

## Class 5

### Modelling a Service Station (I): Empirical/Deterministic Models; Fluid/Flow Models/Approximations of Predictable Queues

- Introduction:
  - Legitimate models: Simple, General, Useful
  - Approximations (strong)
  - Tools
- Scenario analysis
  - vs. Simulation, Averaging, Steady-State
  - Typical scenario, or very atypical (eg. "catastrophe")
- Predictable Variability
  - Averaging scenarios, with small "CV"
  - A puzzle (the human factor  $\Rightarrow$  state dependent parameters)
  - Sample size required increases with CV
  - Predictable variability could also turn unpredictable
- Hall: Chapter 2 (discrete events);
- 4 Pictures:
  - Cummulants
  - Rates ( $\Rightarrow$  Peak Load)
  - Queues ( $\Rightarrow$  Congestion)
  - Outflows ( $\Rightarrow$  end of rush-hour)
- Phases of Congestion: under-, over- and critical-loading
- Scales (Transportation, Telephone (1976, 1993, 1999))
- Simple Important Models: EOQ, Aggregate Planning
- Queues with Abandonment and Retrials (=Call Centers; Time- and State-dependent Q's).
- Bottleneck analysis in a (feed-forward) Fluid Network, via National Cranberry
- Addendum
- (Skorohod's Deterministic Fluid Model (of a service station): teaching note)

**Recitation 5: Fluid models, with application to staffing.**

**HW 5: "Fluid Models".**