UNE IMP

EHE ★QMIPS★ CWI

INR UER

ZAR UTO

Q uantitative
M odeling
I n
P arallel
S ystems

Wiener-Hopf Analysis of an $M/G/1$ Queue with Negative Customers and a Related Class of Random Walks

N. Bayer and O.J. Boxma
CWI
P.O. Box 94079, 1090 GB Amsterdam, The Netherlands

D W2.T1.6-6.v1

September 15, 1995

Distribution Level: Unrestricted

Approved by: O. Boxma

Abstract Two variants of an $M/G/1$ queue with negative customers lead to the study of a random walk $\mathbf{X}_{n+1} = [\mathbf{X} + \boldsymbol{\xi}_n]^+$, where the integer-valued $\boldsymbol{\xi}_n$ are not bounded from below or from above, and are distributed differently in the interior of the state-space and on the boundary. Their generating functions are assumed to be rational. We give a simple closed-form formula for $\mathbf{E}(s^{\mathbf{X}_n})$, corresponding to a representation of the data which is suitable for the queueing model. Alternative representations and derivations are discussed.

The QMIPS Project: The QMIPS project is a collaborative research project supported by the CEC as ESPRIT-BRA project no 7269. It is being carried out by the following organisations: CWI (Amsterdam), EHEI (University of Paris V), Imperial College (London), INRIA (Sophia-Antipolis), University of Erlangen, University of Newcastle, University of Torino and University of Zaragoza.

With this formula, we calculate the queue length of the $M/G/1$ queue with negative customers, in which the negative customers can remove ordinary customers only at the end of a service. If the service is exponential, the arbitrary-time queue length is a mixture of two geometrical distributions.