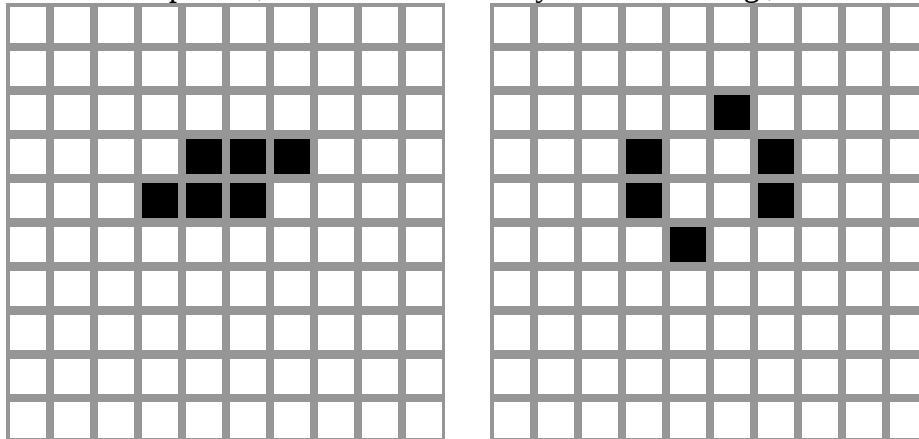


Conway's Game of Life

The rules:

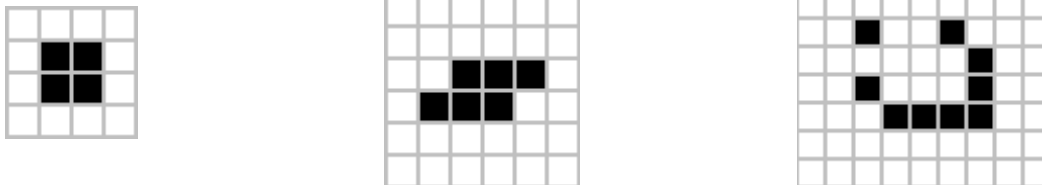
1. Start with a square grid of “cells”, each of which is “alive” or “dead”.
2. At each step, we count the number of each cells neighbours that are alive, and
 1. any live cell with fewer than 2 live neighbours dies
 2. any live cell with more than three neighbours dies
 3. any live cell with 2 or 3 live neighbours lives on
 4. any dead cell with exactly three live neighbours becomes alive, and otherwise stays dead

We start with some initial pattern, and then watch the system evolve: e.g.,



The interesting thing is how much variety such simple rules can create. Let's have a go!

- (1) First, let's try it with graph paper. Draw the following three shapes on graph paper, count the number of neighbours for each square, and then draw the next generation, and so on:



The first pattern is called a “block”, the second is called “the toad” and the third is a “lightweight spaceship”. Any idea why?

- (2) Obviously, graph paper is tedious. We need a computer to do this quickly (without mistakes). Login using the following

username: mathsearch

password: On+Quob2

Then open the Game of Life program from the start menu:

Start → All Programs → GameOfLife → Game of Life

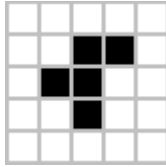
You should get a grid on the screen. You can draw on it, creating a starting pattern of “live” cells. Try the patterns you did on the graph paper:

1. Clear
2. Draw the pattern with the mouse
3. Hit “NEXT” to see the pattern evolve one step
4. Hit “START” to see it evolve.

(3) Now let's go looking: try to find

1. a **still life**, that is a pattern that doesn't change
2. an **oscillator**, that is, a pattern that repeats itself
3. a **spaceship**, that is a pattern that moves along
4. a **gun**, which generates spaceships (this one is hard)

If you have trouble, don't worry. Just play around, and eventually you will find some examples. The following one is particularly fun, its called the F pentomino.



If you want more space (what happens at the edges?) then change the size from “Big” to “Medium” or “Small” (its the size of the cells, not the board).

If you want it to go faster, change the speed from “Slow” to “Fast” or “Hyper”.

(4) The previous program is fun, and easy to use, but it has limits (what happens at the edges?) Now lets try a more serious “Life” program. Open it using

Start → All Programs → Golly 2.3 → Golly

This version is a little more complicated to use, but has a large library of patterns.

Start by maximising the window to give yourself more room to play with.

Use the “Control” menu to make it go slower (or hit the '-' key).

Edit a pattern with the mouse.

Make it run using the “play” button in the top left.

Or, in the left hand box select the “Life” patterns, and choose something to get started.

Or experiment with some of the other patterns from systems like “Life” but with different rules.

Have another play, and see what you can find.
I will give **prizes** for interesting patterns!