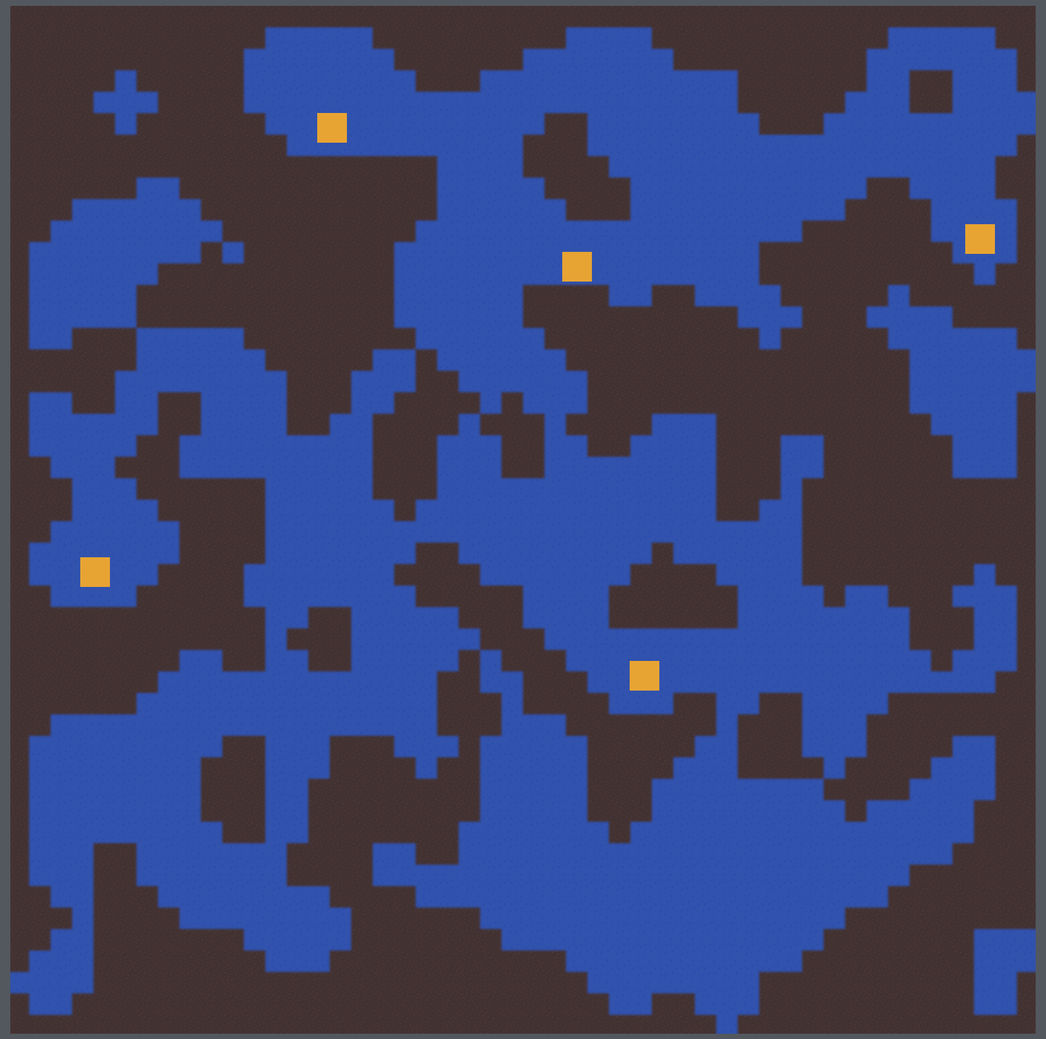
Repeat again.



And again.



Place entities.



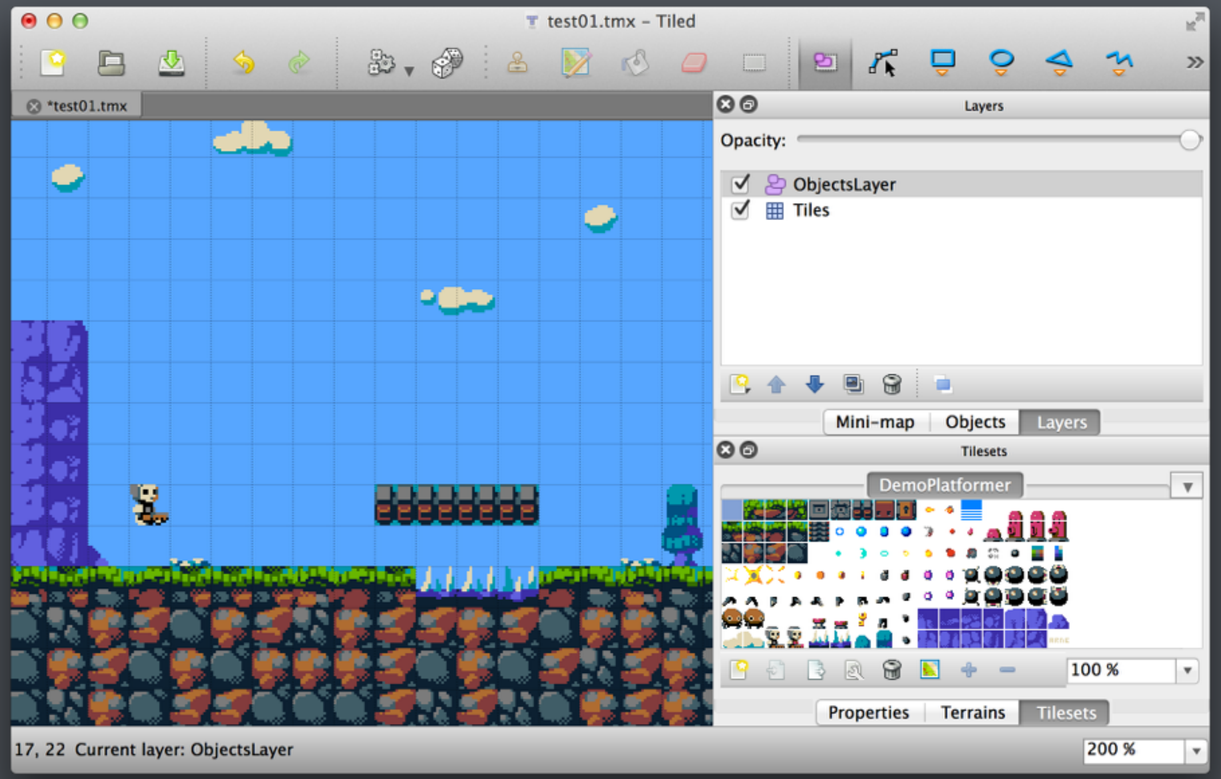
Procedural generation!

Generate Random Cave Levels Using Cellular Automata

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

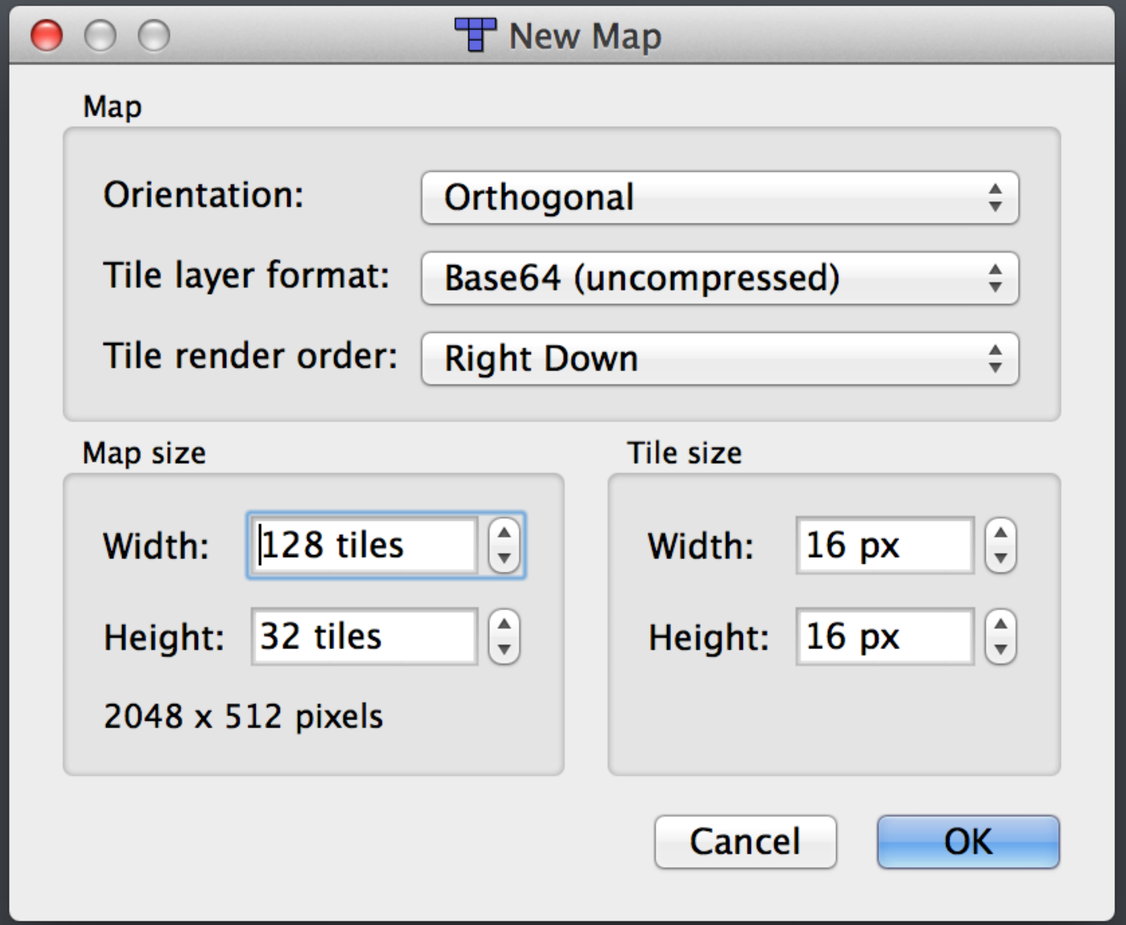
Using a **map editor**.

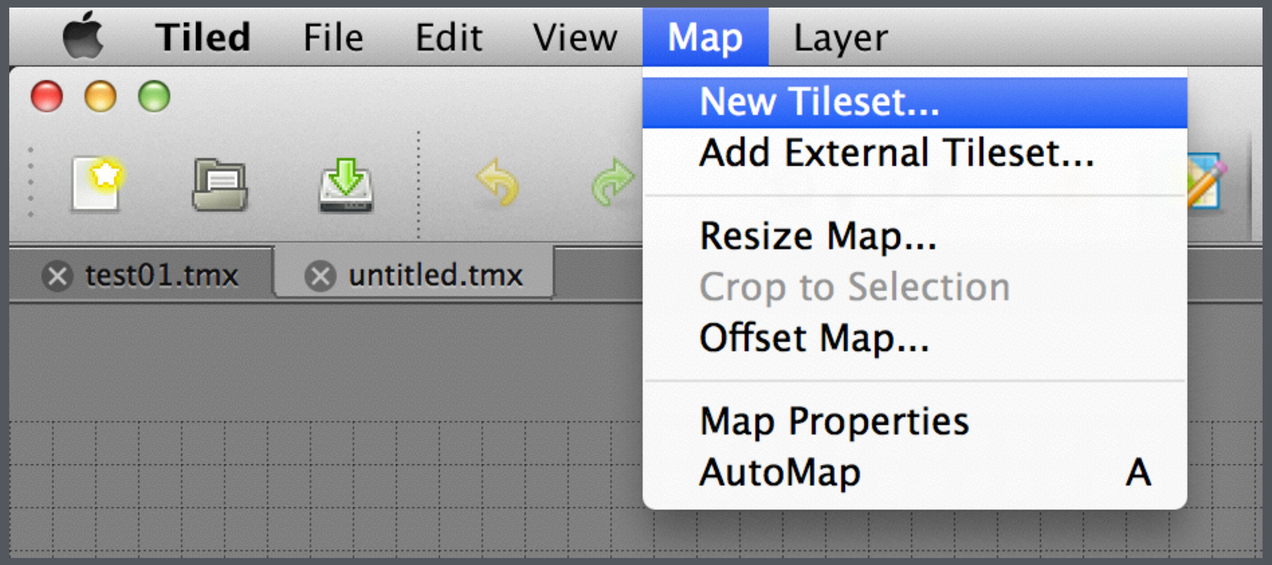
Tiled

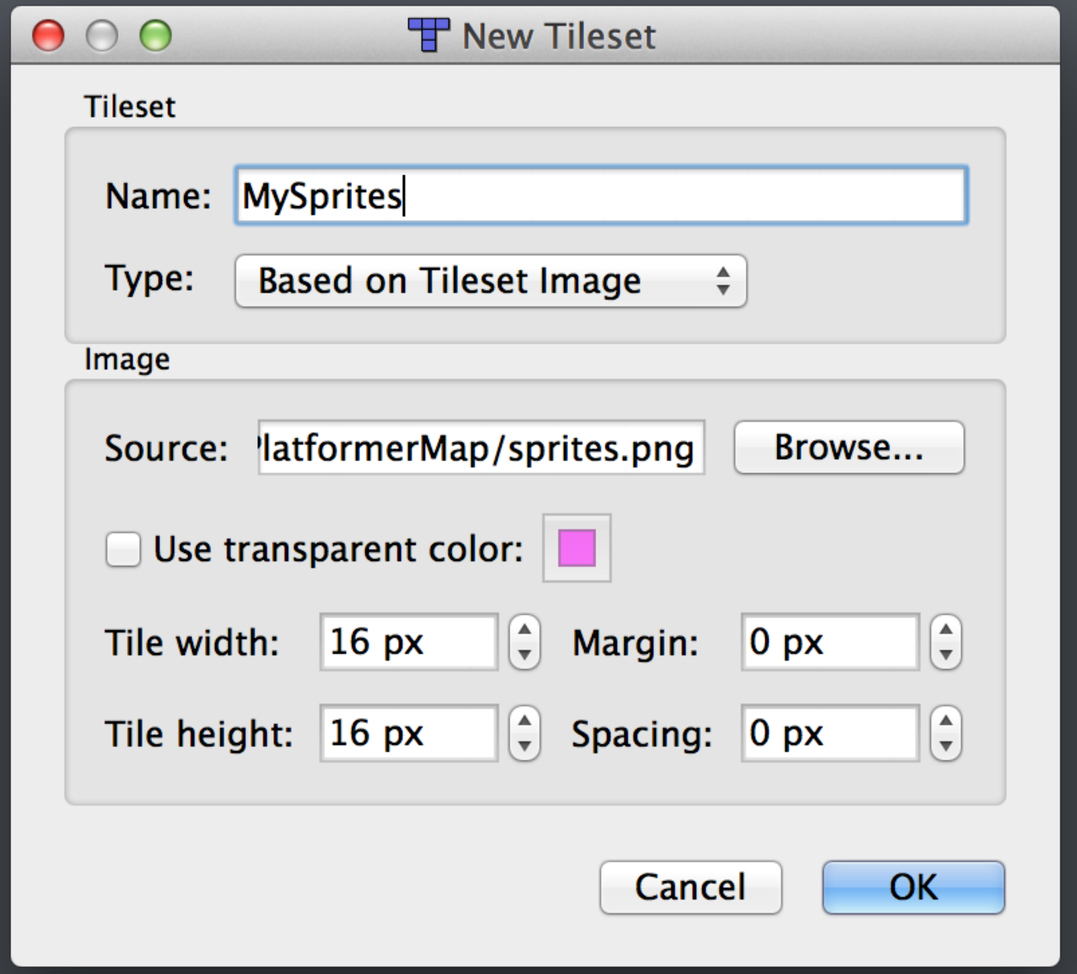


http://www.mapeditor.org/

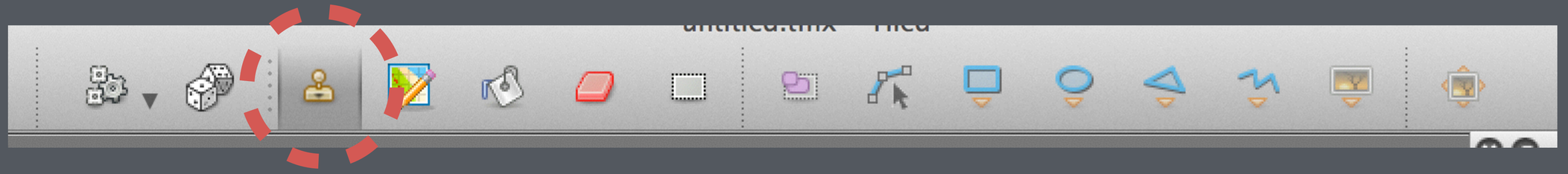
Building a level with **Tiled**.

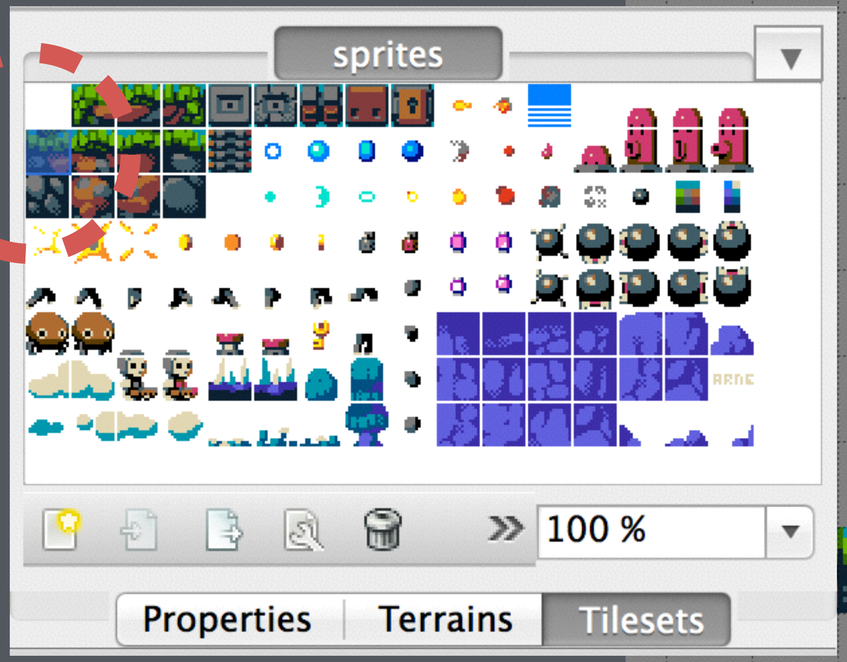

New Map
Map
Orientation:
Orthogonal
Tile layer format:
Base64 (uncompressed)
Tile render order:
Right Down
Map size
Width:
128 tiles
Height:
32 tiles
2048 x 512 pixels
Tile size
Width:
16 px
Height:
16 px
Cancel
OK

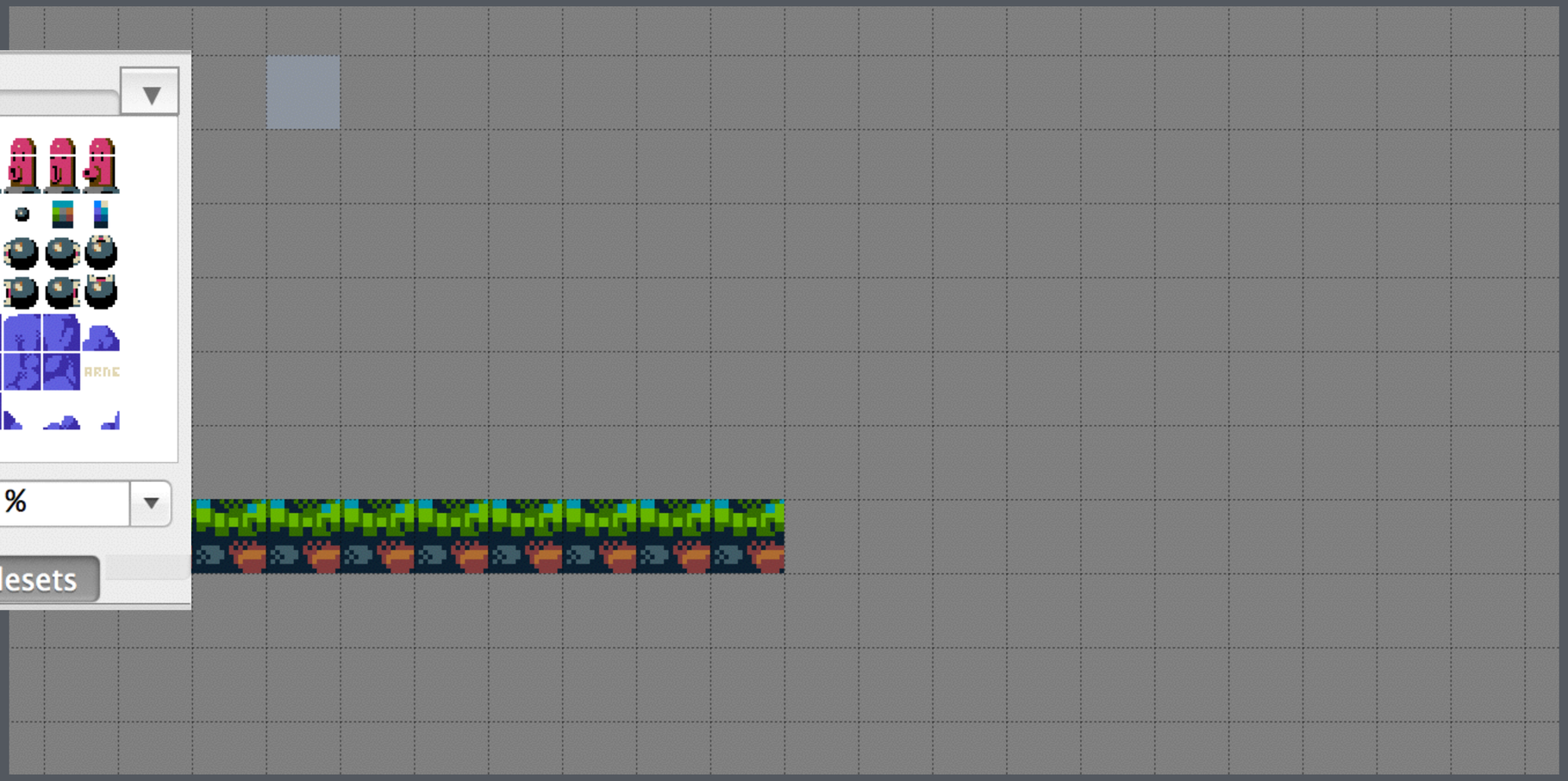

Tiled
File
Edit
View
Map
Layer
New Tileset...
Add External Tileset...
Resize Map...
Crop to Selection
Offset Map...
Map Properties
AutoMap
A
test01.tmx
untitled.tmx


New Tileset
Tileset
Name:
MySprites
Type:
Based on Tileset Image
Image
Source:
latformerMap/sprites.png
Browse...
Use transparent color:
Tile width:
16 px
Margin:
0 px
Tile height:
16 px
Spacing:
0 px
Cancel
OK

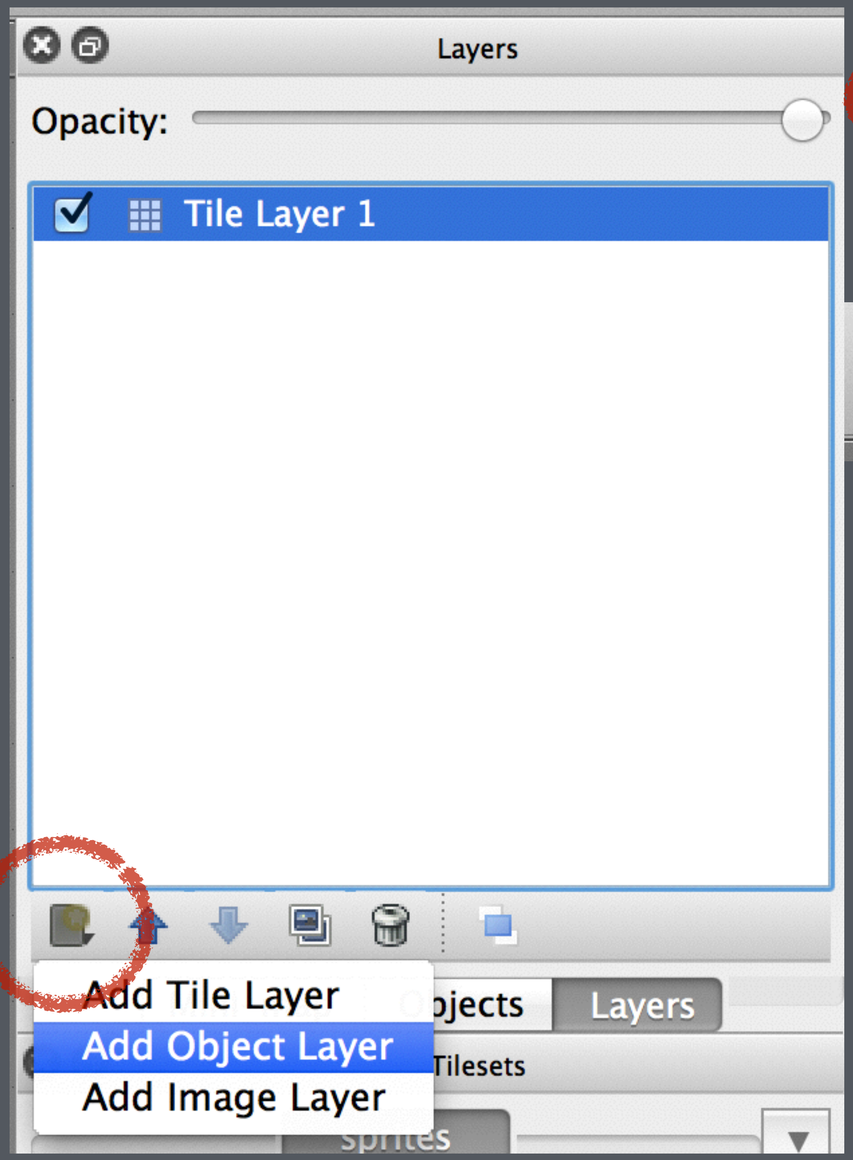
Drawing **tiles**

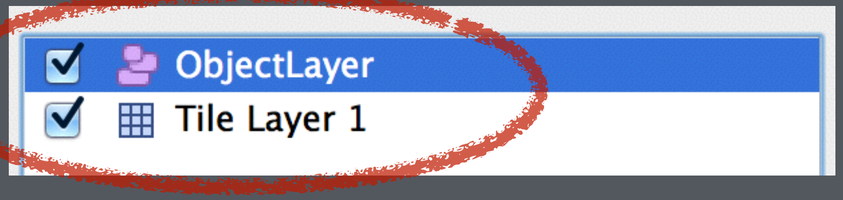



sprites
100 %
Properties
Terrains
Tilesets

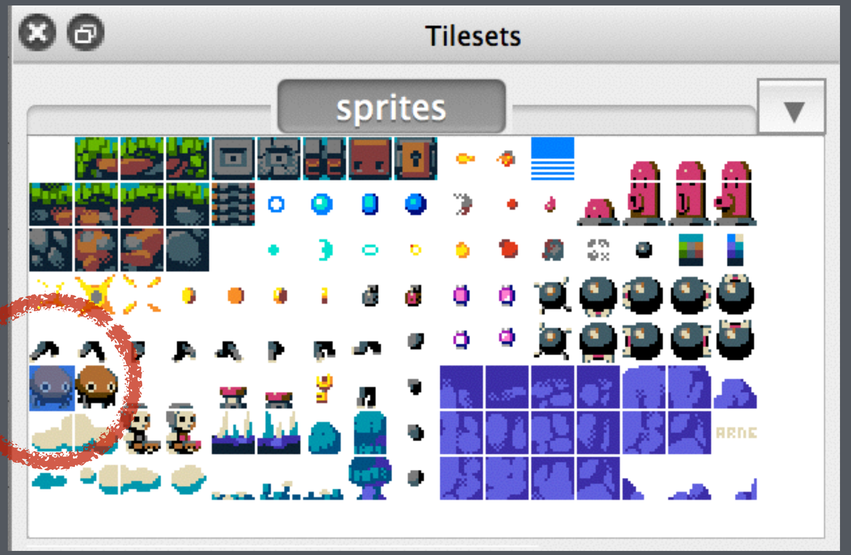


Placing **entities**.

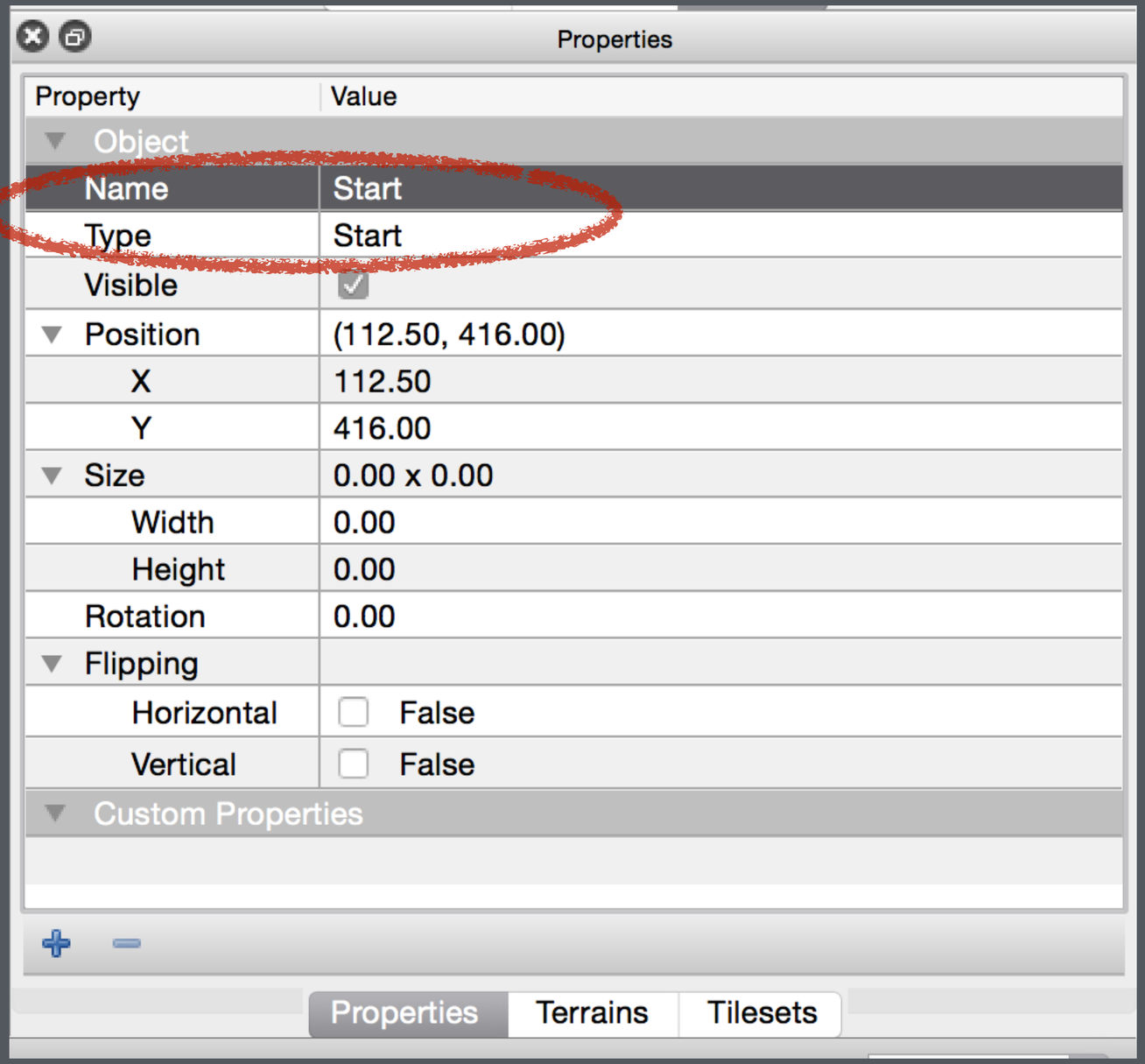

Layers
Opacity:
Tile Layer 1
Add Tile Layer
Add Object Layer
Add Image Layer
Layers
Tilesets


ObjectLayer
Tile Layer 1


Insert Tile (T)

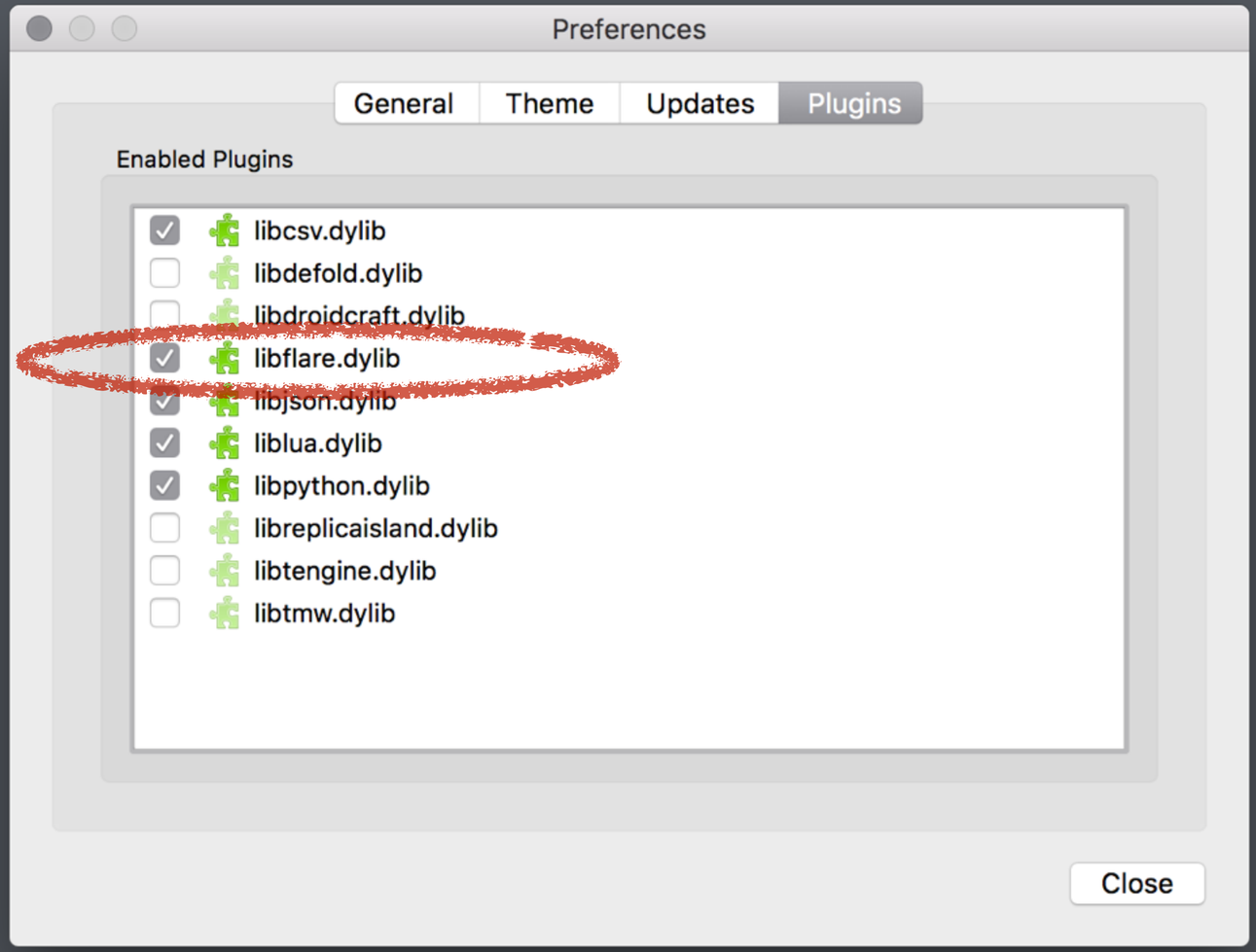

Tilesets
sprites

Make sure you fill in the **Name** and **Type** fields.

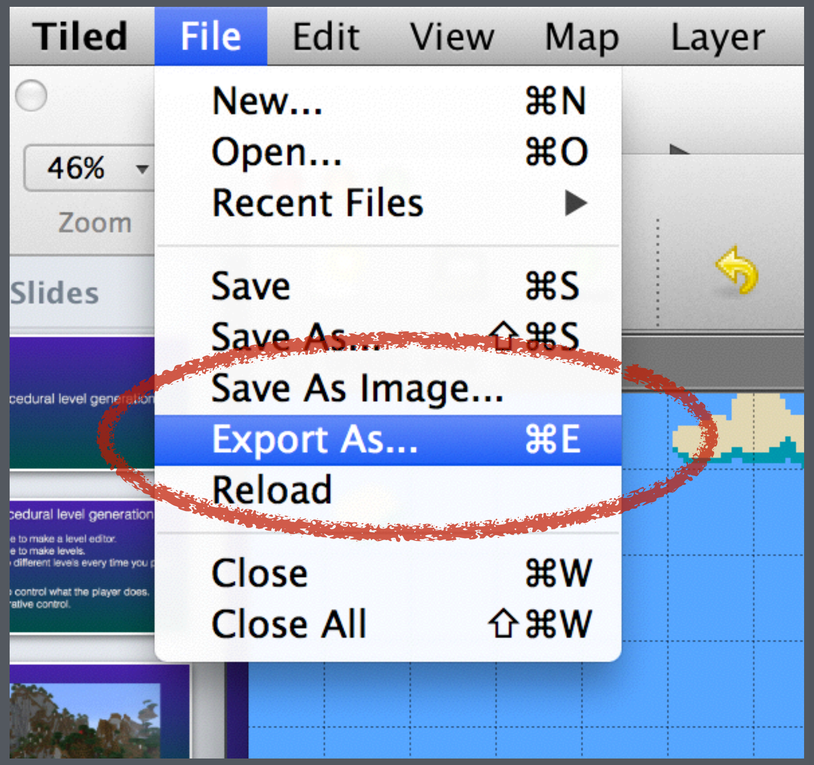


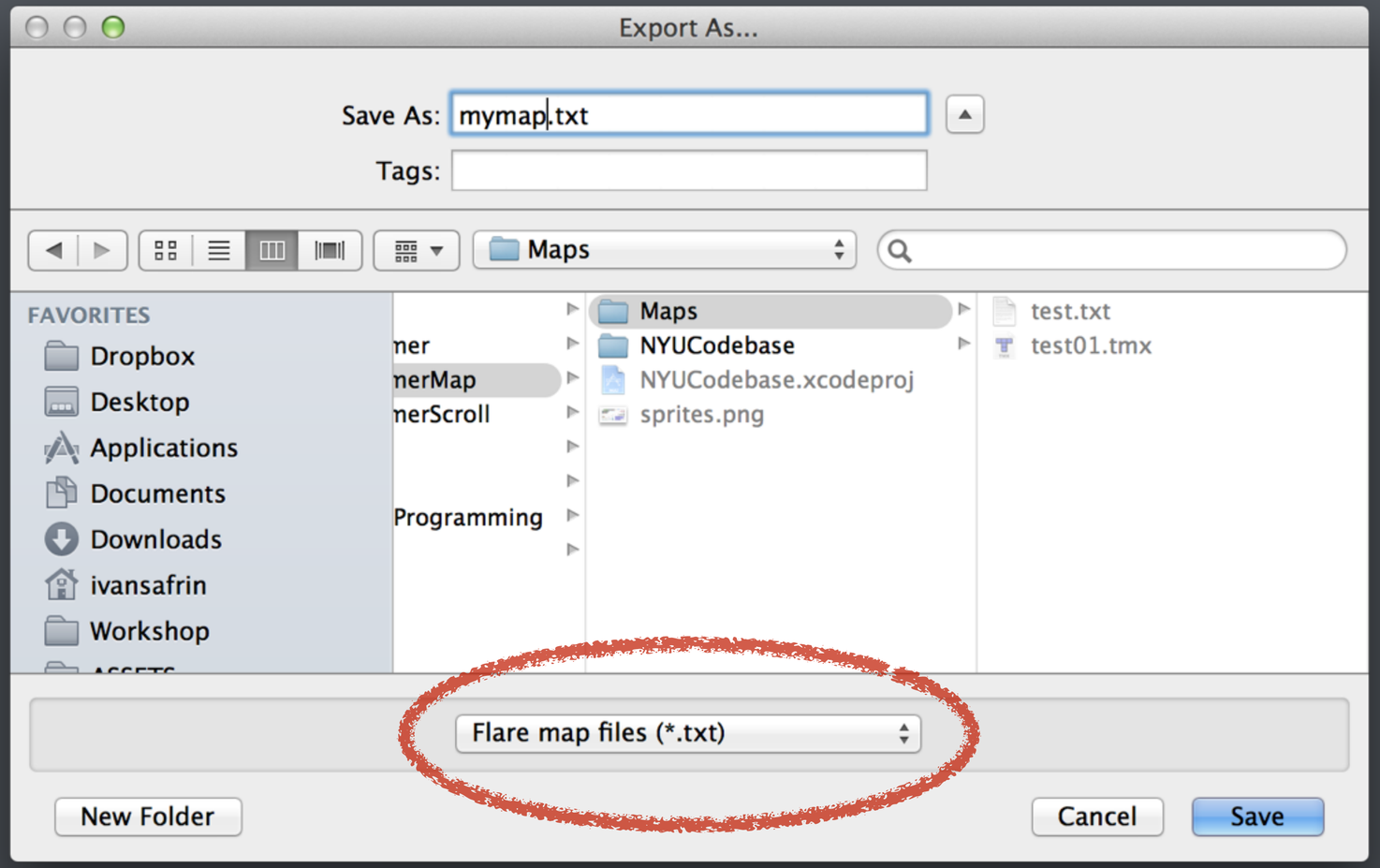
Loading **Tiled** levels in your game.

Export as **Flare map** file.



Export as **Flare map** file.





This is what it looks like

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

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

[ObjectsLayer]
# Start
type=Start
location=24,34,1,1

[ObjectsLayer]
# Enemy1
type=Enemy
location=42,40,1,1
```

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
0,0,0,0,0,0,0

[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**.