1 Extra exercise round - notes and a solution

1.1 Task 1

There were three states identified:

1. The call in progress or being established exists consistently in the spare unit (state P_0).
2. The call has been successfully disconnected in the active and the spare unit (state P_1).
3. There has occured an inconsistency in the spare unit (state P_2).

The Markov model for these states with the parameters described looks like in Figure 1

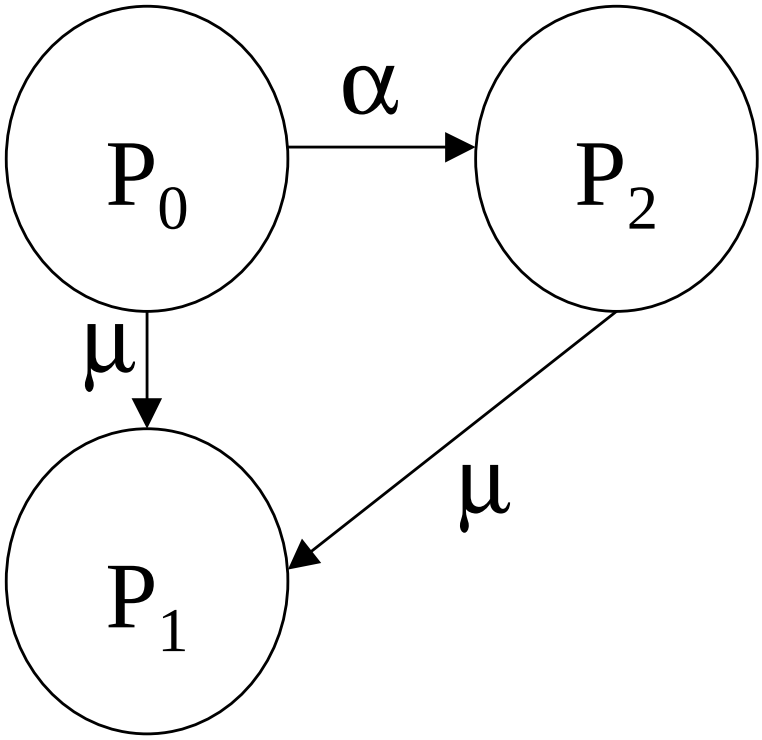

Figure 1: Markov model

And the steady-state probabilities are counted with

$$\begin{aligned} (\alpha+\mu)P_0 &= 1-(\alpha+\mu)P_0 \\ \mu P_2 &= \alpha P_0 \\ P_0+P_1+P_2 &= 1 \end{aligned}$$

which when solved gives

$$\begin{aligned} P_0 &= \frac{1}{2(\alpha+\mu)} \\ P_1 &= \frac{2\mu-1}{2\mu} \\ P_2 &= \frac{\alpha}{2\mu(\alpha+\mu)} \end{aligned}$$

Inserting $\mu = 5000$ calls cleared per minute and $\alpha = \frac{1}{10080}$ errors occuring per minute we get the following average times in each of the states for one years time.

Table 1: Time spent in each of the states in one year's time

P_0	52 minutes
P_1	364 days 23 h 7 min
P_2	0,00006 seconds

1.2 Tasks 2-4

The solutions may be found from the exercise solution material distributed via Otapaino. Note that in task 2 you should first solve for the slip occurence and then insert appropriate probability values to get the slip occurence as a function of the probability. In task 4 look for the formulas for *rearrangeably* non-blocking and symmetric Clos network. You can choose p and q freely, as long as their product is $N = pq = 30$.