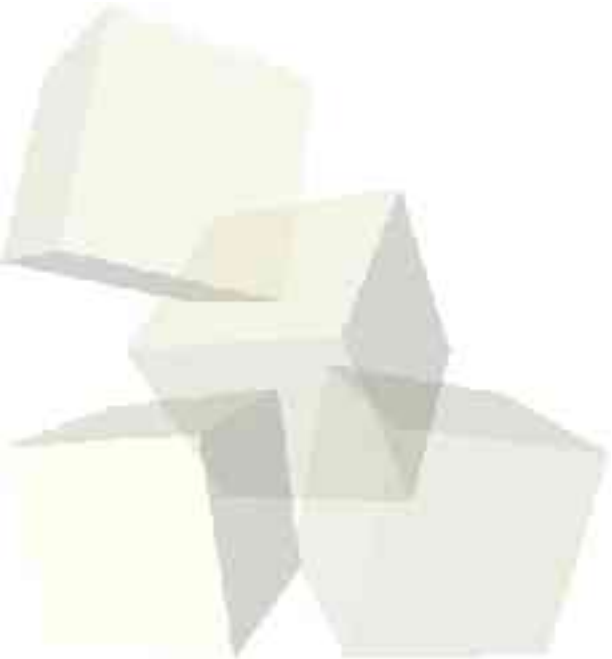
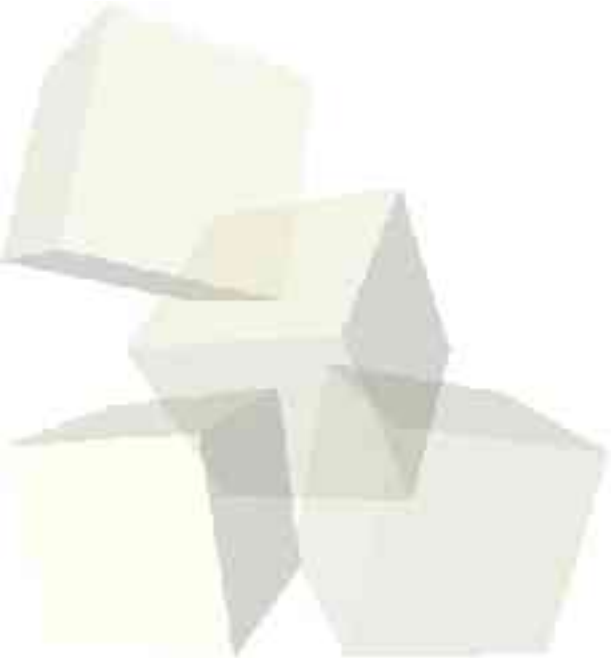
Model Components and Definitions

1-20-2005



Opening Discussion

- What did we talk about last class? Let's go over some of the key concepts of that again.
- How would you define what a simulation is? Can you make that definition formal?



States

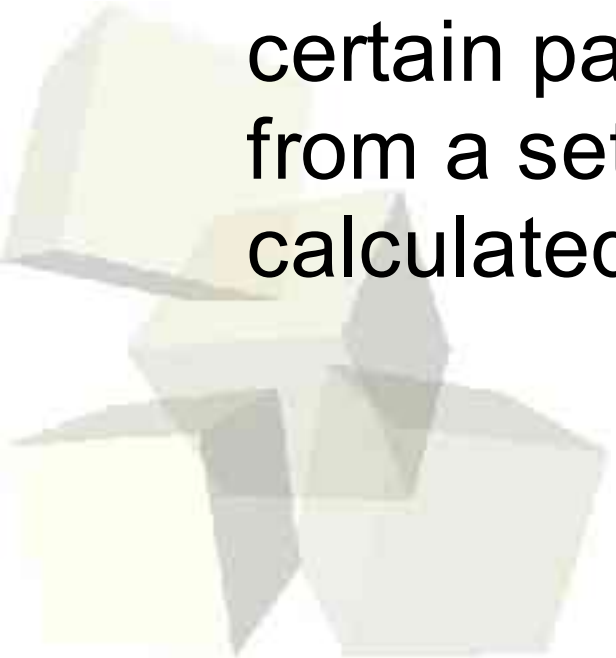
- For any simulation that we might create, we can describe the simulation at any given time as being in a certain state. This is basically the set of values that define what the system is like. If you want, you could view it as a tuple of values.
- For any simulation, there will be a number of allowable states that the simulation can be in. For some styles, this set might be small, for others it is very large. Is it ever infinite?

Events

- Your book defines an event as a combination of a state and a time. It says that the system changes to the provided state at the given time.
- Personally, I don't really like this definition despite the fact that it is good for formal treatments. Instead, you should probably think of an event as a transition of a system from one state to another and that does happen at some time.
- What would be an example of this?

Input and Output

- Our simulations can also take values from outside the system as input. These typically change with time.
- Similarly, we often don't care about the entire state of the simulation but instead on certain parts so the output is often pulled from a set that is a subset of the states or calculated from the states.



Time

- Obviously we need some concept of time in our simulations because their dynamic comes from the idea that their state changes over time.
- One big question though is how the system changes over time. Again, the distinction between continuous and discrete systems can be significant. In reality, everything on the computer is discrete, we make it look continuous by having the events come very close together.

Formal Definition of a Model

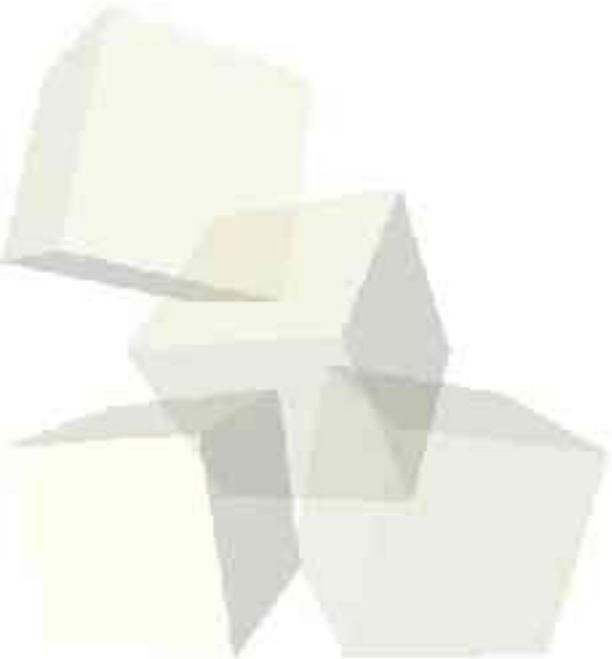
- Your book defines a mode as a tuple that includes the following.
  - Time set : typically integers or reals
  - Input set : the set of things that can be inputs
  - Output set
  - State set : a set of all possible valid states
  - Set of acceptable input functions : these functions map from the time set to the input set
  - A transition function : takes a state, two times, and an input function and generates a state
  - An output function : maps a state to an output

Declarative vs. Functional Models

- Declarative models focus on the states that the machine is it.
- Functional models focus on the events or the transitions from one state to another.
- When giving direction, a map is declarative while the written description of how you drive and turn is functional.

Principle of Locality

- Typically changes in systems are localized and proper implementations of the formal model will only deal with the aspects that are changed.



Minute Essay

- What did we talk about today?