# Notes on the Burke’s Theorem

compiled by D. Gueorguiev, 4/21/2024

## Introductory notes

Burke’s Theorem asserts that for queue, queue, and queue *in steady state* with Poisson arrivals with rate then:

i) The departure process is Poisson process with rate as well

ii) At time the number of customers in the queue is independent of the departure process prior to time

The Proof of this theorem is facilitated by considering reversible stochastic process and showing that the queue is a reversible stochastic process, that is Markov chain.

## Kolmogorov’s Criterion and Discrete Time Markov Chains

**Theorem**: Kolmogorov’s Criterion

Irreducible positive recurrent aperiodic Markov chain with transition matrix P is reversible

## References

[The Output of a Queuing System, Paul J. Burke, Operations Research, Vol. 4, No. 6, 1956](https://github.com/dimitarpg13/queueing_theory/blob/main/literature/articles/Burkes_theorem/The_Output_of_Queueing_System_Burke_1956.pdf)

[Brownian Motion and Stochastic Flow Systems, J. Michael Harrison, Stanford, 1985](https://github.com/dimitarpg13/queueing_theory/blob/main/literature/books/Brownian_Motion_and_Stochastic_Flow_Systems_Harrison_1985.pdf)