Problems

Solutions to be submitted:

2.1 Customers arrive at a fast-food restaurant at a rate of five per minute and wait to receive their order for an average of 5 minutes. Customers eat in the restaurant with probability 0.5 and carry out their order without eating with probability 0.5. A meal requires an average of 20 minutes. What is the average number of customers in the restaurant?

2.2 Two communication nodes 1 and 2 send files to another node 3. Files from 1 and 2 require on the average R_1 and R_2 time units for transmission, respectively. Node 3 processes a file of node i (i = 1; 2) in an average of P_i time units and then requests another file from either node 1 or node 2 (the rule of choice is left unspecified). If λ_i is the throughput of node i in files sent per unit time, what is the region of all feasible throughput pairs (λ_1, λ_2) for this system?

2.3 The average time T a car spends in a certain traffic system is related to the average number of cars N in the system by a relation of the form

$$T = \alpha + \beta N^2,$$

where $\alpha > 0$, $\beta > 0$ are given scalars. What is the maximal car arrival rate λ that the system can sustain?

Solutions NOT to be submitted:

2.4 An absent-minded professor schedules two student appointments for the same time. The appointment durations are independent and exponentially distributed with mean 30 minutes. The first student arrives on time, but the second student arrives 5 minutes late. What is the expected time between the arrival of the first student and the departure of the second student?