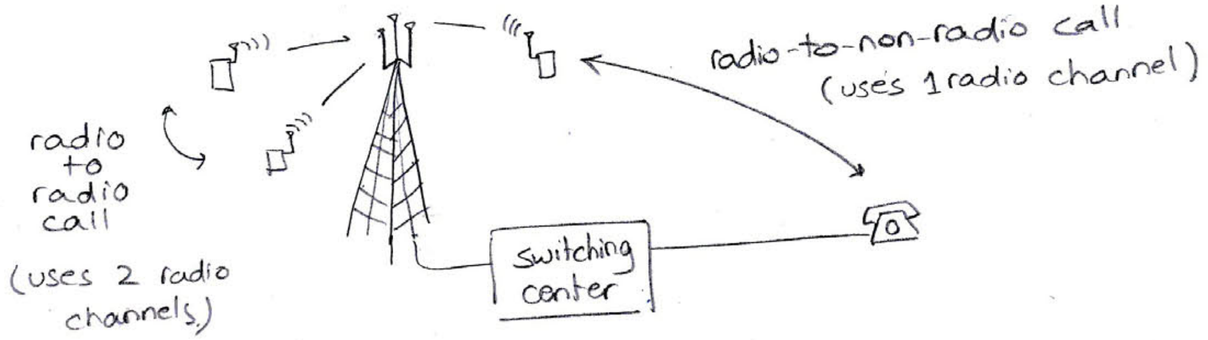
3.25

- Let n_1 be the number of radio-to-radio calls in the system
  n_2 be the number of radio-to-non-radio calls in the system

- The arrivals of radio-to-radio calls and radio-to-non-radio calls are independent
  - Arrivals of radio-to-radio calls $\rightarrow$ Poisson with rate λ_1
  - Arrivals of radio-to-non-radio calls $\rightarrow$ Poisson with rate λ_2
  - call durations $\rightarrow$ exponential with mean $= 1/\mu$



- Consider the Markov chain with the state defined as (n_1, n_2)

$$(n_1, n_2) \in S \triangleq \{(n_1,n_2):\ n_1 \geq 0,\ n_2 \geq 0,\ \underbrace{2n_1 + n_2 \leq m}_{\substack{\text{only } m \text{ radio} \\ \text{channels in the} \\ \text{system}}},\ n_1 \in \mathbb{Z},\ n_2 \in \mathbb{Z}\}$$

$$p(n_1, n_2) = \frac{1}{G} \frac{\rho_1^{n_1}}{n_1!} \cdot \frac{\rho_2^{n_2}}{n_2!}, \qquad (n_1, n_2) \in S$$

where $G = \sum_{(n_1,n_2)\in S} p(n_1, n_2)$, $\quad \rho_1 = \frac{\lambda_1}{\mu}$ and $\rho_2 = \frac{\lambda_2}{\mu}$

$$\begin{aligned} P_{B1} &= \mathbb{P}(\text{radio-to-radio call blocked}) \\ &= \mathbb{P}(\text{no radio ch. available}) + \mathbb{P}(\text{only 1 radio ch. available}) \\ &= \sum_{(n_1,n_2):\,2n_1+n_2=m} p(n_1, n_2) + \sum_{(n_1,n_2):\,2n_1+n_2=m-1} p(n_1, n_2) \end{aligned}$$

$$\begin{aligned} P_{B2} &= \mathbb{P}(\text{radio-to-non-radio call blocked}) \\ &= \mathbb{P}(\text{no radio ch. available}) \\ &= \sum_{(n_1,n_2):\,2n_1+n_2=m} p(n_1, n_2) \end{aligned}$$