Comparative Analysis of Serial-Parallel and Parallel Network Reliability for different distributions with Monte Carlo Simulations

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Abstract. This paper is about the reliability of some networks with serial-parallel and parallel-serial architectures. It compares the dynamic mathematical models of both types of networks. The unit's lifetimes of the networks are independent and identically distributed random variables, with cumulative distribution functions having a uniform or exponential distribution. The model of the lifetime of each network's unit is a nonnegative random variable. The network's reliability is represented by the survival function, which is the tail of the cumulative distribution function of the network's lifetime. It was used Analytical and empirical methods and formulas which were established in earlier studies, to obtain the formulas for the reliability of both mentioned networks. Monte Carlo simulations are used for empirical verification, using Python Programmer Language. Through examples, we compare the reliability of two different architecture networks, where the number of subnets and units in each subnet remain constant.

It provided graphical representations and calculations for each case, offering valuable insights into the impact of network architecture on reliability under dynamic conditions, and providing a foundation for further exploration of complex network systems under real-world dynamic conditions.

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