

# CS4237: Systems Modeling & Simulation (2006/07 Semester 1)

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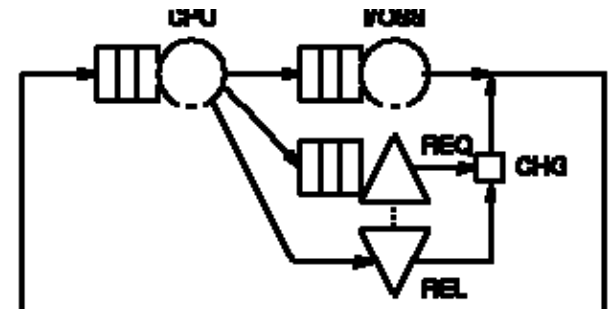
url: [www.comp.nus.edu.sg/~teoym](http://www.comp.nus.edu.sg/~teoym)

# Understanding and Studying System Performance - 3 Fundamental Techniques

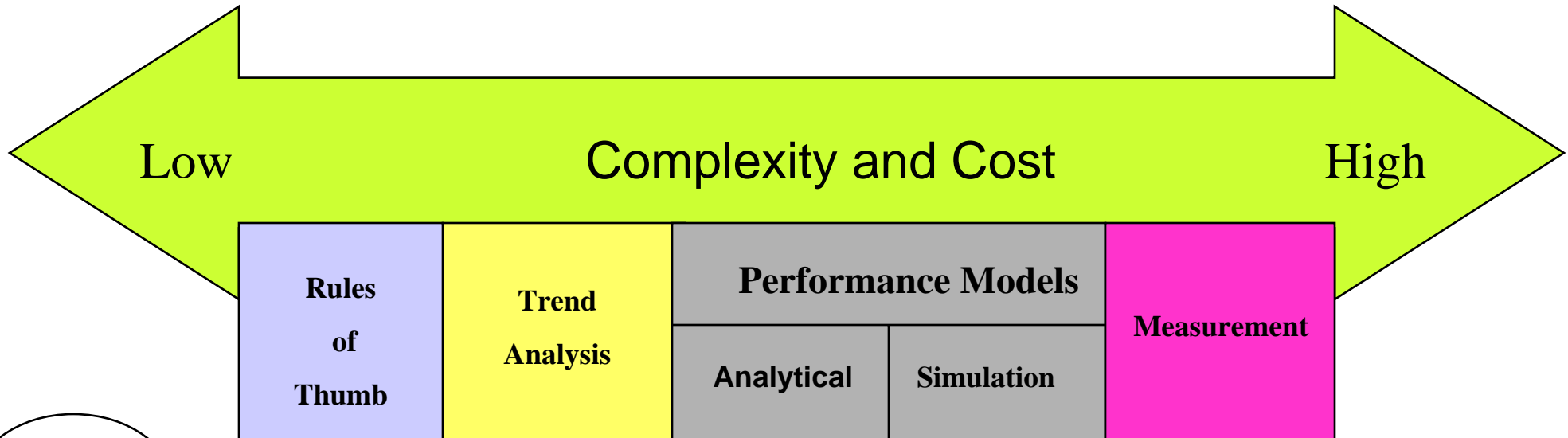
◆ **Measurements** of actual systems

◆ **Simulations** using software models

◆ **Mathematical modeling** using such techniques as queuing analysis



# Performance Evaluation



after-the-fact  
analysis

CS4237: Systems Modeling and Simulation

CS5233: Simulation and Modeling Techniques

CS5239: Computer System Performance Analysis

CS5271: Performance Analysis of Embedded Systems

# Technical Attractions of Simulation\*

- ◆ Ability to compress time, expand time
- ◆ Ability to control sources of variation
- ◆ Avoids errors in measurement
- ◆ Ability to stop and review
- ◆ Ability to restore *system state*
- ◆ Facilitates *replication*
- ◆ Modeler can control level of detail

\**Discrete-Event Simulation: Modeling, Programming, and Analysis* by G. Fishman, 2001, pp. 26-27

# Course Objective

covers the *methodology* and *techniques* in systems modeling and the design of computer simulation models

# Course Coverage

## Part I – Theory (2/3rd)

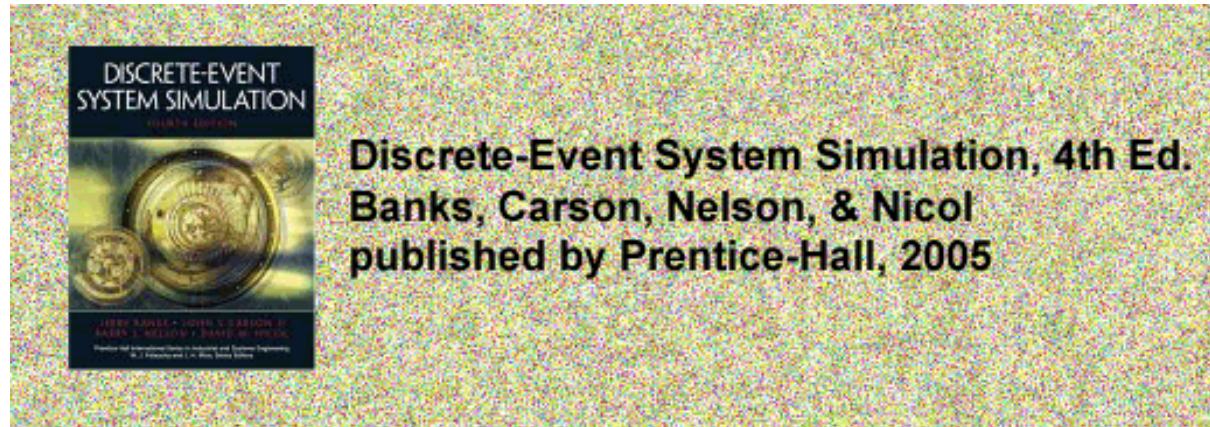
- ◆ Different Approaches to Study a System
- ◆ Modeling and Simulation Lifecycle
- ◆ Principles of Discrete-event Modeling & Simulation
- ◆ Statistical Models in Simulation
- ◆ Random Number and Random Variates
- ◆ Input Data Collection and Modeling
- ◆ Model Verification and Validation
- ◆ Analysis and Presentation of Results
- ◆ Comparison and Evaluation of System Design Alternatives

## Part 2 – Practice (1/3rd)

- ◆ Simulation programming in Java
- ◆ Examples and hands-on in modeling and simulation of computer systems and simulation of computer networks

# Books

## Recommended Text



## Others

- ◆ *Simulation Modeling and Analysis*, 3rd Edition, A.M. Law and W.D. Kelton, McGraw-Hill, 2000
- ◆ *The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation and Modeling*, R. Jain, John-Wiley, 1991.

# Module Assessment



## 1. Continuous Assessment (60%)

- ◆ Recitation (10%)
- ◆ Test (20%)
- ◆ Assignment/project (30%)

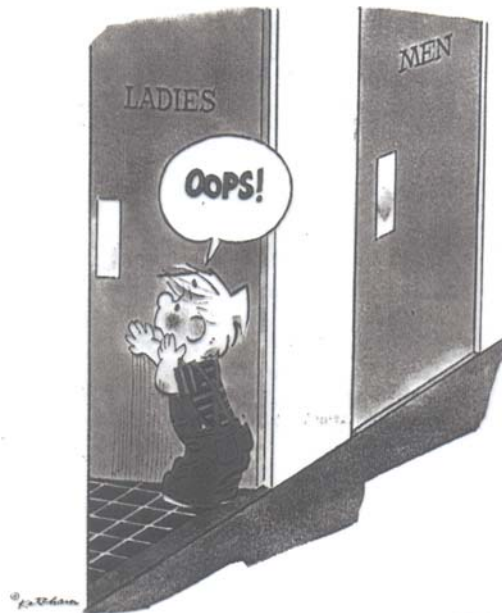
## 2. Exam (40%)

Everything should be made as simple as possible, but no simpler – attributed to Albert Einstein

# Problems



If you're not sure,  
don't guess...**ASK!**



Wrong guesses are **COSTLY!**



- consultation hours, email,  
catch me after lectures ....

# Approaching the Questions

1. Easy first, difficult last
2. Don't get carried away
3. Never give up

# Answering the Questions

1. Allocate your time wisely
2. Always read critically
3. Give the right amount of information
4. Plan for extra time – double-checking
5. If you find a question ambiguous, be sure to write down any assumptions you make. Be neat. If we can't understand your answer, we can't give you credit!

# The Power of Thought

I can score “A”s 😊

- see yourself as an “A” student
- what would you do, if you were an “A” student?



# The 4-minute mile

In 1954, Sir Roger Bannister overcame this supposed “impossibility”.

- Within one-year, 37 other did it, and in the following year, another 300 did it.

Breaking the barrier!

