EXERCISES S-38.215: WEEK 4

Exercise 10:

Consider the space priority model described in the lecture of this week. The single source is regulated by a Markov process with state space $\{0, 1\}$ and infinitesimal generator Q given by $q_{0,0} = q_{1,1} = -1$ and $q_{0,1} = q_{1,0} = 1$. When the Markov process is in state 0, the source does not produce any fluid. When the Markov process is in state 1, the source produces fluid of type 1 with rate 3 and fluid of type 2 with rate 1. The capacity of the output channel equals 2, the buffer which is shared by both fluid types has size 4. Compare the buffer sharing discipline in which we do not accept fluid of type 2 if the current buffer content bigger is than 3 with the discipline in which we always accept fluid of both types. Calculate in both cases for both types of fluid the fraction of fluid that overflows, the fraction that is not accepted and the fraction that is transmitted successfully.

Exercise 11:

Consider a communication channel that is used by two on-off sources, each having its own infinite buffer. On-off source i, $i = 1, 2$, has input rate r_i during exponentially distributed on-times with parameter μ_i, and input rate 0 during exponentially distributed off-times with parameter λ_i. The total output capacity of the channel equals c. It is used for traffic from source 1 first. The leftover capacity is used for traffic from the second source. With $Z_i(t)$ we denote the buffer content of the i-th buffer at time t. Discuss what kind of fluid models we obtain if we are interested in the processes $\{Z_1(t)\}$, $\{Z_2(t)\}$, $\{Z_1(t) + Z_2(t)\}$ and $\{(Z_1(t), Z_2(t))\}$, respectively. Which processes are easy and which processes are (too) difficult to analyze?