The poisson process

- Draw the transition graph for the poissson 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 $\frac{\mathrm{d}p_{03}(t)}{\mathrm{d}t}$ for the Poisson process.

The poisson process

- Show in your notes why the fact that $\frac{\mathrm{d}p_{00}(t)}{\mathrm{d}t} = -\lambda t$ together with the fact that $P_{00}(t) = 0$ implies that $P_{00}(t) = e^{-\lambda t}$.

- Show that $\frac{\mathrm{d}\left[e^{\lambda t} P_{01}(t)\right]}{\mathrm{d}t} = e^{\lambda t}\frac{\mathrm{d}P_{01}(t)}{\mathrm{d}t} + \lambda e^{\lambda t} P_{01}(t)$ 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.

The poisson process

- 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.