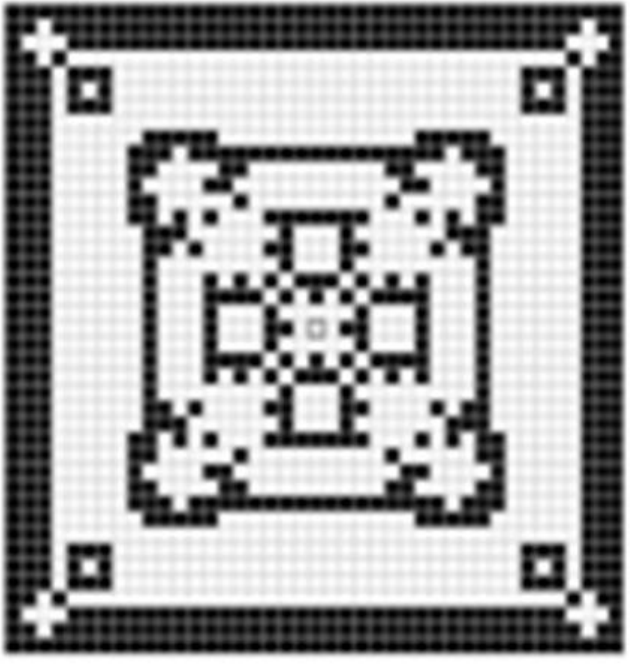
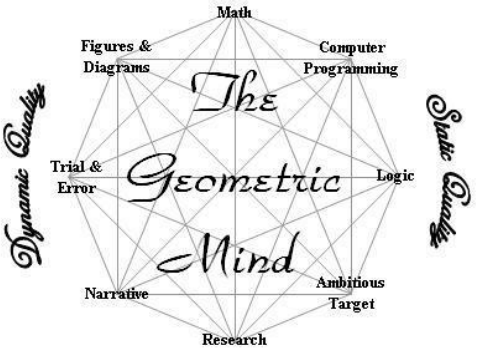
THE GEOMETRIC MIND SERIES
an *auto*SOCRATIC QUICK-START publication

The Game of Life

An Introduction to John Conway's "Game of Life"





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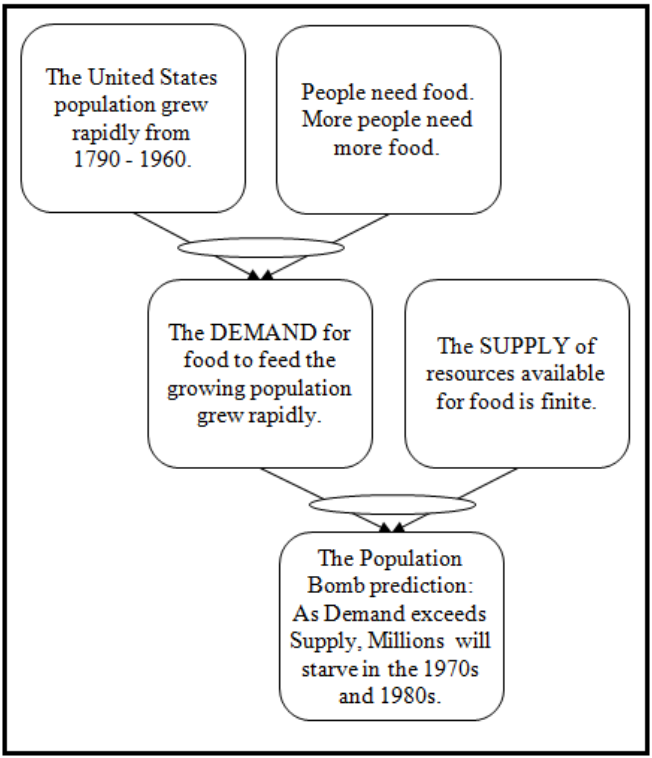
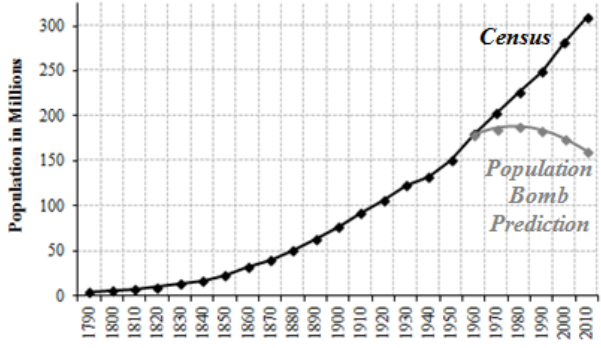
THE POPULATION BOMB

A 1960s Prediction on Population, Supply and Demand



THE USA POPULATION

It's Now 2013 … WHAT HAPPENED?

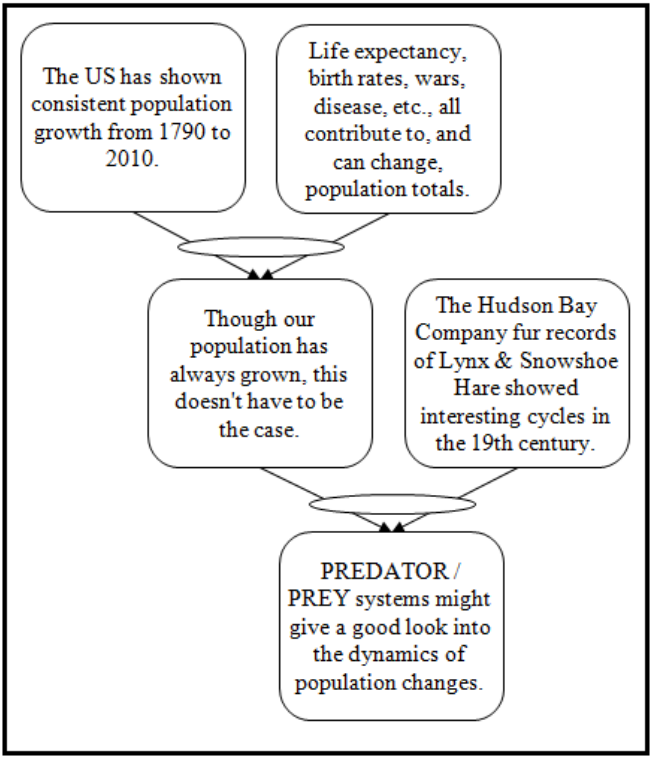


There was no "Population Bomb", obviously.

However …

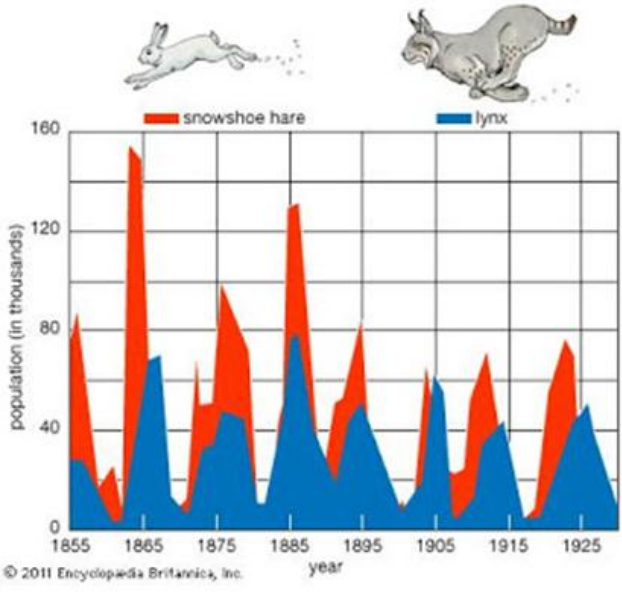
A NAGGING THOUGHT

Is This ALWAYS How Population Changes Over Time?



THE LYNX AND THE HARE

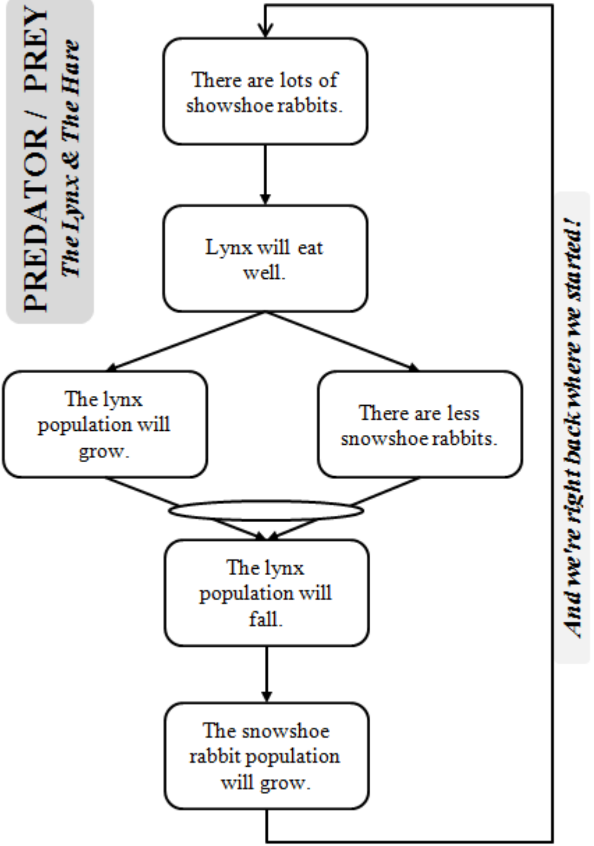
The Ebbs and Flows of Predator / Prey Populations



What is going on here?

PREDATOR / PREY

The Lynx & The Hare



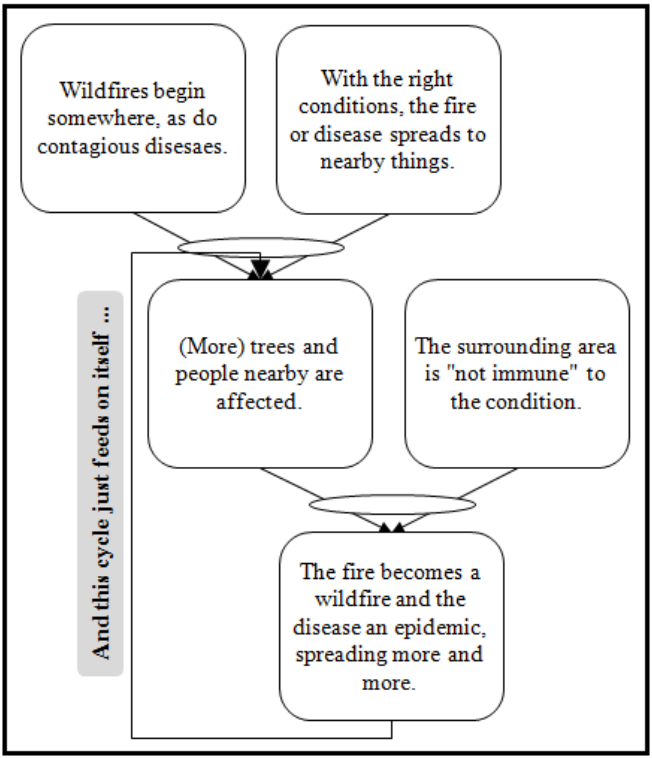
…

Dynamic Change

A Few More Examples

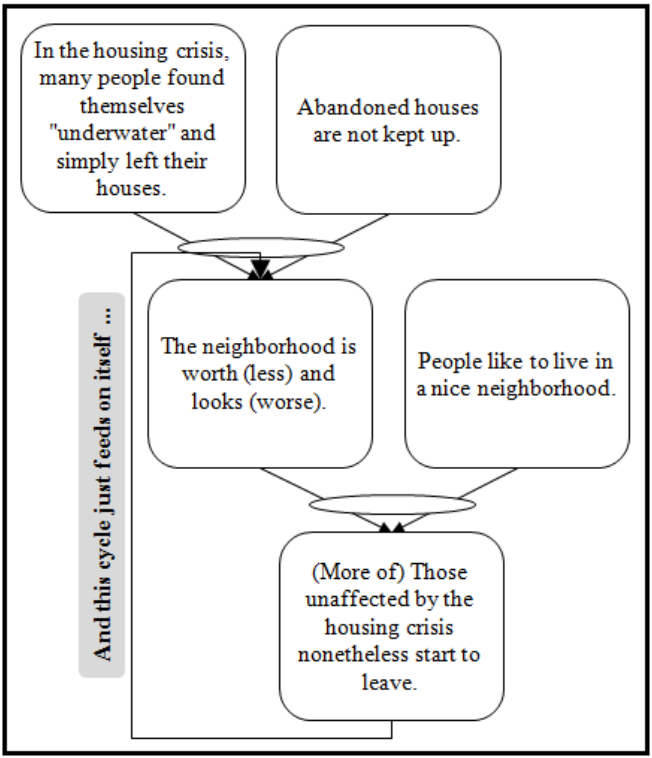
WILDFIRES AND DISEASES

How Do Things Spread?



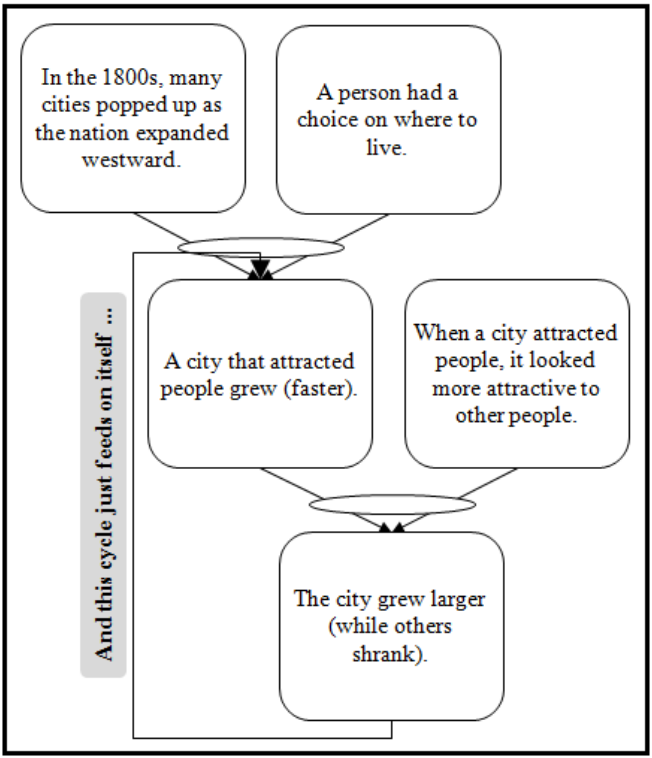
NEIGHBORHOOD DECLINE

How Does a Neighborhood Become Less a Neighborhood



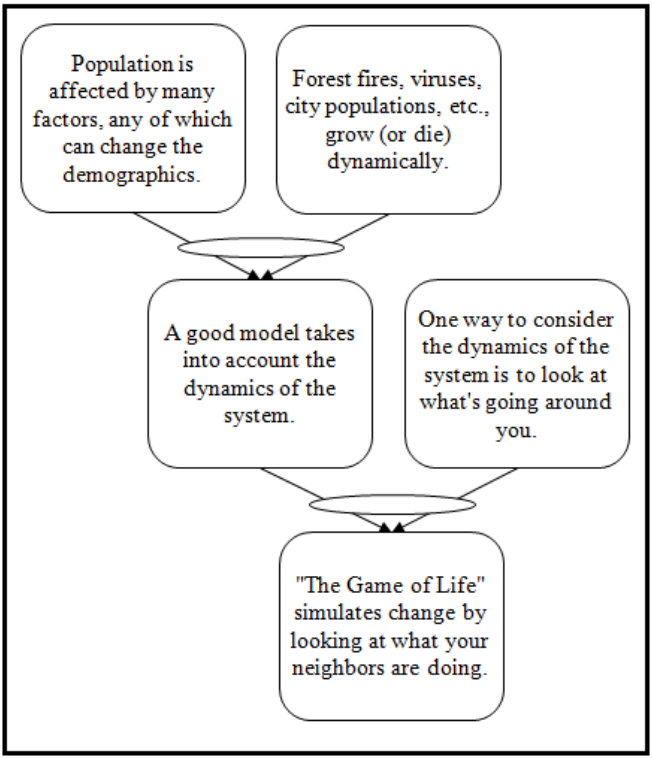
A CITY'S DECLINE

How Does A City Lose Population?



WHAT IS A GOOD MODEL?

A Good Model Considers the Dynamic Nature of Change



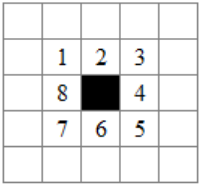
The Game of Life

Simulation of Life – Death – and Everything In-between

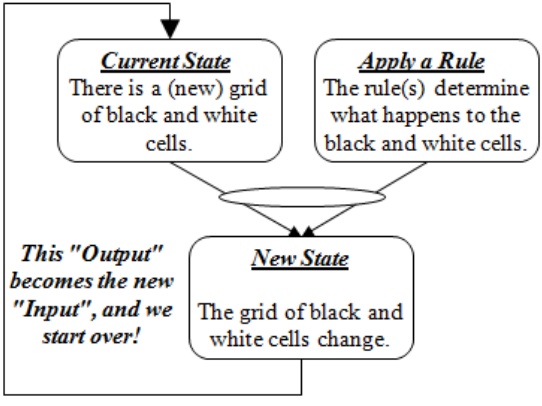
THE GAME OF LIFE

An Introduction

Consider this black cell. Let's say it's on fire. Every cell has eight neighbors. *What would happen to them?*



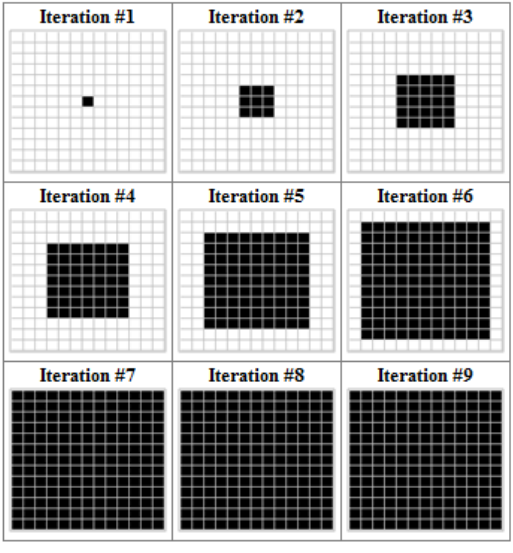
How the System Changes



A SPREADING SYSTEM

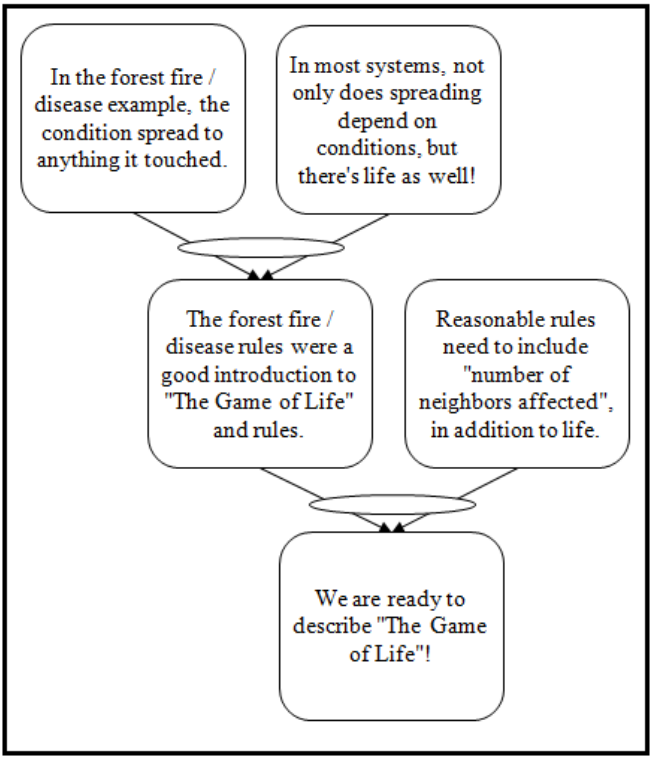
A Forest Fire or a Disease

FROM A SINGLE SPARK / GERM ...
How Do This Change Over Time?



A SIMPLE RULE

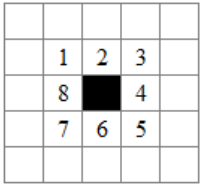
From a Good Introduction to "The Game of Life"



THE GAME OF LIFE

How the Game Works …

I am a black cell, and I have eight possible neighbors ...



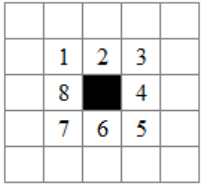
THE GAME OF LIFE RULES

What happens to me depends on how many neighbors I *actually* have:

IF I HAVE …	I AM …	SO I …
too many neighbors	overcrowded	die
too few neighbors	lonely	die
a reasonable # of neighbors	content	survive
have room to grow	excited	grow

THE GAME OF LIFE

How the Game Works …



IF I'M ALIVE (BLACK CELL)

and I have 4 or more neighbors, then I die of overcrowdedness (change to WHITE CELL).

and I only have 0 or 1 neighbors, then I die of lonliness (change to WHITE CELL)

and I only have 2 or 3 neighbors, then I remain alive (stay BLACK CELL)

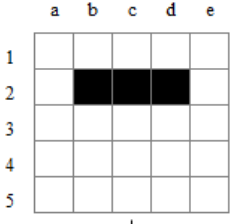
IF I'M NOT ALIVE (WHITE CELL)

and I have exactly three neighbors, then I come to life (change to BLACK CELL)

A SIMPLE EXAMPLE

The Game of Life

My Starting Grid

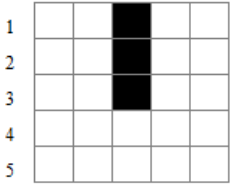


My Decisions

cell	neighbors	status
b2	1	dies
c2	2	lives
d2	1	dies

cell	neighbors	status
c1	3	grows
c3	3	grows

My Next Grid



My Decisions

cell	neighbors	status
c1	1	dies
c2	2	lives
c3	1	dies

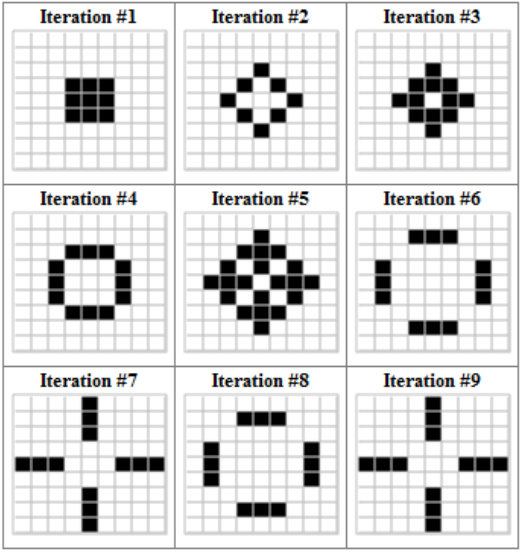
cell	neighbors	status
b1	3	grows
d1	3	grows

A 3 x 3 GRID

The Game of Life

3 x 3 GRID STARTING POINT

How Does This Change Over Time?



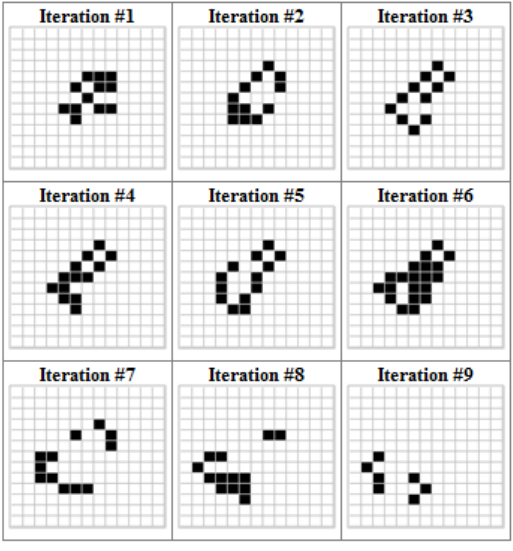
At some point, this becomes a "Blinker", like changing from "heads" to "tails"and back to "heads" again!

A RANDOM STARTING GRID

The Game of Life

3 x 3 RANDOMLY FILLED GRID STARTING POINT

How Does This Change Over Time?

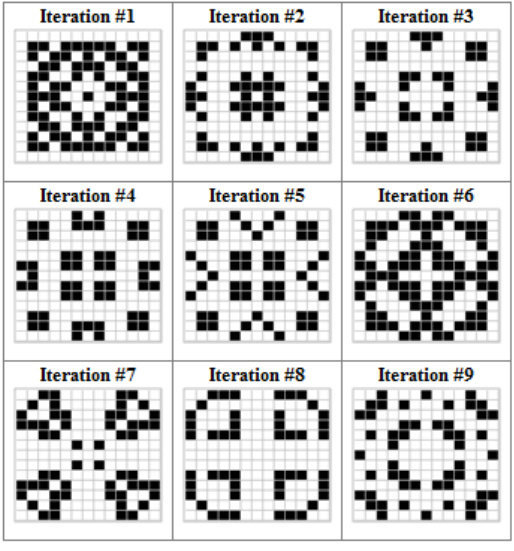


SYMMETRIC STARTING GRID

The Game of Life

SYMMETRICALLY FILLED GRID STARTING POINT

How Do This Change Over Time?



JOHN CONWAY

THE GAME OF LIFE

The process described here is a recent development in math. Things like this are now possible – easily – because of the computer.

In 1970, John Conway discussed this structure, called The Game of Life, dealing with individual entities. The movement of the entities – *cellular automata* – spawned a unique structure for possibly understanding the nature and operation of the universe – to be explored in a later issue!

PROBLEMS

The following three problems each have a CHECK (to make sure you've done the problem right).

Once you've confirmed you've done the problem right, there's a KEY. The key is necessary to unlock the next installment.

Key1

Key2

Key3

PROBLEM 1

PROBLEM 2

PROBLEM 3

CONCEPT CARD