Modeling and Simulation

Dr. G.H.J. Lanel

Lecture 1

Outline

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What is A model?

A Representation of an object, a system, or an idea in some form other than that of the entity itself.
(Shannon)

Types of Models:

- **Physical:** Scale models, prototype plants, . . .
- **Mathematical:** Analytical queuing models, linear programs, simulation.

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- The model is amenable to manipulation which would be impossible, too expensive, or too impractical to perform on the system which it portrays.
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- Evaluating a new military weapons system or tactics.
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Steps in Simulation and Model building:

1. Define an achievable goal.
2. Put together a complete mix of skills on the team.
3. Involve the end-user.
4. Choose the appropriate simulation tools.
5. Model the appropriate level(s) of detail.
6. Start early to collect the necessary input data.

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- System analyst skills (model formulation).
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- Does anyone believe the results?
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- The End-user (your customer) can (and must) do all of the above BUT, first he must be convinced!
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  - Little or no additional software cost.
  - Universally available (portable).
  - No additional training (Everybody knows(language X)!)
- Disadvantages:
  - Every model starts from scratch.
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- PASCAL: Not as universal as FORTRAN
- MODULA: Many improvements over PASCAL
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  - Interpretive Execution
  - FORTRAN-based (Help blocks)
  - World-view: Transactions/Facilities
- SIMSCRIPT II.5:
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- OPNET: Simulator for communication networks, including wireless networks
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  - E.g., customers at a bank

Terminology: Ctd

- Attribute:
  - a property of an entity
  - E.g., checking account balance
- Activity:
  - Represents a time period of specified length.
  - Collection of operations that transform the state of an entity
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- Pure Discrete Simulation
  - Event-oriented
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Examples of both types of models

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  CPU scheduling model vs. number of students attending the class

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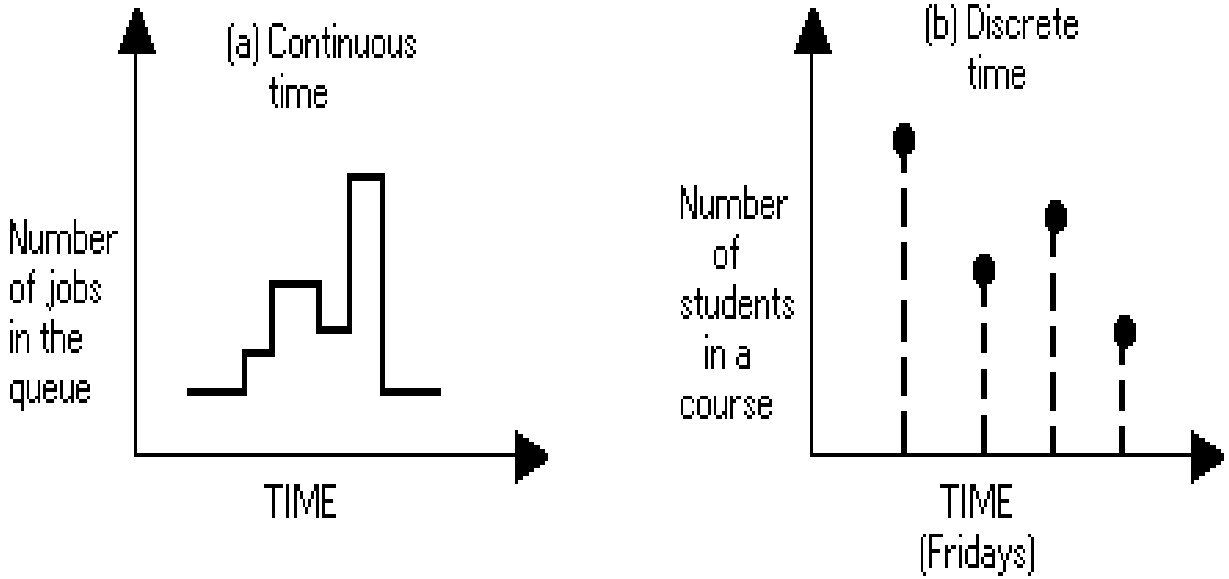

Examples: Ctd

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  Example: Time spent by students in a weekly class vs. Number of jobs in Q.

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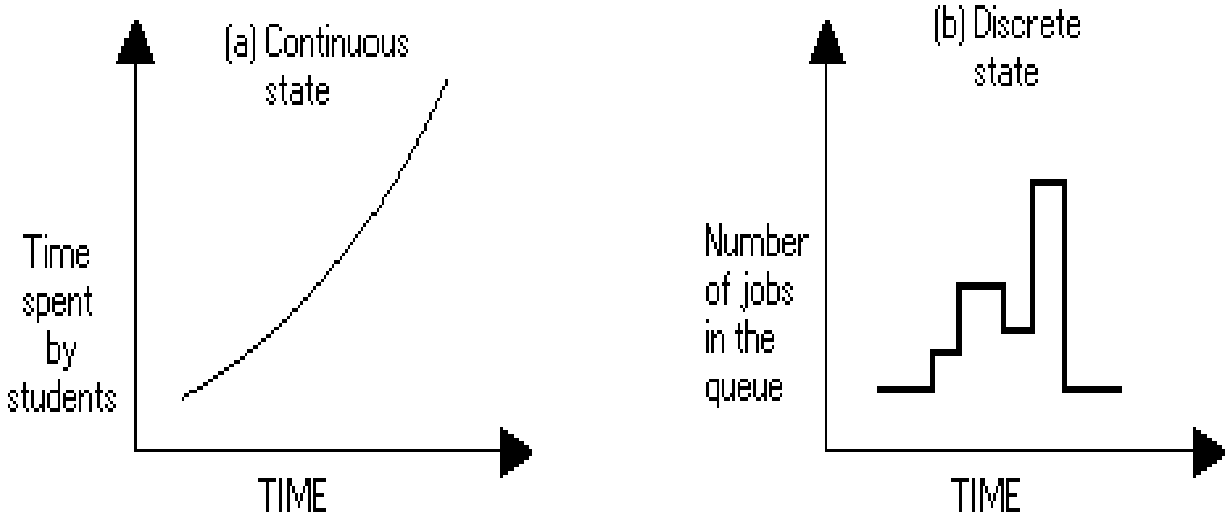

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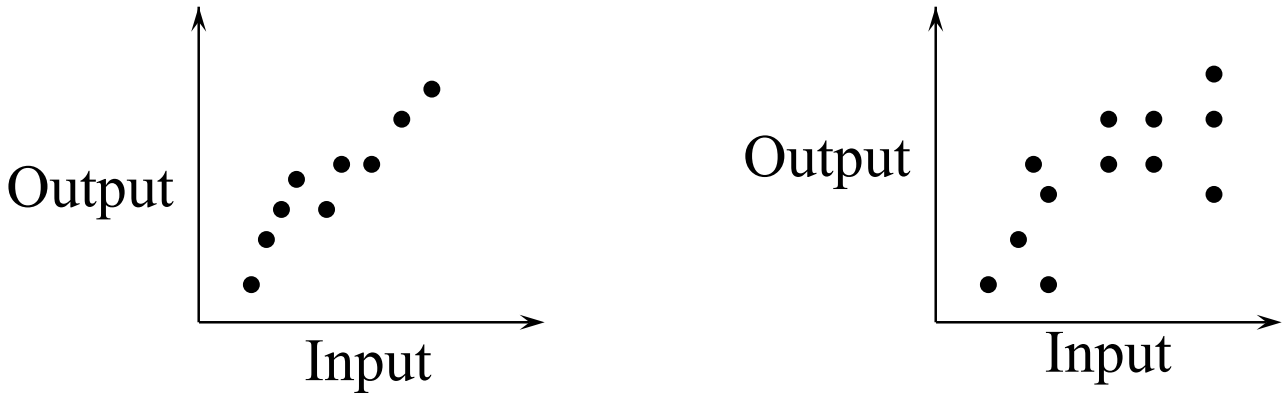

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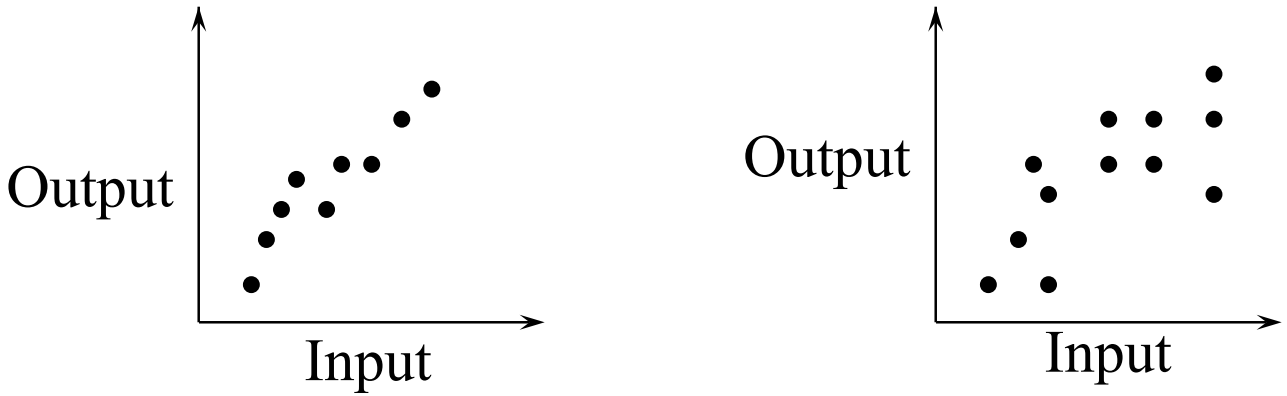

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- Data comes in two quantities:

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End!