Class 7

Arrivals: Forecasting, and some loose ends
Service Times; Phase-type Distributions

Arrivals: Review

- Poisson processes: review;

- Forecasting arrivals;

- The Offered Load.

Defining, Modelling and Designing Service Times

- What is "Service-Time"? via Empirical analysis of face-to-face, telephone services; hospitals, ...

- Service time is a Statistical Distribution: lognormal, exponential.

- Service time is a Process: Phase-type distributions.

- Beyond Means and Beyond CV's.

- Stochastic Ordering.

- Subtleties.

Laws of Congestion: Old and New
The 0-th Law for (The) *Causes of Operational* Queues :
     Scarce Resources and Synchronization Gaps (in DS-Project Networks);
The First Law of *Conservation* :
     Little's Law for Customers, Service-providers and Managers.
     Little's Law for the Offered Load (Utilization Profiles).
The Second Law of Completely *Random Arrivals* :
     Levy/Watanabe Axioms of Randomness;
     The Law of Poisson-Counting (Law of Rare Events);
     The Law of Independent Memoryless (Exponential) Inter-arrivals;
     The Brownian-Law of Rescaling & Centering Arrivals;
     The Laws of Decomposition-Superposition.
The Third Law of *Human Service-durations* :
     The Law of Phase-types for the Durations of Human Upaced Services;
     The Empirical Law of Exponential/Log-Normal Durations.
The Fourth Law of *Sampling* :
     Random Sampling: Wolff's PASTA = Poisson Arrivals See Time Averages;
     Biased Sampling: Costs of Randomness; (Coefficient of Variation, or Form Factor).

Recitation 7. Statistical analysis of an arrival process.