Define the term Markov Chain. Why is the Markov property useful in modelling queueing systems? 

Consider a birth–death queueing system with the following birth and death coefficients in which the state index represents the number of customers in the system:

\[
\lambda_k = (k + 2)\lambda \quad k = 0, 1, 2, \ldots \\
\mu_k = k\mu \quad k = 1, 2, \ldots 
\]

All other coefficients are zero. Solve for \( p_k \), the set of equilibrium probabilities for all states \( k \), for \( k = 0, 1, 2, \ldots \) State how you would find the average number of customers in the system.