ISyE 2030
Lab #4 — Steady-State Queues

The following problems are transcribed from Banks, Carson, Nelson, and Nicol, Chapter 6.

1. A tool crib has exponential interarrival and service times, and it serves a very large group of mechanics. The mean time between arrivals is 4 minutes. It takes 3 minutes on the average for a tool-crib attendant to service a mechanic. The attendant is paid $10 per hour and the mechanic is paid $15 per hour. Would it be advisable to have a second tool-crib attendant?

2. A two-runway (one runway for landing, one for taking off) airport is being designed for propeller-driven aircraft. The time to land an airplane is known to be exponentially distributed with a mean of 1.5 minutes. If airplane arrivals are assumed to occur at random, what arrival rate can be tolerated if the average wait in the sky is not to exceed 3 minutes?

3. The Port of Trop can service only one ship at a time. However, there is mooring space for three more ships. Trop is a favorite port of call, but if no mooring space is available, the ships have to go to the Port of Poop. An average of seven ships arrive each week, according to a Poisson process. The Port of Trop has the capacity to handle an average of eight ships a week, with service times exponentially distributed. What’s the expected number of ships waiting or in service at the Port of Trop?

7. Suppose that mechanics arrive randomly at a tool crib according to a Poisson process with rate $\lambda = 10$ per hour. It is known that a single tool clerk serves a mechanic in 4 minutes on the average, with a standard deviation of approximately 2 minutes. Suppose that mechanics make $15 per hour. Find the steady-state average cost per hour of mechanics waiting for tools.