Overview

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Outline

- Syllabus
- Reading
  - Reading
  - Q & A
- Model and Simulation
- Discrete Event Simulation

Syllabus

- Instructor's contact and office hours
- Content to cover
  - Discrete event simulation (based on the textbook by Leemis and Park)
  - Discrete event simulation with NS-3 (http://www.nsnam.org/)
- Grading

Reading

- Which Is The Fastest Check-Out Lane At The Grocery Store?

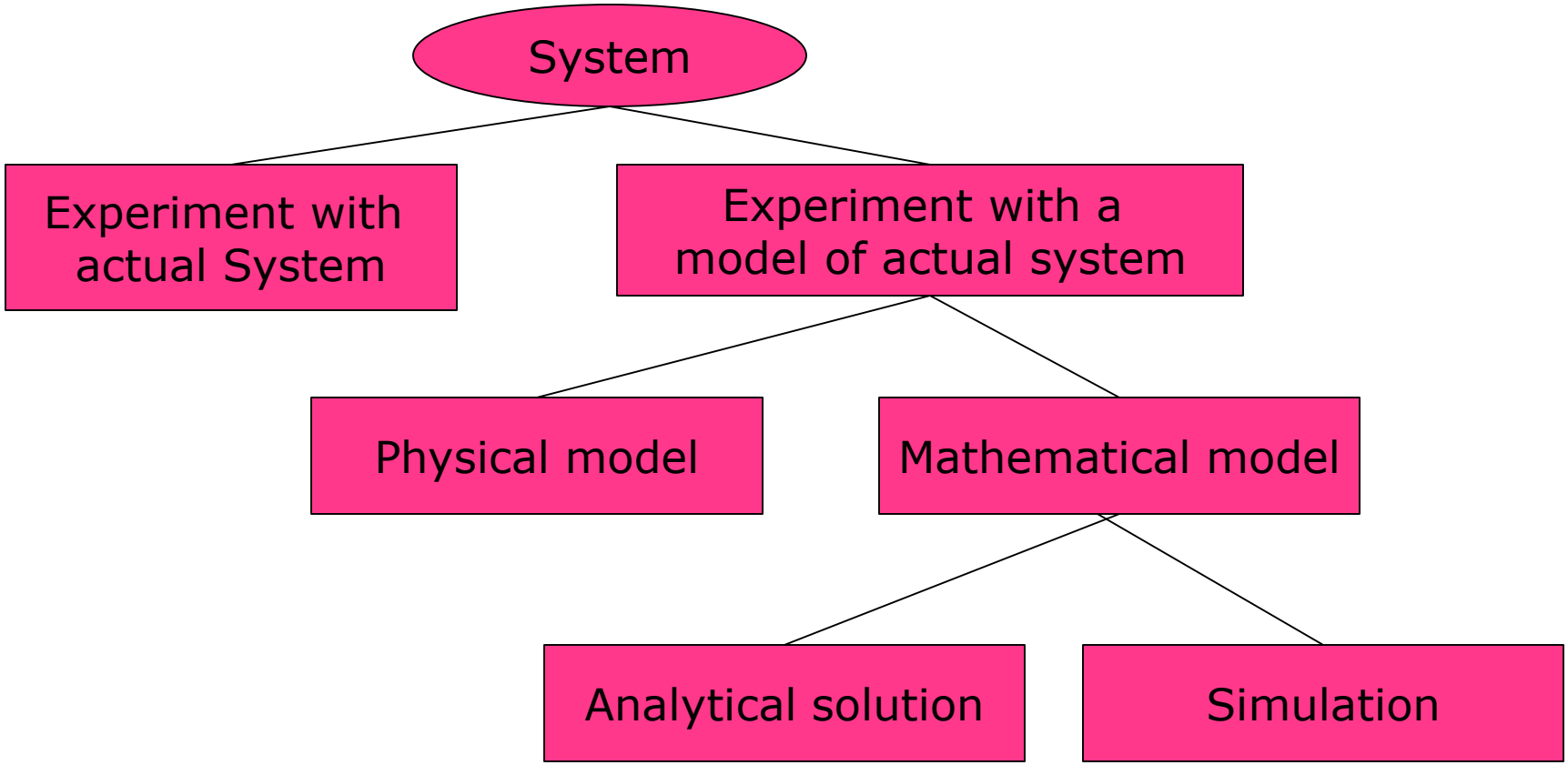
Discussion

- How to answer the question asked in the article?
- How is it relevant to computer science?

Model and Simulation

- Model
  - Construct a conceptual framework that describes a system
- Simulate
  - Experiment using computer implementation of a model
- Analyze
  - Draw conclusion and aid decision making

How to study a system?



Why Simulate?

- Study a system
  - Prediction
    - Predict behavior before building
    - Predict for future expectations
  - Testing
    - System characterization
- Virtualization
- Your application example

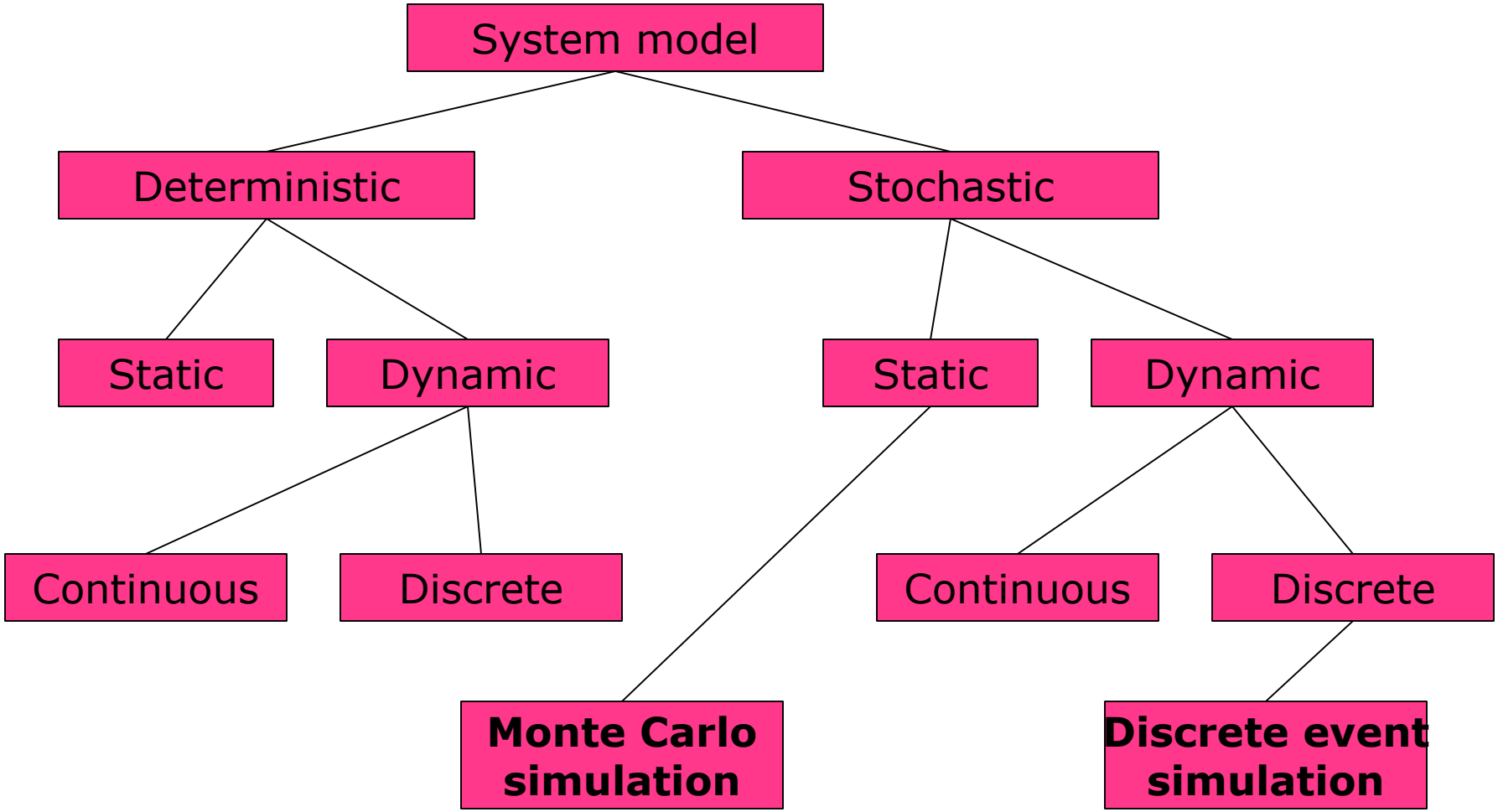
Characterization of Models

- Deterministic or stochastic?
  - Does the model contain stochastic (random) component?
- Static or dynamic?
  - Is time a significant variable?
- Contiguous or discrete?
  - Does system state evolve continuously or only at discrete point in time?
  - Continuous systems
    - Classical mechanics
  - Discrete systems
    - Queuing, inventory, machine shop model

Discrete-Event and Monte Carlo Simulations

- Discrete-Event Simulation
  - Stochastic
  - Discrete
  - Dynamic
- Monte Carlo Simulation
  - Stochastic
  - static

Characterization of Models



Building DES Model

- Algorithm 1.1: How to develop a model?
  - Determine goals and objectives
  - Build a conceptual model
  - Convert into a specification model
  - Convert into a computational model
  - Verify: do we build the model right (do we meet the specification)?
  - Validate: do we build the right model (do we analyze the system to be analyzed)?
- An interactive process

Building DES Model: Three Levels

- Conceptual
  - How comprehensive should the model be?
  - What are the state variables, which are dynamic, which are stochastic, which are important?
  - System diagrams
- Specification
  - On paper
  - May involve equations, pseudo-code, algorithms, etc
  - How will the model receive input, what the output are
- Computational
  - A computer program
  - General purpose or simulation programming language?

Building DES Model: Verification vs. Validation

- Verification
  - Did we build the model right?
    - Computational model should be consistent with speciation
- Validation
  - Did we building the right model?
    - Computational model should be consistent with the system analyzed
    - Can an expert distinguish simulation output from system output?

Summary

- Model and simulation: an overview
- Reading assignment:
  - the machine shop model (section 1.1.1 – 1.1.3 in the textbook)