Class 3

Measurements – The First Prerequisite

- Transaction-based (Event-based) measurement: Bank Tellers, Telephone, Internet, Transportation, Administrative.
- Towards Queueing Science.
- Summary statistics and simple tools: Pareto charts, Histograms, Fishbone diagrams, Scatterplots, . . .
- The System’s (Network) View.
- Some subtleties in Measurements: Patience; What is Service-Time (Duration) - Part I?
- Sample Size; Scales, Resolution, Aggregation.
- Hall – Measurements and MOP’s (Chapter 2).

Modelling – The Second Prerequisite

- Flanders: important to recognize the existence of skeptics, useful to recruit influential opponents, and unethical to deny limitations.
- Larson: first example of a Dynamic Stochastic Processing Network: the AToA process; Further Examples: Research and Development, Software Development, Product Development (which has lead to DS-PERT/CPM and Multi-Project Management), QC (Quality Control) Labs in the Pharmaceutical and Biotechnology Industries.

Reading Assignments, on Measurements and Models, for next class:

The following two readings provide the basis for parts of next class’s discussion. The subject is “The Two Prerequisites for our Course: Measurements and Models.” Read the two articles. Then discuss, within your study group, the questions that follow.


Discuss within your study group answers to the following questions:

F1. In the “Production process of Justice”, who are the customers? Who are the servers?
F2. What are the costs of delay? (It is often said that “Justice delayed is justice denied”.) Who is paying?
F3. Why is the justice process challenging (perhaps impossible) to model?
F4. What are Flanders’ alternatives to model-based analysis? Should they be alternatives or perhaps supplements?
F5. On the last line of page 316, Flanders describes the “Profit and loss statement” of a judge. How can it be used to infer “processing times” of files? (See also Note 5.) Contemplate on the use of models to fill in data that is either missing or expensive to collect.
F6. In any service system, performance record-holders are important to identify. Why? What is peak performance for judges? What constitutes an expert judge?
F7. Understand the problems in dividing files into types. How can they be overcome, or at least simplified?
• **Read** (carefully enough to be able to answer the questions that follow)


• Discuss within your study group answers to the following questions:

  **L1.** Understand the AtoA process, especially Figure 1. How does it differ from traditional PERT/CPM? (Hint: stochastic, dynamic)

  **L2.** What are here the costs of delay? Supplement F2. above, if relevant.

  **L3.** Prove that, for any random variables $X_1, X_2, \ldots, X_i, \ldots$, we have:

  $$E[\max_i X_i] \geq \max_i E[X_i].$$

  When is an equality possible?

  Verify that the inequality applies to Figure 1 of Larson’s article. (See also page 84 of “Improving the N.Y. City Arrest-to-Arraignment System”, by R. Larson, *Interfaces*, 23, 76–96, 1993, which can be downloaded from the Related Material to Lecture 2 on the course site.)

  **L4.** What were the reasons for choosing Simulation? Spreadsheet?

  **L5.** Identify decisions at the strategic, tactical and operational level, in managing the AtoA process.

**Recitation 3: Empirical Models.**

**HW 3:** “Empirical Models”.

**Reading Packet: Measurements and Performance Measures**


• Hall, Chapter 2, “Observations and Measurements”, mainly Section 2.7 on Measurement Techniques.


• F&F, Chapter 9, “The service encounter”, mainly pages 258–265.

  A useful supplement on Work Measurements, mainly for non-I.E. students.