Model Thinker Topics

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John Conway's Game of Life

- The Game of Life is a cell replication simulation created by John Conway. Depending on the initial placement of cells, patterns may be created.
- The Game of Life abides by the following mathematical rules:
  - For a space that is populated:
    - Each cell with one or no neighbors dies, as if by solitude.[1]
    - Each cell with four or more neighbors dies, as if by overpopulation.[1]
    - Each cell with two or three neighbors survives.[1]
  - For a space that is 'empty' or 'unpopulated':
    - Each cell with three neighbors becomes populated.[1]
- Simulation can be found **here.**

1

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[1]https://bitstorm.org/gameoflife/

The Simpson's Paradox

- ▶ The Simpson's Paradox happens when the average of each of multiple groups of data is higher than the corresponding average of other groups of data, but the overall averages between the sets of the different groups shows a different trend.
- ▶ The formal definition is shown by the following formula.

$$\frac{a_i}{A_i} \leq \frac{b_i}{B_i} \text{ for all } i = 1, 2, \ldots, n \text{ but } \frac{\sum_{i=1}^{n} a_i}{\sum_{i=1}^{n} A_i} \geq \frac{\sum_{i=1}^{n} b_i}{\sum_{i=1}^{n} B_i},$$

- ▶ This paradox occurs when the groups that are compared initially are different sizes.
  - ▶ An exaggerated example is

Day	You	Friend
1	$\frac{998}{1000}$	$\frac{2}{2}$
2	$\frac{0}{2}$	$\frac{2}{1000}$
Overall	$\frac{998}{1000}$	$\frac{4}{1000}$