

1998 Paper 8 Question 3

Computer System Modelling

Define the term *Markov Chain*. Why is the Markov property useful in modelling queueing systems? [5 marks]

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:

$$\begin{aligned}\lambda_k &= (k + 2)\lambda & k = 0, 1, 2 \dots \\ \mu_k &= k\mu & k = 1, 2 \dots\end{aligned}$$

All other coefficients are zero. Solve for p_k , the set of equilibrium probabilities for all states k , for $k = 0, 1, 2 \dots$. State how you would find the average number of customers in the system. [15 marks]