LifeGenesis Help Index

The Index lists all LifeGenesis Help topics.

To learn how to use Help, choose Using Help from the Help menu, or press F1.

How to Play

Commands

More on Life

Overview

LifeGenesis is based on the remarkable Life simulation rules developed by the mathematician John Horton Conway. (See History of Life.) LifeGenesis includes both a Life simulator and a game based on Life that you can play against the computer.

Imagine that you are looking into a microscope and you see a grid pattern on a glass slide. Some of the squares on the grid are empty, and some contain live tiny organisms or cells. Some organisms seem to live a long time, while others die quickly. On parts of the slide, new organisms spring to life. As new generations of cells live and die, they form patterns of shifting color.

This microscopic drama is based on a mathematical model following three simple rules, (see Rules of Life) which determine, as each generation passes, who lives, who dies and where new life begins.

These rules are not meant to accurately model any particular life system. They are instead a mathematical abstraction which has fascinated game players for more than 20 years because of the wonderful patterns that emerge as generations progress. From the chaos of a random distribution of cells eventually emerges unexpected symmetries or quirky behaviors. For most players, the magic is that three simple rules of logic can yield such diversity and beauty.

Related Topics

- Playing the Game
- Rules of Life
- Scoring

Playing the Game

The object of the Game of Life is to remove all the red cells from the grid. The computer will try to remove all the blue squares. You and the computer take turns adding and deleting cells.

To Choose a Skill Level:

- From the Game menu, choose Easy, Hard, or Very Hard.

To Add a Blue Cell:

- Click the square where you want to add the cell.

To Delete a Red Cell:

- Click the red cell you want to delete.

To Make the Computer Take its Turn:

- Click the mouse anywhere in the window to compute a generation. The computer will take its turn (adding a red square and deleting a blue square) and the next generation will be computed.

To Get a Hint:

- You can ask for a hint whenever it is your move. The mouse pointer is moved to the suggested square.

Related Topics

- Rules of Life
- Overview

Rules of Life

Each square on the Life grid can have up to eight neighboring squares; above, below, left, right, and four diagonal squares. It is the number of neighbors that each square has in one generation that determines its fate in the next. If a living cell is too crowded or too isolated, it dies. If an empty square has just the right conditions, it can spawn new life. Here, then, are the Facts of Life:

1. **A living cell with fewer than two neighbors dies of isolation.**

2. **A living cell with more than three neighbors dies of overcrowding.**

3. **New life is generated in an empty square with exactly three neighbors.**

These are the classic rules for Life. They are all applied simultaneously to determine each new generation. LifeGenesis extends this by allowing living cells to come in two varieties distinguished by their color. The only modification required to accommodate this is an addition to rule 3. In LifeGenesis, the new cell generated is the same color as the majority of its three neighbors.

Edge Effect

These Life rules make no mention of what happens when a pattern grows beyond the edge of the grid. In fact, the rules implicitly assume an infinite grid. Because there are no Windows video drivers for infinitely sized screens, this option is not available, and patterns are subject to what is called the Edge Effect. Some implementations of Life wrap around to the other side of the grid. LifeGenesis uses the Columbus Rule; when patterns expand too far, they just fall off the edge of the world.

This edge effect means that patterns at the edges can have unusual behavior. This is only really interesting mathematically. It's still pretty to watch.

Related Topics

- Playing the Game
- Strategy

Scoring

➧ After each generation, a score is displayed in the right side of the menu bar. There are two numbers. The first is the count of blue cells on the grid (your score in the game) and the second is the count of red cells on the grid (the computer's score in the game).

Strategy

This section contains helpful hints for playing LifeGenesis successfully.

- To succeed at the Game of Life, you need to develop a feeling for how the patterns evolve. Spend some time exploring Life by drawing your own patterns, or studying and modifying the built-in ones. Use F3 to step through the generations one at a time, and look for patterns that are inherently stable, or are very fragile.
- As a human, you have two advantages over the computer. One is that you get to go first. New players especially have a hard time winning once the computer gets the upper hand, so make that first move count. The other is that you can identify patterns, while the computer doesn't even try to do that. As you gain experience, you will begin to notice familiar shapes that work.
- If there are many cells on the grid, it can become very difficult to figure out all the possibilities. Try to keep the number of cells down.
- Watch what the computer does on its turn. On the Very Hard skill level in particular, it can come up with some clever ideas. This is useful for learning how to get out of tight spots, or how to destroy whole patterns with a single move. But remember, the computer has no long-term strategy and it will often keep making the same stupid mistakes.

Related Topics

- Playing the Game
- Rules of Life

How to Play

This section contains information about how to play LifeGenesis.

Commands

This section contains information about commands in LifeGenesis.

Game Menu Commands

This section contains information about Game menu commands in LifeGenesis.

New Game

Starts a new game of LifeGenesis.

End This Game

Ends the game and returns you to the Life Generator.

Easy, Hard, Very Hard

Lets you choose the difficulty level for the LifeGenesis game.

Hint

Gives you a hint where you can add or delete a cell.   You can ask for a hint whenever it is your move.

Life Menu Commands

This section contains information about the Life menu commands in LifeGenesis.

Next

Computes one generation of cells according to the Rules of Life.

Go

Computes continuous generations of cells. This will continue until either all the square die, or until a stable pattern (called a Still Life) is formed.

Stop

Halts the computing of generations.

Clear

Clears the grid of all cells.

Random

Distributes cells at random over the grid.

Patterns

Displays one of a number of interesting patterns on the grid.

Options

Lets you determine the grid size and speed of generations. Also lets you choose whether to display grid lines.

Exit

Exits LifeGenesis. You can exit LifeGenesis at any time.

Patterns

LifeGenesis includes some built-in Life patterns you can explore. Some are interesting, some are just pretty. One is the answer to a mathematical puzzle. You can play around with these as is, or use them as a starting point for your own experiments. You can use the mouse to add your own cells to the existing pattern, or delete some cells by double-clicking.

Traffic Lights

This pattern starts as a simple row of five cells. After only a few generations, it becomes four blinkers arranged in Traffic Lights.

Honey Farm

After 14 generations, this becomes a still life; four honey combs arranged in a Honey Farm.

Oscillators

These are patterns that after a few generations, return to their starting configurations. The one in the top left is called a Figure Eight. It looks like an "8" and it also has a period of 8. That is, it takes 8 generations to return to its original form.

The pattern in the top right is called Tumblers. After 7 generations, it returns to the original shape, only it is upside down. After another 7 generations, it is right side up again.

The two bottom configurations are just pretty designs. The one on the left has a period of 3, the one on the right has a period of 5.

Pulsar

Pulsar starts as a simple pattern with two-way symmetry. It gradually develops four-way symmetry and settles into an impressive oscillator with a period of 3.

Gliders

Gliders are simple five-cell patterns with an interesting property: after four generations they return to their original shape, having moved one square diagonally. Two Gliders in the corners fly towards each other and crash. The pattern in the center is a Glider generator. It sends Gliders flying toward the other two corners. These gliders would continue to fly forever were it not for the edge effect which causes them both to become blocks.

Spaceships

Spaceships are similar to gliders except that they fly straight instead of diagonally. Three Spaceships are displayed; a light-weight, a middle-weight, and a heavy-weight. They are identical except for their lengths. Again, the edge effect prevents their infinite flights. One becomes a Glider, one becomes half a Pulsar, and one disappears.

Eater

The Eater is an interesting discovery. It has the amazing property of being able to swallow incoming Gliders and Spaceships and return to its original shape. A Spaceship flies straight down and a Glider floats in diagonally toward the Eater. They both meet the same fate.

Virus

Virus shows how delicate the balance of Life can be. A stable pattern of blue blocks is disrupted by a single red Virus which gradually eats away at all the blocks around it. Experiment by trying this with larger grid sizes, and placing the red virus in different locations. Remember that you can delete any cell by double-clicking on it.

Glider Gun

The Glider Gun put to rest the question of whether Life patterns, on a theoretical infinite grid, could grow to an unlimited size. (Gliders move arbitrarily far away, but the number of cells doesn't continue to increase.) The answer is yes, and the proof is the Glider Gun. This oscillator eventually cycles through a repetitive pattern, but through each cycle, it throws off a Glider. The longer it runs, the more Gliders are born and let loose. To prevent Gliders from eventually overrunning your computer, this example has another Eater which gobbles up Gliders as fast as the Glider Gun can generate them.

History of Life

The world first learned of John Conway's Life rules when they were presented in Martin Gardner's "Mathematical Games" column in the October 1970 issue of *Scientific American*.   That and a follow-up article in February 1971 were enough to start amateur and not-so-amateur mathematicians scrambling to find new and interesting Life patterns and properties.

Remember that this was before the dawn of personal computers, so much of the early work was done by hand on paper and on Go boards.   Early questions concerned topics like the eventual fate of various initial patterns.   The famous "R Pentomino" is a five-cell pattern that finally settles down to an oscillator after 1,103 generations.   Such long-lived patterns are called Methuselahs.   A seven-celled Methuselah called Acorn lives for over 5,000 generations.

Other questions surrounded the theoretical existence of a Garden of Eden pattern, one that has no possible ancestor.   Early proofs determined that such a pattern must exist within a grid 10,000,000,000 squares on each side.   By 1974, two had been found, one of which has only 226 cells.

A newsletter devoted to Life research called Lifeline was published from March 1971 to September 1973.   Articles on Life appeared in Byte magazine, IBM Research Reports, and even Time magazine (January 1974).

If you'd like to learn more about Life, a good place to start is Martin Gardner's "Wheels, Life and Other Mathematical Amusements" published in 1983 by W. H. Freeman and Company.

Edge Effect refers to what happens when life patterns extend beyond the edge of the grid.   In LifeGenesis, cells just disappear and are no longer counted when calculating new generations.