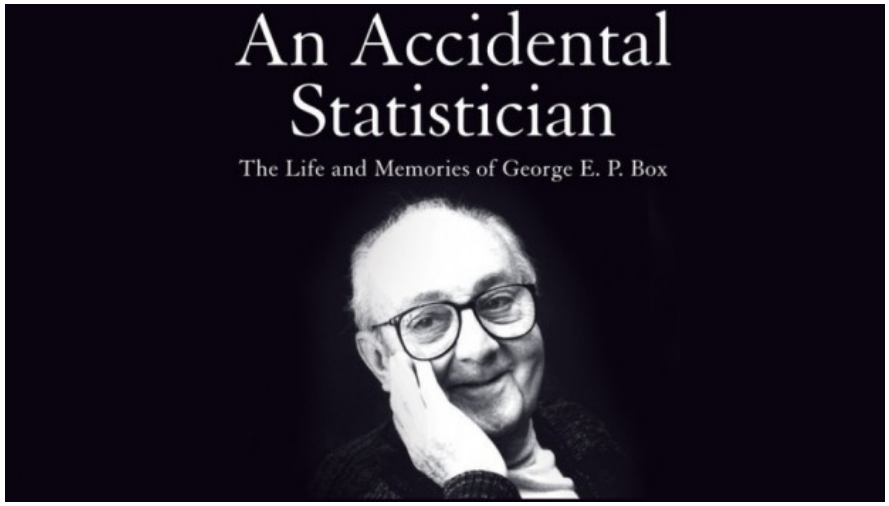
Stochastic Thinking and Random Walks, Segment 3

Simulation Models

- A description of computations that provide useful information about the possible behaviors of the system being modeled
- Descriptive, not prescriptive
- Only an approximation to reality
- "All models are wrong, but some are useful." – George Box

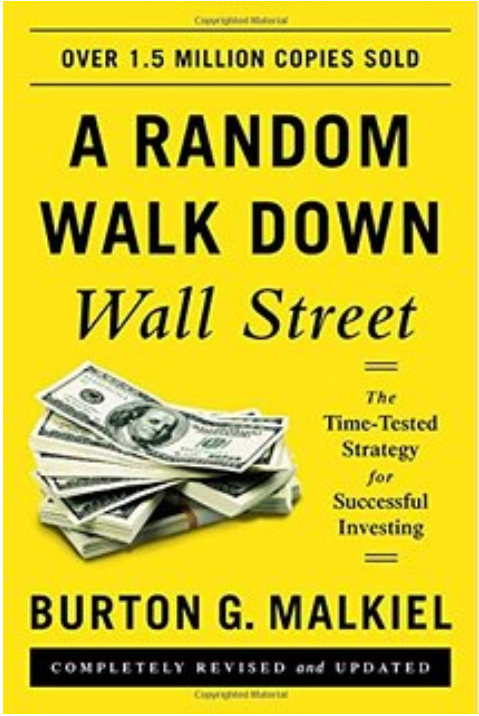


Simulations Are Used a Lot

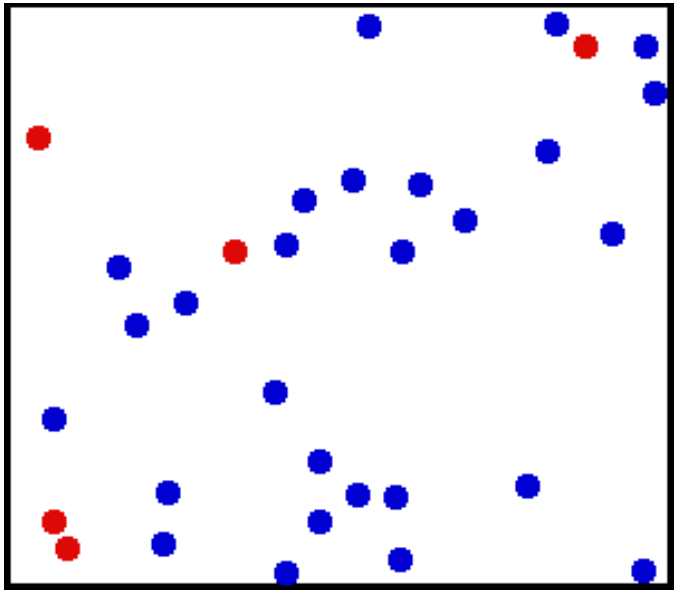
- To model systems that are mathematically intractable
- To extract useful intermediate results
- Lend themselves to development by successive refinement and “what if” questions
- Start by simulating random walks

Why Random Walks?

- Random walks are important in many domains
  - Understanding the stock market
  - Modeling diffusion processes
  - Etc.
- Good illustration of how to use simulations to understand things
- Excuse to cover some important programming topics
  - Using inheritance mechanisms
  - More about plotting

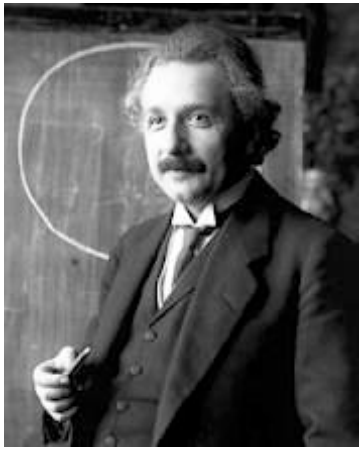


Brownian Motion Is a Random Walk



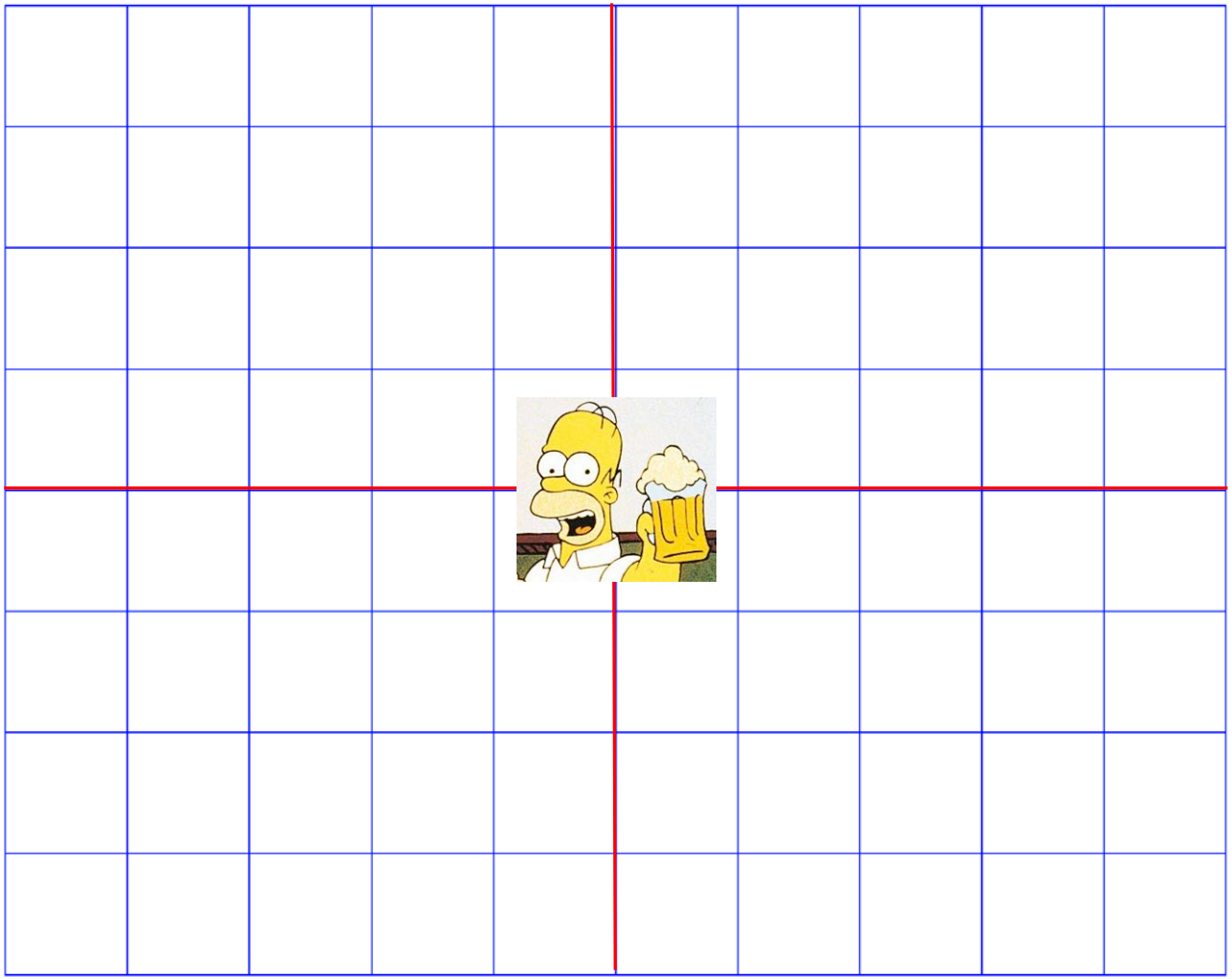
Brown

Bachelier

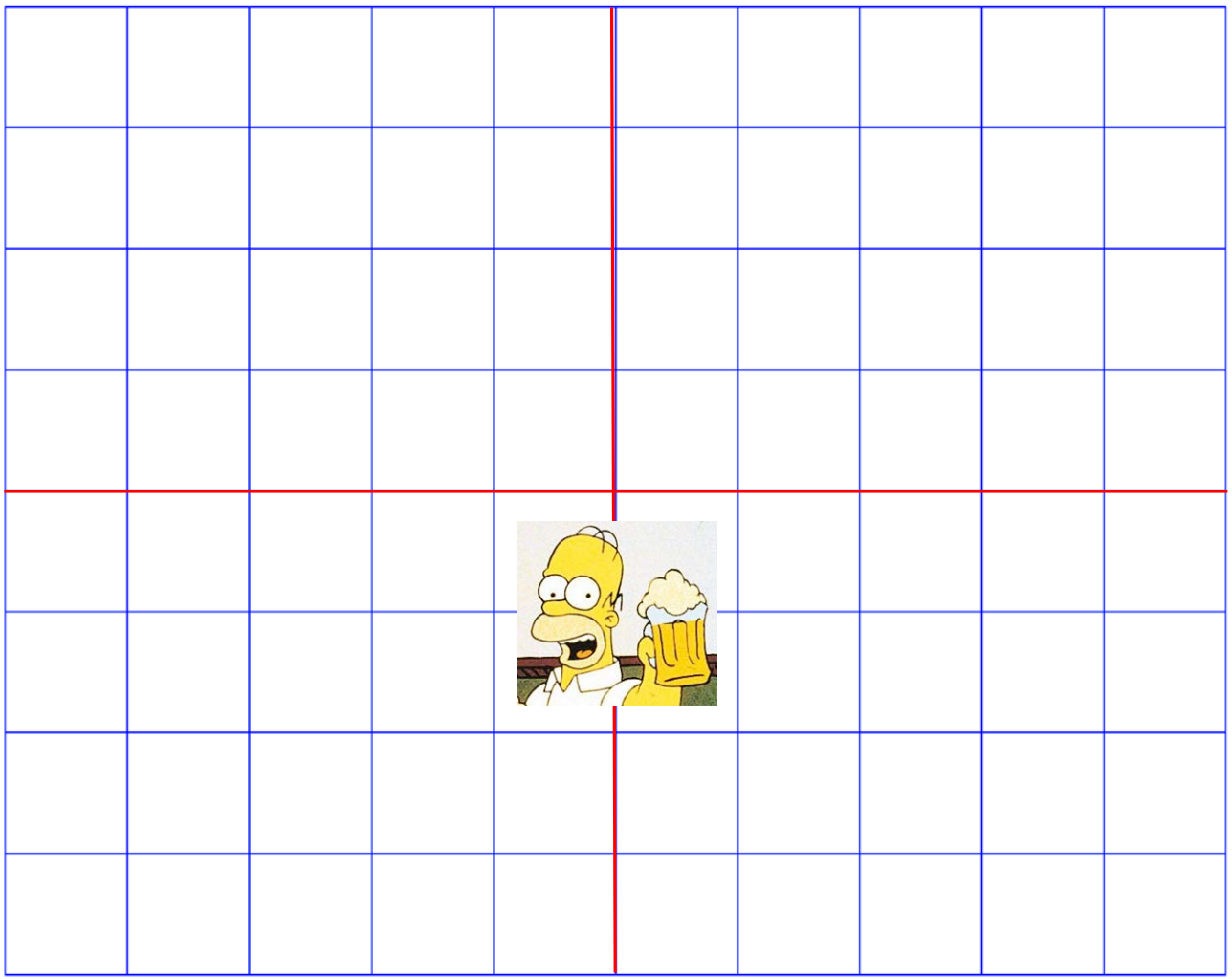


Einstein

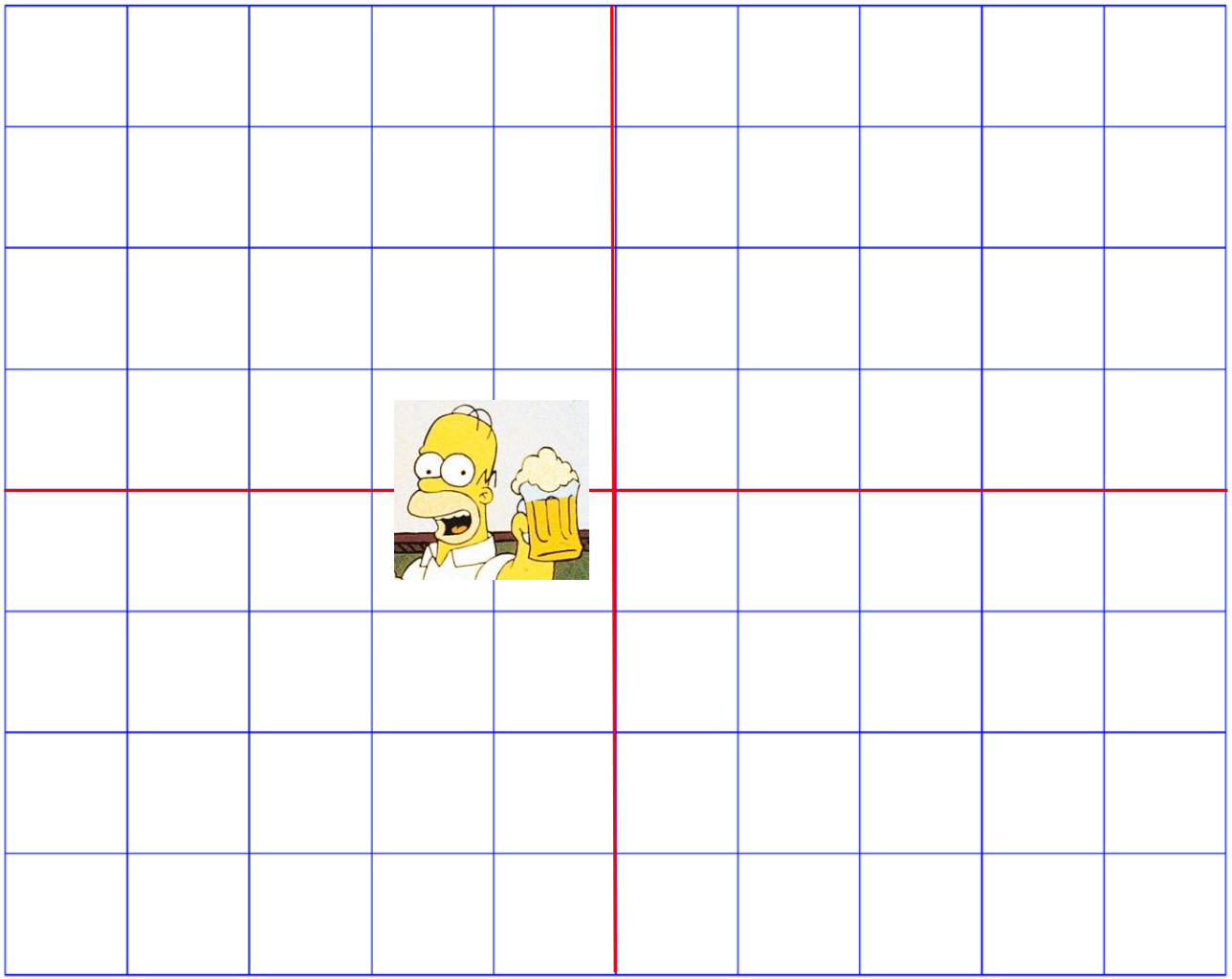
Drunkard's Walk



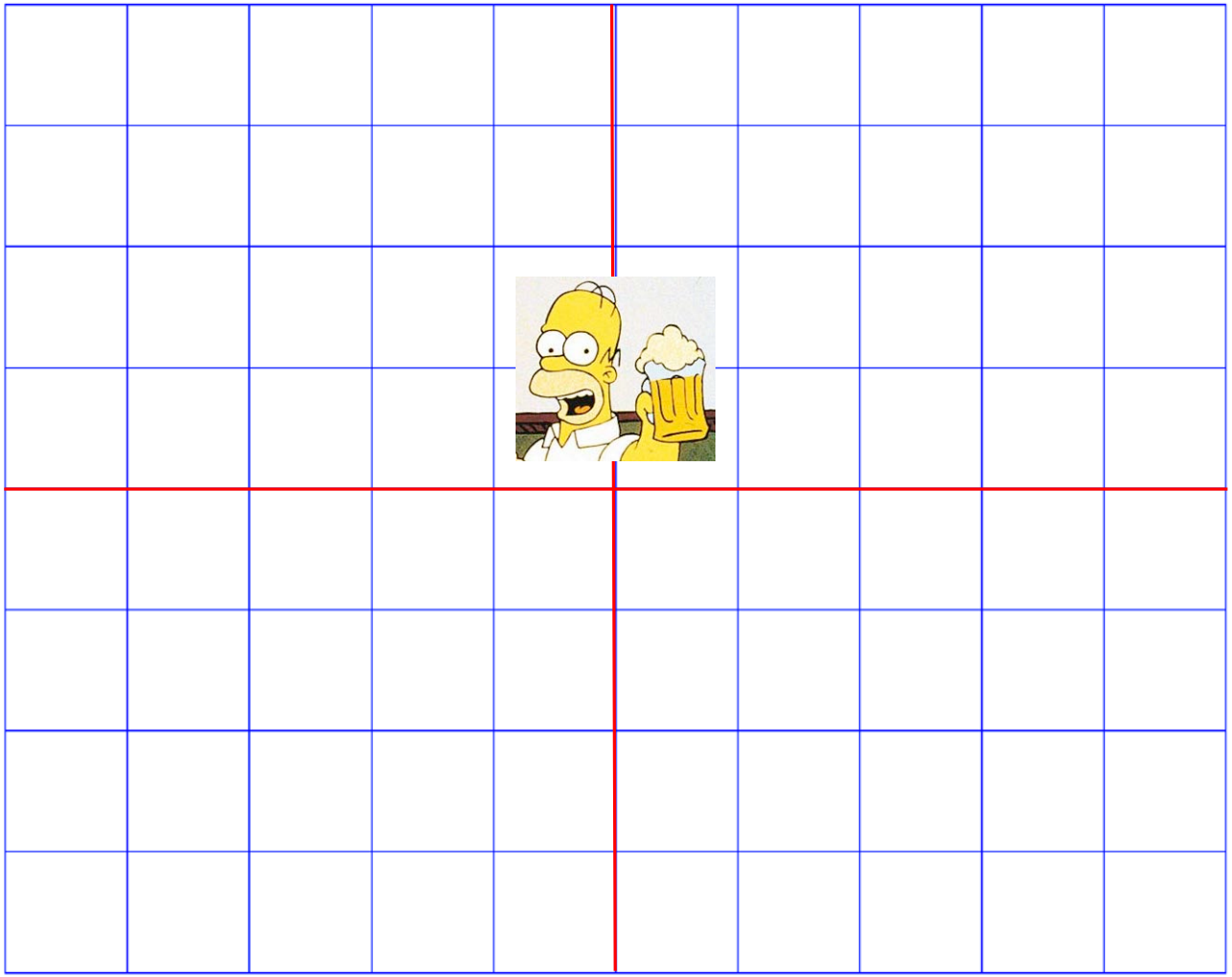
One Possible First Step



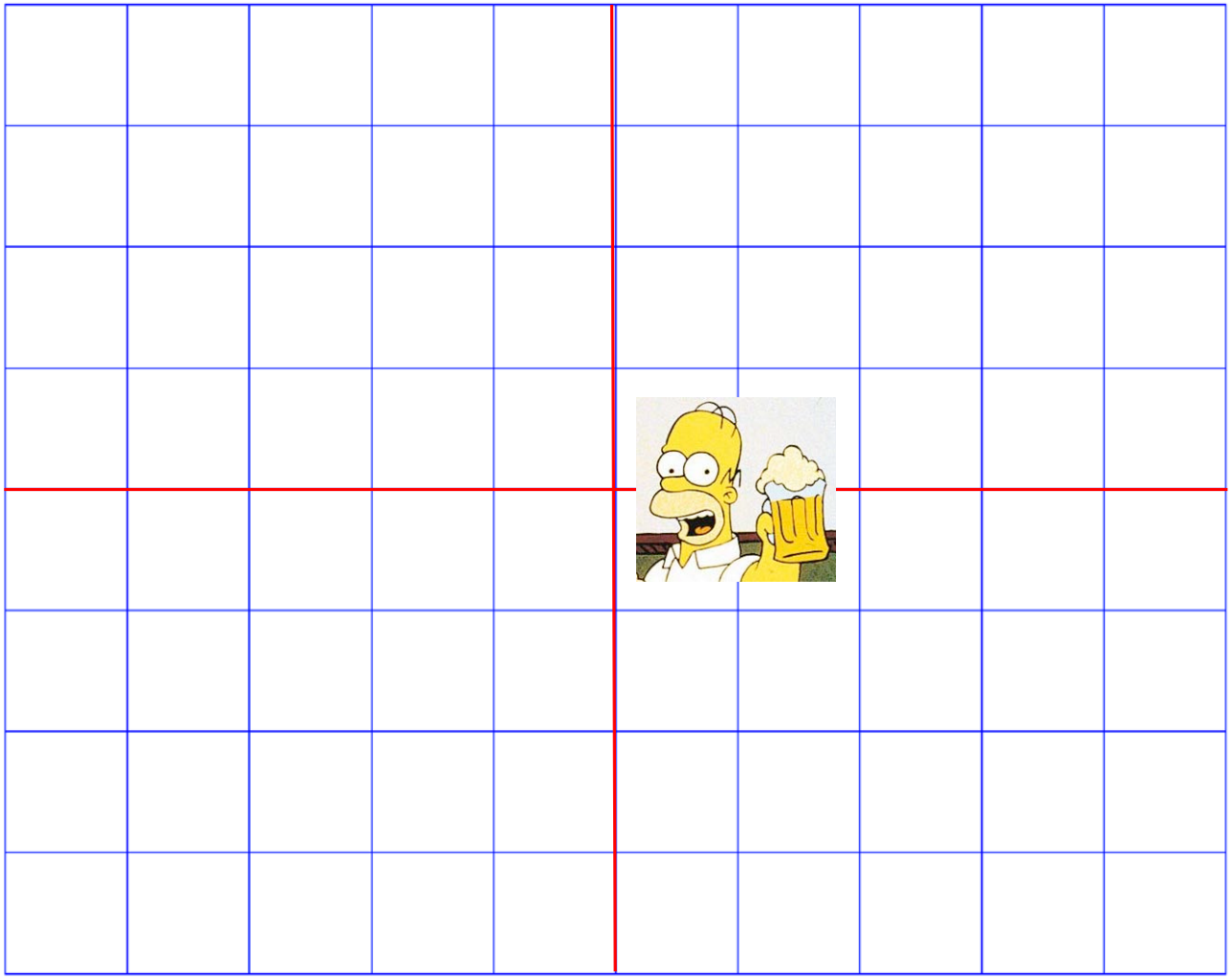
Another Possible First Step



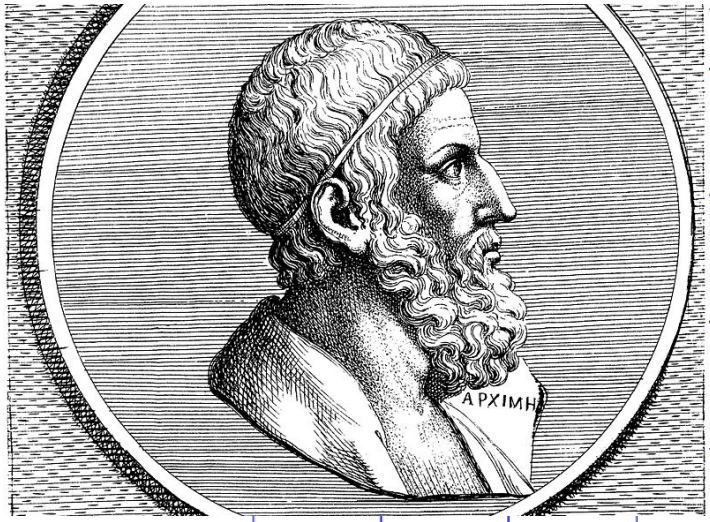
Yet Another Possible First Step



Last Possible First Step



Possible Distances After Two Steps



Expected Distance After 100,000 Steps?

- Need a different approach to problem
- Will use simulation
- But not until the next lecture