Inventory and Other Topics

1-19-2011

Opening Discussion

- What did we talk about last class?
- Let's talk about the event graph again. We want to consider the system where we make an event to represent going from the line to the service counter.
- Minute Essays:
  - Determining arrival times.
  - Lack of details in the book?
  - Weak minute essay response.
  - Pairing lecture and reading.

Inventory System

- The text runs through an alternate example of a system we could simulate: an inventory system.
- The goal is to compare different approaches to ordering inventory to see which minimizes costs.
- Events
  - Objects demanded
  - Orders arrive
  - Evaluate inventory

Simple Ordering System

- To keep things simple they explore a “simple (s, S) ordering policy”.
  - At the beginning of the month if there are fewer than s items in inventory order enough to get up to S.
- Costs
  - Order/purchase costs
  - Inventory costs
  - Shortage costs

Details

- Again we can use “integrals” to calculate the total cost. These are really just the sum of areas of rectangles.
- Have to pick multiple purchase policies that span the range of possibilities. We then compare the results of those.
- Spanning parameter spaces is hard for high dimensional spaces.

Why Simulate?

- The inventory system requires simulation because while there are obvious trends in different costs as the order procedure is changed, the change in total cost is nearly impossible to predict.
- Needs multiple simulations to get good statistics.

Parallel Simulation

- You typically break a system into separate *logical processes* (LP) and have them send messages between one another.
- Conservative synchronization makes sure no LP gets too far ahead.
- Optimistic synchronization lets things run forward, but potentially has to roll back if a message comes in late.

Steps in Simulation Study

- It isn't just about writing code and running that code.
  - Formulate problem
  - Collect data/define model
  - Check validity of assumptions
  - Write program and verify it
  - Do pilot runs
  - Check if simulated behavior is correct
  - Design experiments
  - Do production runs
  - Analyze data
  - Document/present results

Other Types of Simulation

- Continuous simulation
  - Typically differential equations.
- Combined discrete-continuous simulation
  - You have a continuous system where certain thresholds can trigger events in a discrete manner.
- Monte Carlo Simulation
  - Lots of random events.
  - Static simulation.
- Spreadsheet Simulation

Drawbacks of Simulation

- Stochastic simulations give estimates in a single run.
- Can be expensive to develop.
- It is easy to put too much faith in a simulation.

Pitfalls of Simulation

- Poorly defined objectives
- Inappropriate level of detail
- Failures in communication/understanding
- Acting like it is just programming
- Lack of experienced team members
- Poorly collected system data
- Inappropriate software
- Misuse of animation

More Pitfalls

- Using arbitrary distributions
- Treating answers of a single run as the “true answers”
- Failure to move past transient behavior

Minute Essay

- Did you try to rewrite one of the simulations presented in this chapter in a more OO style? If so, what did you notice about it?