1. Consider the following queueing model: customers arrive at a service station according to a Poisson process with rate λ. There are c servers; the service times are exponential with rate μ. If an arriving customer finds c servers busy, then he leaves the system immediately.

a. Model this system as a birth and death process.

b. Suppose now that there are infinitely many servers ($c = \infty$). Again model this system as a birth and death process.

2. In Example 6.11 it is shown, using the backward equations, that

$$P'_{00}(t) = \mu - (\mu + \lambda)P_{00}(t).$$

a. Derive this result using the forward equations.

b. Derive a differential equation for $P_{11}(t)$ in two ways: using the forward and backward equations.

c. Suppose the machine is working at time 0. What is the probability that the machine is also working at time t?

3. Exercise 6.8.

4. Exercise 6.10 (but you do not have to verify that the transition probabilities satisfy the forward and backward equations).