A communication channel with RED

A communication protocol uses a variant of RED – Random Early Detection – to perform flow control. The buffer have a size N = 16. Packets arrive at rate λ *= 200 pkt / sec* and are transmitted at a rate μ *= 100 pkt / sec*. Whenever there are less than $N_0 = 8$ packets in the buffer, new packets are always accepted and increase the queue length. If there are more than $n > N_0$ packets, new arrivals are discarded with probability $p(n) = \min(1, (n - N_0) / (N - N_0))$.

Considering that all timings are exponentially distributed:

- Model the system with a birth death process, where the population count represents the occupation of the buffer. In particular, use the following expressions for λ_i and μ_i:

$$\lambda_i = \begin{cases} \lambda & i < N_0 \\ \lambda \dfrac{N - i}{N - N_0} & N_0 \leq i < N \end{cases}$$

$$\mu_i = \mu$$

- Determine and plot the steady state distribution of the buffer occupation [for $0 \leq i \leq N$]. Please note that since the birth probability becomes zero for $i \geq N$, infinite summations can be truncated at *i = N*.