CPSC 531:
System Modeling and Simulation

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Fall 2017

Performance Evaluation

- Often in Computer Science you need to:
  - demonstrate that a new concept, technique, or algorithm is feasible
  - demonstrate that a new method is better than an existing method
  - understand the impact of various factors and parameters on the performance, scalability, or robustness of a system

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Performance Evaluation Methodology

- The performance evaluation work can be done using either experimental, simulation, or analytical approaches (or a combination thereof)
- The design of a performance study requires careful thought about the experimental design/methodology
- Need to identify
  - experimental factors to be tested
  - levels (settings) for these factors
  - performance metrics to be used
  - experimental design to be used

Factors

- Factors are the main "components" that are varied in an experiment, in a controlled way, in order to understand their impact on system performance
- Examples: request rate, file size, read/write ratio, number of concurrent clients

- Need to choose factors properly, since the number of factors affects the size of the performance study

Levels

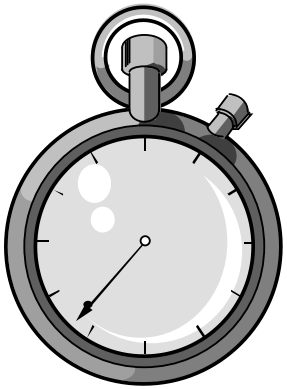
- Levels are the precise settings of the factors that are to be used in an experiment
- Examples: file size S = 1 KB, 10 KB, 1 MB
- Example: num clients C = 10, 20, 30, 40, 50
- Example: http (unencrypted), https (encrypted)
- Example: sort algorithm = selection, merge, quicksort

- Need to choose levels realistically
- Need to cover useful portion of the design space

Performance Metrics

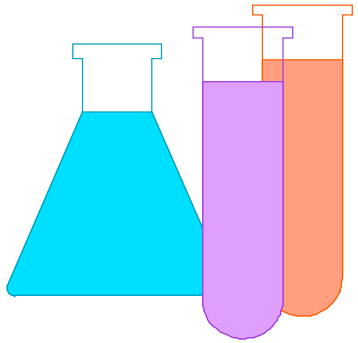
- Performance metrics specify what you want to measure in your performance study
- Examples: response time, throughput, packet loss

- Must choose your metrics properly and instrument your experiment accordingly



Experimental Design

- Experimental design refers to the organizational structure of your performance study
- Need to methodically go through factors and levels to get the full range of experimental results desired
- There are several “classical” approaches to experimental design



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Examples of Experimental Design

- One factor at a time
  - vary only one factor through its levels to see what the impact is on performance
  - all other factors are kept fixed at their default settings
- Two factors at a time
  - vary two factors to see not only their individual effects, but also their interaction effects, if any
- Full factorial
  - try every possible combination of factors and levels to see full range of performance results

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Summary

- Computer systems performance evaluation defines well-known methods for designing and conducting performance studies
- Great care must be taken in experimental design and methodology if the experiment is to achieve its goal, and if results are to be fully understood