



The poisson process

- Draw the transition graph for the poisson process. How many states does this markov chain have.
- Write out the jump rate matrix for the poisson process.
- Explain the three assumptions that we make when we model a counting process using a poisson process.
- Use the kolmogorov equation to derive a differential equation involving $\frac{dp_{03}(t)}{dt}$ for the Poisson process.



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- Show in your notes why the fact that $\frac{dP_{00}(t)}{dt} = -\lambda t$ together with the fact that $P_{00}(t) = 0$ implies that $P_{00}(t) = e^{-\lambda t}$.
- Show that $\frac{d[e^{\lambda t} P_{01}(t)]}{dt} = e^{\lambda t} \frac{dP_{01}(t)}{dt} + \lambda e^{\lambda t} P_{01}(t)$ using the product rule and explain how this fact is used when we solve a differential equation using an integrating factor.
- Use the method of integrating factors to derive an expression for $P_{03}(t)$ starting from the differential equation that you wrote down in the third of these questions.
- Give the expression for $P_{0n}(t)$ that is derived in the video for the poisson process.



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- Given the expression that we derived for $P_{0n}(t)$ what is the expectation value for $\mathbb{E}[N(t)]$ if $N(t)$ is a counting process that can be modelled using a Poisson random variable.