Simulation

Variance reduction

Example

Wash machine

- Consider the wash machine example from introduction
  - Goal is to simulate the utilization rate U/T
  - Compare between two variants
    - Fast service time Unif(4,8) (s=6)
    - Slow service time Unif(6,10) (s=8)
  - Interarrival time Exp(a), a=8

Utilization rate

- Different ways to estimate the utilization rate U/T
  - Compute directly the utilization time U
  - Estimate the lost clients
    - $U=Ts/a – Ls$
  - Estimate the queue full time and potential of losing the clients
    - $U= Ts/a – s(F/a) = (T-F)s/a$

Utilization rate

- Estimate lost clients
  - 200 runs of 1000 time units
  - Direct evaluation
    - Mean 11,525, stddev = 4,81 (fast variant)
    - Mean 22,905, stddev= 7,18 (slow)
  - Monitoring full time
    - Mean 11,675, stddev = 3.25 (33% reduction)
    - Mean 22,780, stddev = 5,44 (23% reduction)

Comparison

- Compare the lost clients for two variants
  - Direct comparison
    - Difference of mean = 11,38
    - Stddev = stddev(fast)+ stddev(slow)
    - = 4,81 + 7,18 = 11,99
  - Pairwise comparison (common random streams
    - Stddev = 3.82 (75% reduction, 16 times speedup)