CS 482

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Contents

Chapter 1

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This'll be an interesting class lets hope I can figure out stats.

- building complex models
- algorithmic randomness
- statistically analyzing data

Chuck data into a black box of modelling code and get result data out.

Simulations give the most realistic answers for complex systems that cannot be linearly solved.

Simulation is only good for basically unsolvable problems.

Chapter 2

Terminology

2.1 System

A collection of *entities* that interact with a common purpose according to sets of *laws* and *policies*

example: a store, airport terminal, etc.   most things

2.2 Entities

The components/objects that define a system

Physical or Logical objects

Temporary or Permanent

2.3 Attributes

The traits that define an entity

static or dynamic

qualitative or quantitative
A cashier in a store :

- has a high school diploma (static, qualitative)
- has an IQ of 104 (static, quantitative)
- can be busy or idle (dynamic, qualitative)
- can process customers at a rate from 6/hour to 20/hour (dynamic, quantitative)

2.4 Entity-Attribute Hierarchy

determines the level of detail in the simulation

- Regional Plants
- Production Lines
- Work Areas
- Machines, Tools, Operators

The *level of detail* in the simulation model is set by the entity/attribute hierarchy boundary, which is determined by the *objectives of the study*.

Attributes become entities if you want more detail in a system

The boundary between attribute/entity determines the level of detail in the simulation.

2.5 Laws and Policies

Both Laws and Policies govern the behavior of the system, but Laws cannot be changed while Policies can be changed.

Laws are followed, Policies are set.

2.6 Model

The thing that we're trying to do in this class

A simplification of a system

there are many ways to model a system

1. Events List
2. Difference Equations
3. Markov Chains

2.6.1 State Space

A Collection of variables that represent and measure the condition of the system (busy, idle, broken, etc.)

The state space is the *film* for a photo snapshot of a system.

2.7 Event

An instant of time when one of the following occurs

- the state(s) change(s)

- other events are caused (scheduled) or prevented (cancelled) (i.e. other states change)
- data is collecte dand statistics may be compiled (based on or uses states)

  examples:

- a part arrives
- A machine starts or stops or breaks down
- The end of day of operation

2.8 Process

An indexed set of states of events

Let N_t be hte number of customers in the system at time t

Let B_j be a $0-1$ indicator of whether or not that jth customer does or doesn't get on hold.

2.9 Discrete-Event Simulation

A model where the state S changes at *discrete* points in time

what/when/how/what impact of changes

2.10 Single Server Queue

λ is the rate at which parts arrive

μ is the rate at wich the server can process parts
Number in system = number in queue + number in service.
events schedule other events.

2.11 Building Simulation Models

- define states
- identify when and how the state change
- define events
- define initialization
- ALL simulation models have an initialization event.
- assume a random number generator is available
- a new random variable value must be generated each time a random variable is used or called
- arrival events schedule more arrival events (self-generating)

2.11.1 When executing an event:

- State changes occur first
- Events scheduled or cancelled occur second

Once you have all of the states and changes and whatever, coding the simulation itself is not actually that hard.

hop from most recent event to most recent event until done, changing the event queue as needed.

2.11.2 Dynamic Simulation

Events are scheduled and executed in time sequence

States are changed as each event is executed

Data can be colelcted as events to do stats and math stuff

Know where to collect data and what type of data to collect.