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General Information

The Life game was created by John Horton Conway.   Conway was a mathematician at Gonville and Caius College of the University of Cambridge.   One of the first publications of the rules for this algorithm was made in the Mathematical Games feature of Scientific American some years ago.

Written well before the era of personal computers, the Scientific American article suggests using a checkerboard and checkers or poker chips to represent the Life universe.   There have been some advances since then, but Life's rules are still the same.   This present application is an elaborate adaptation of Conway's idea.

This adaptation of the Life game was written originally by Steve Emmons at Micrografx. Michael Harrison made substantial modifications.   David M. Wilson enhanced the performance.   This on-line information was written by Derrel R. Blain.

For a complete description of how the Life game works see Life's Rules.

Life's Rules

The Life universe, consists of a starting pattern of <u>cell</u> or organisms within a framework of adjacent squares.   These cells are born, die, or survive for each step or <u>generation</u> according to a set of simple rules.

Conway's original rules, to which this application conforms, are as follows:

Survivals

Every cell with two or three neighboring cells survives until the next generation.

Deaths

Cells with four or more cells adjacent to them, in any single generation, die from overpopulation.   Every cell with one or fewer neighbors dies from isolation.

Births

Each empty cell which is next to exactly three neighbors will experience a birth in the next cycle.

How The Game Proceeds

The game begins with an initial population or pattern which you create using the mouse by clicking on cells in the Life universe.   At each step or generation, all births and deaths within the Life universe occur simultaneously according to the rules listed above.   The cycles or generations continue until there is no change in the <u>pattern</u>.

Example

In the example pattern below, you can see three succsesive generations of three different cell groups.

First Generation

Our example begins with a pattern of three isolated groups of cells.   Each of the cells is colored red to signify that it is a new cell.
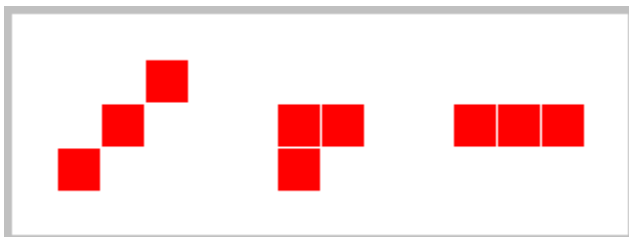

Second Generation

Notice the changes in this second generation.   Each of the cells that remain from the preceding generation are colored blue.   Cells that were born in this generation are colored red.   Two cells in the left group have died from isolation.   In the middle group, a

new cell has been born.   In the right group two cells died and two others were born.
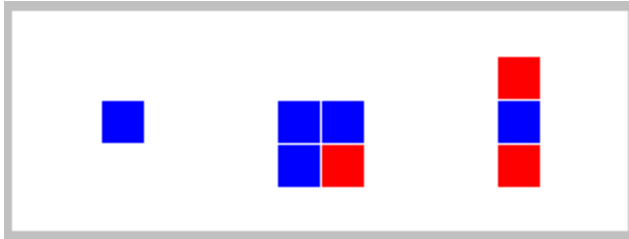
Third Generation

In this third generation, all the cells in the left hand group have expired.   The group in the middle has reached a stable condition and will remain in this state as long as the Life universe continues.   You can see that the cells at the right are now at the same state in which they were prior to this generation.   This particular pattern will continue to oscillate with a period of two steps for as long as the Life universe continues to cycle.
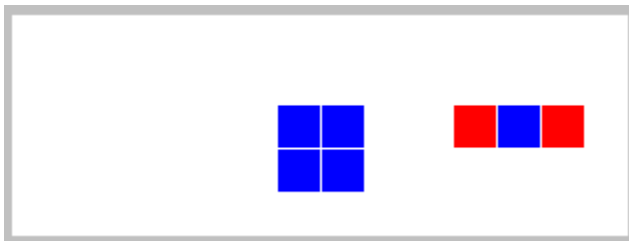
Other Patterns

The files distributed with this application include other examples of both stable and oscillating patterns.   Some patterns oscillate with a long period of several steps.   Others, named "Walkers" or "Gliders", actually move across the Life universe by replicating and shifting themselves using several steps.

File

The commands in this menu enable you to import and export <u>patterns</u> as files.   Export will write a cell pattern to disk.   Import will read a pattern file from disk.

The command available in this menu are :

<u>Import</u>
<u>Export</u>

Import

Use import to read a <u>cell</u> <u>pattern</u> file from disk.

To Import a pattern:

1.   Select Import in the File menu.
2.   Either select a pattern file name with the mouse or enter the valid name of a pattern file in the dialog box.
3.   Move the cursor to the upper left corner of the area in which you want the imported pattern to be pasted.
3.   Click the mouse button.

Export

Use Export to save a portion of Life's <u>cell</u> <u>pattern</u> as a file.

To Export a pattern to a file:

1. Select Export.
2. Place the cursor at one corner of the area to be saved.
3. Click and drag the cursor to the opposite corner of the pattern area.   The Life game will display a square around the selected area as you click and drag.
4. Release the mouse button.

Edit

The commands in this menu enable you to modify the displayed pattern.   Changes may be made to the displayed pattern at any time when the Life universe is not cycling though successive generations.

They are:

Copy
Cut
Paste
Move
Delete

Copy

Use Copy to copy an area of the displayed cell pattern to the Clipboard.   The pattern on the display is not changed.   The cell pattern is saved to the in a binary format intelligible only to the Life application.   You will not be able to view the pattern in the Clipboard with another application.

To Copy a pattern:

1.   Select Copy in the File menu.
2.   Place the cursor at one corner of the pattern area to be copied.   This may be only a portion of the complete Life universe displayed.
3.   Click and drag the cursor to the opposite corner of the pattern area.   The Life game will display a square around the selected area as you click and drag.
4.   Release the mouse button.

Cut

Moves a <u>pattern</u> to the <u>Clipboard</u>, replacing the previous Clipboard contents.   The pattern on the display is removed.

To Cut a pattern:

1.   Select Cut.
2.   Place the cursor at one corner of the pattern area to be Cut.
3.   Click and drag the cursor to the opposite corner of the pattern area.   The Life game will display a square around the selected area as you click and drag.
4.   Release the mouse button.

Paste

Inserts the pattern from the Clipboard at the cursor.   A pattern must have been cut or copied to the Clipboard previously.

To paste a pattern from the Clipboard:

1.   Select Paste from the Edit menu.
2.   Place the cursor in the Life universe where the upper left corner of the pasted pattern should begin.
3.   Click the mouse.

How the cells from the Clipboard are pasted into the displayed pattern depends on the options Toggle, Alive, and Dead.

If Toggle is currently selected, then any place where one cell would be pasted over another, the cell is dead after the paste.   Any place where only one cell is pasted, the cell remains alive.   Dead cells are not changed.

If Alive is currently selected, then any place where a cell is to be pasted is marked as alive. Alive cells from   the previous pattern are not changed.

If Dead is currently selected, any place where one cell is pasted over another is marked as dead.   Other cells are not changed.   No new cells are made alive.

Move

Move enables you to select a portion of the displayed to be moved within the display.   The moved pattern is also copied to the Clipboard.

To Move a pattern:

1. Select Move from the Edit menu.
2. Place the cursor at one corner of the area to be moved.
3. Click and drag to the opposite corner of the pattern to be moved.
4. Release the mouse button.
5. Move the cursor inside the box bounding the selected area.
5. Click and drag the box to the area where the moved pattern should be pasted.
6. Release the mouse button.

Delete

Deletes a portion of the displayed pattern.   The contents of the Clipboard are not changed.

To Delete a pattern:

1.   Select Delete from the Edit menu.
2.   Place the cursor at one corner of the pattern area to be deleted.
3.   Click and drag the cursor to the opposite corner of the pattern area.   The Life game will display a square around the selected area as you click and drag.
4.   Release the mouse button.

Options

The menu selection available under the Options menu enable you to customize some of the operations of the Life game.

Clear
Dimensions
Toggle
Alive
Dead

Clear

Use Clear to eliminate all living <u>cells</u> from the displayed <u>pattern</u>.

Dimensions

Use Dimensions to change the size of the Life universe.

To use Dimensions:

1. Select Dimensions in the Options Menu.
2. Enter a new number for the horizontal cells.
3. Enter a new number for the vertical cells.
4. Select OK or Cancel

If there are any living cells in the Life universe before the dimensions are changed, these will be eliminated.

Toggle

Use the Toggle option to change the manner in which <u>cells</u> clicked on with the mouse behave.   If the Toggle option is selected, clicking on a living cell will cause it to die and clicking on a dead cell will cause it to be marked as alive.

Alive

Use the Alive option to change the manner in which cells selected with the mouse behave. If the Alive option is selected, clicking on any cell, living or dead, will cause that cell to be marked as alive.

Dead

Use the Dead option to change the manner in which <u>cells</u> selected with the mouse behave. If the Dead option is selected, clicking on any cell, living or dead, will cause that cell to be marked as dead.

Step

Use Step to cause one cycle or generation of the Life universe.

Start

Use Start to cause the Life universe to cycle through successive generations automatically.

Stop

Use Stop to cause the Life universe to discontinue its generation.

Cell

A cell is one of the spaces within the life universe.   Cells may be either alive or dead.   Dead cells are not displayed.

Clipboard

The Clipboard is a temporary storage area.

Pattern

A pattern is a collection of living <u>cells</u>.

Generation

A generation or step occurs when all the rules for birth, life, and death are applied to all cells within the Life universe simultaneously.

Click and Drag

To Click and Drag means to place the cursor at some beginning position, hold down a mouse button (usually the left button), then move the cursor to a new position while holding the mouse button down.