

Assignment class 7 of MQSN (LNMB, October 2014): Mean Value Analysis

Main references:

Ivo Adan, Jan van der Wal, Mean Values Techniques. In: Queueing Networks, a fundamental approach (chapter 13, pp. 561-586). Editors Richard J. Boucherie, Nico M. van Dijk. International Series in Operations Research & Management Science, Volume 154. ISBN: 978-1-4419-6472-4, Springer US, 2011. Doi: 10.1007/978-1-4419-6472-4_13

and

Ward Whitt, The Queueing Network Analyzer. Bell System Technical Journal, vol. 62, No. 9, November 1983, pp. 2779-2815.

Always determine the expected waiting time per queue in stationarity, and the expected total number of customers in the network, as follows:

1. Perform MVA for the single-class open product-form network, as defined in Adan and Van der Wal, with $M = 5$, $c_m = 1$ for $m \neq 2$, $c_2 = 2$, $\mu_m \equiv 2$, $\lambda = 2$, $q_1 = q_4 = 1/2$, $p_{1,2} = p_{4,2} = 1$, $p_{2,3} = 1 - p_{2,5} = 3/8$, $p_{3,1} = p_{5,4} = 1 - p_{3,0} = 1 - p_{5,0} = 1/3$.
2. Perform MVA for the (closed) network as in 1. but with $p_{3,1} = p_{5,4} = 1$, for $K = 1, 2, 3$.
3. Perform the QNA algorithm for the network in 1. with the same Poisson arrival stream(s), but with service times uniform on $[0, 1]$ (rather than exponential).

Briefly discuss the differences in outcome for closely resembling models.