Example The Two State Markov Chain Consider a Markov chain $X(t)$ with state $0, 1$ whose infinitesimal matrix is

$$Q = \begin{bmatrix} -\lambda & \lambda \\ \beta & -\beta \end{bmatrix}$$

The process alternates between states 0 and 1. The sojourn times in state 0 are independent and exponentially distributed with parameter $\lambda$. Those in state 1 are independent and exponentially distributed with parameter $\beta$. This is a finite state birth and death process for which $\lambda_0 = \lambda, \lambda_1 = 0, \mu_0 = 0$ and $\mu_1 = \beta$. 