Queueing Systems Assistance (QSA) in Action

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Outline

- Introduction
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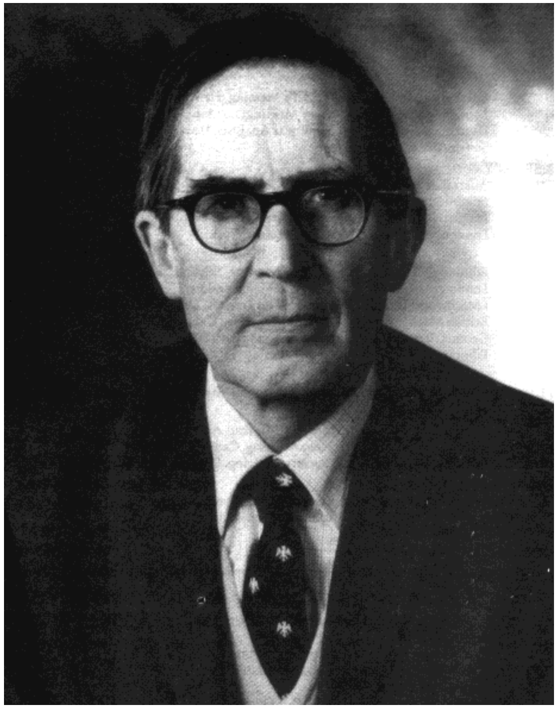
Kendall's Notation



David G. Kendall, 1918-2007

A/B/c/K/m/Z

Performance Metrics

- Utilizations
- Mean Number of Customers in the System / Queue
- Mean Response / Waiting Time
- Mean Busy Period Length of the Server
- Distribution of Response / Waiting Time
- Distribution of the Busy Period
- Distribution of Number of Customers Served during a Busy Period
- Distribution of Number of Retrials until Service Completion

Tool Supported Modeling

- University of Dortmund: *HIT, HiQPN, APNN*
  http://ls4-www.infromatik.uni-dortmund.de/tools.html/
- University of Illinois at Urbana-Champaign: *MÖBIUS*
  http://www.mobius.uiuc.edu/
- University of Erlangen: *PEPSY, MOSEL*
  http://www4.informatik.uni-erlangen.de/Projects/MOSEL/
- University of Oxford: *PRISM*
  http://www.prismmodelchecker.org/

Software and Information

http://web2.uwindsor.ca/math/hlynka/qsoft.html

http://mason.gmu.edu/~jshortle/QtsPlus-4-0.zip

QSA (Queueing Systems Assistance)

https://qsa.inf.unideb.hu

Lecture Notes

https://irh.inf.unideb.hu/~jsztrik/education/16/SOR_Main_Angol.pdf

https://irh.inf.unideb.hu/~jsztrik/education/16/Queueing_Problems_Solutions_2021_Sztrik.pdf

The main advantages of QSA over QTSPlus

- It runs on desktops, laptops, mobile devices
- It calculates not only the mean but the variance of the corresponding random variables
- It gives the distribution function of the waiting/response times (if possible)
- It visualizes all the main performance measures
- It graphically supports the decision making

Case Studies

Example 1

Customers arrive to a 2 server system according to a Poisson process with rate 3. The service times are exponentially distributed with parameter 2.

Find the minimum capacity of the system for which the probability of blocking is less than 0.01 and the probability that the waiting time exceeds 1.8 minutes is less than 0.05.

Case Studies

Example 2

We have a finite-source system with 50 sources, the request generation times are exponentially distributed with rate 0.5. The service times are exponentially distributed for all the 5 servers with intensity 2.

Find the minimum capacity of the system for which the probability of blocking is less than 0.01 and the probability that the waiting time exceeds 3.5 minutes is less than 0.05.

Case Studies

Example 3

Let us see an M/M/1 system with arrival intensity 1 and the following costs, cost of service per server per unit time CS = 2, cost of waiting in the system per customer per unit time CW =2, cost of idleness per server per unit time CI=10, cost of service rate per server per unit time CSR=10, reward per customer per unit time R=5.

Find the optimal value for the service intensity which minimize the expected total cost per unit time with linear objective function.

Bibliography on Queueing

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