Formulating Models Simply

- Guiding Principle in modeling: “KISS”
  Capture the essence of reality
- Common mistake: Models which are too big
  Lots of input data to collect & analyze
  Run time goes up
  Output analysis gets more difficult
  Harder to understand how system works
- This course: Arena academic version limitations
- Real world: Check client’s comfort level
  Some systems don’t scale well
Simplify – How?

1. **Omit minor details if they’re not essential**
   - Call Center: omit wrong numbers dialed
   - Bank: omit safety deposit box customers
   - Factory: omit machine breakdowns (maybe)
   - Use a *consistent* level of detail in model
Simplify – How?

2. **Aggregate** (Combine)
   - Multiple entities $\rightarrow$ 1 entity
     - **EX:** Ritz Cracker factory – individuals vs. boxes
     - **EX:** Brewery or Winery – bottles vs. cases of 12
   - Level of detail may depend on project goals & desired performance measures
3. **Substitute** the simple for the complex
   
   - Replace multiple process steps by 1 step:
     - Treat 5 short stages of production before the bottleneck as 1 long stage of production
   
   - Assume all resources in 1 place are alike:
     - One resource with multiple units of capacity vs. Multiple resources each with 1 unit of cap.
     - **EX:** Assume all bank tellers are similar
Simplify – How?

4. **Partition**: Model part of the system
   - Study only a few stages of a sequential process:
     - Look at bottleneck station & station that precedes it
     - Simulate the *worst* department in a big company
   - Study only a few of many similar, parallel units
     - Examine 2-3 lines at supermarket, not all 16 lines
Impact of Simplifying

It depends on your modeling goals:

• If trying to carefully estimate actual performance:
  – Simplifying reality may lead to large errors

• If comparing the behavior of 2 systems:
  – Simplifying may not hurt at all, as long as both systems are affected in the same way

• For gaining qualitative insights about system:
  – Simplifying may help you focus your attention on what really matters in the system
Recap

• Build the *simplest* model that will adequately answer all of your (client’s) questions
• Be sure you *understand* the simpler system before you make it more complicated
• Add *complexities* one at a time, so you see their effect on the system
• If a refinement has no impact, why keep it?
• It’s *easier to enlarge* a small model than to shrink a big, complicated one