Class 11

A Single-Server Service-Station in Steady State; Multi-Server Service-Stations in Steady State; Laws of Congestion.

A Non-Parametric Model of A Single-Server Service-Station

- Analytical models (vs. Simulation/4CallCenters):

  "Approximate" analysis of Exact models – Today;

  vs. "Exact" analysis of Approximate models – Birth & Death Queues, most notably Erlang-A/C/B (as well as Fluid Models).

- A Non-Parametric Model: the GI/GI/1 Queue.

  Lindley's Equations; Stability.

  Tentative: MOP's; Brummelle's Formula.

  Khinchine-Pollaczek Formula (with an illuminating proof: Hall, pages 168-169).

  Allen-Cunneen Approximation (for averages: (5.69) on page 153 in Hall).

  Kingman's Exponential Law of Congestion.

  Approximations (Framework for).

  Tentative: Priorities: Non-Preemptive, Preemptive.

  Tentative: On Optimal Scheduling: The $c\mu$-rule.]

Models of a Multi-Server Service-Station: Non-Parametric (GI/GI/m) and Markovian (M/M/m)

- Congestion Curves
- From M/M/m to G/G/m; (Laws of congestion: Kingman, Allen-Cunneen)
- Strategic Queueing Theory
  - Economies of Scale (EOS) Simply Cases, more Subtle Cases, City Bank
  - Efficiency-Driven Service Operations
  - Pooling in a Queueing Network - Part I
    - Pooling Servers(Capacity): One Fast vs. Several Slow
    - Pooling Queues (Geography): Virtual Call Centers
    - Polling Tasks (Services): Job Design (Perhaps Later)
  - Kleinrock's Cycle: Scale-Up (Pooling Queues), then Technological Improvement (Pooling Servers)
- Tentative: Introduction to QED Services Operations

Laws of Congestion

Recitation 12: MJP Models of Service.