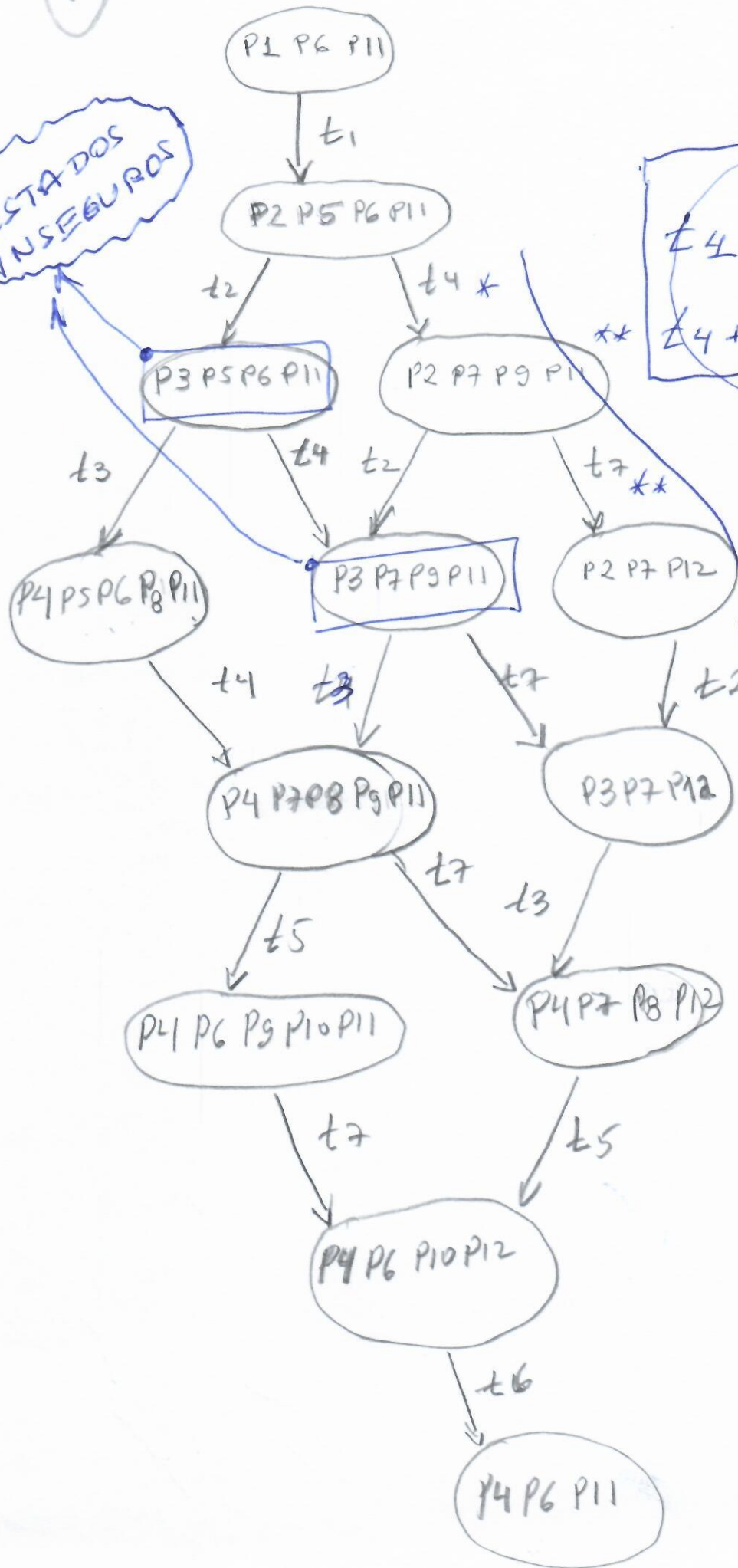


1) 1

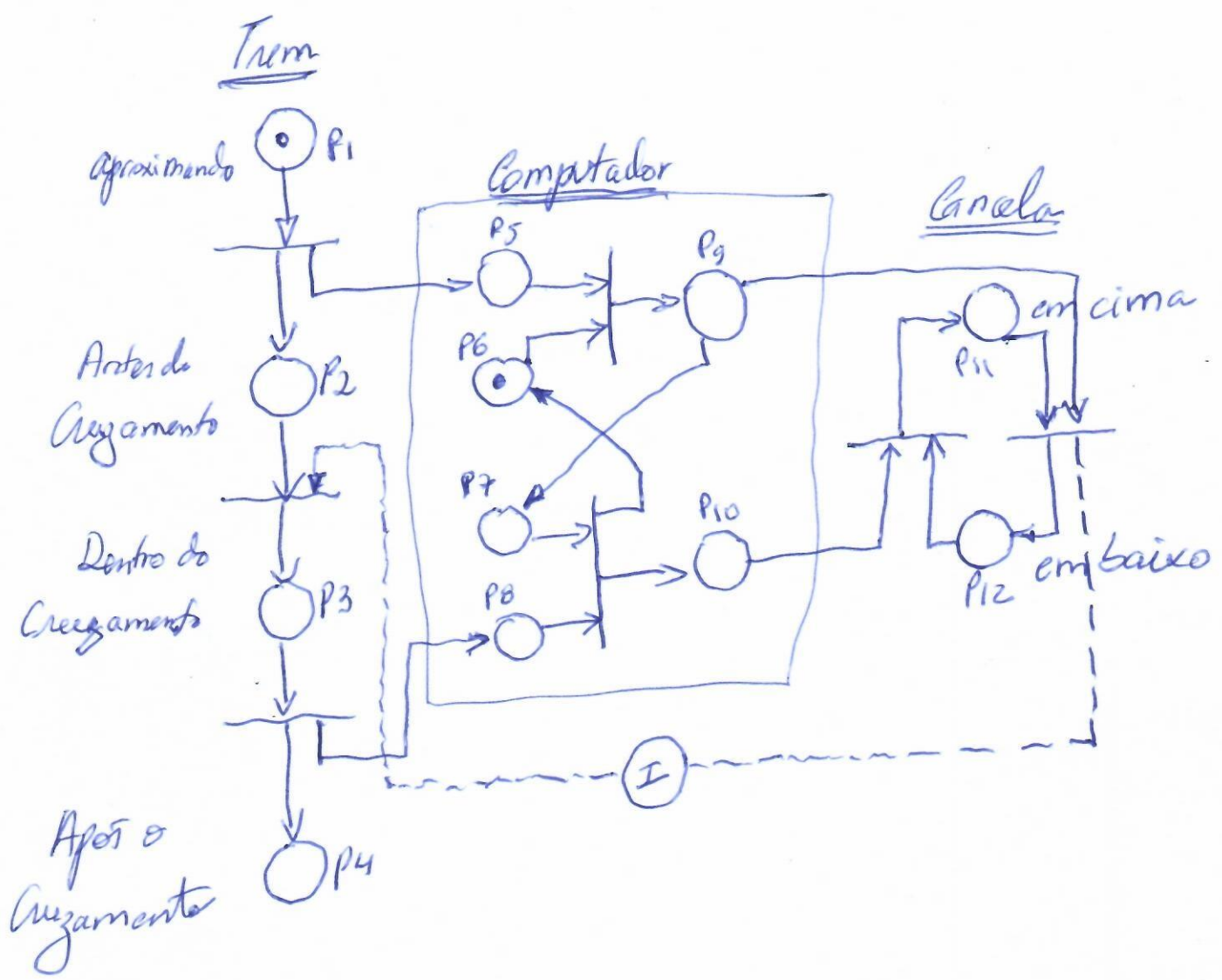
ESTADOS INSEGUROS



$$t_4 < t_2$$

$$t_4 + t_7 < t_2$$

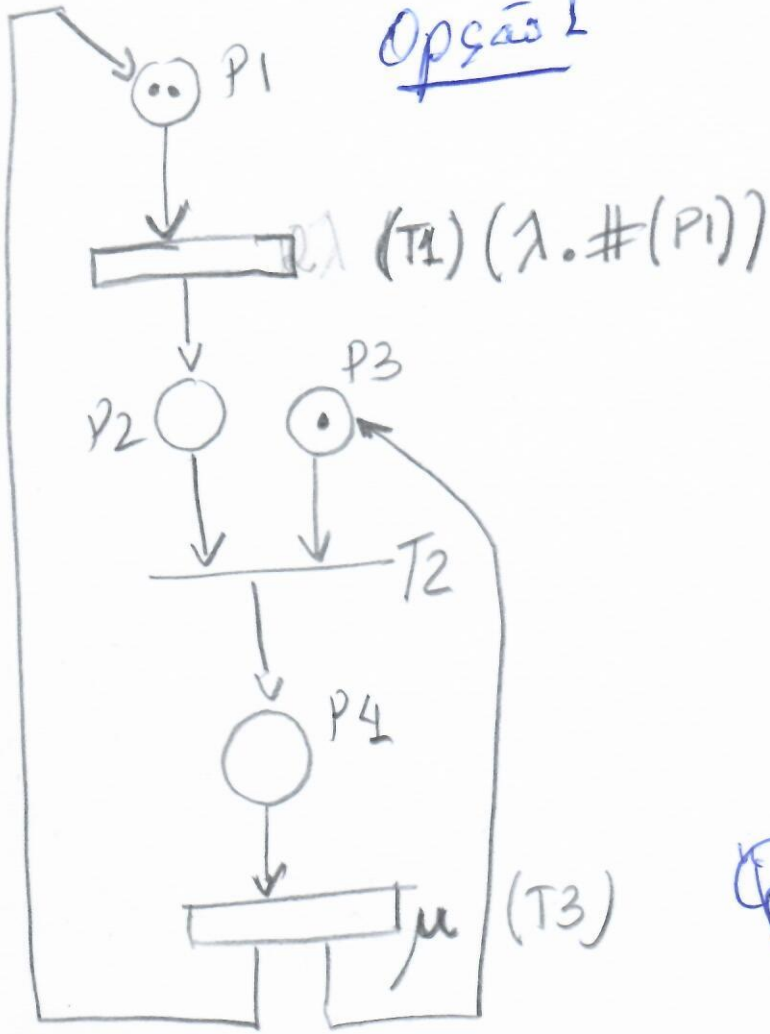
$$t_4 + t_7 < t_2$$



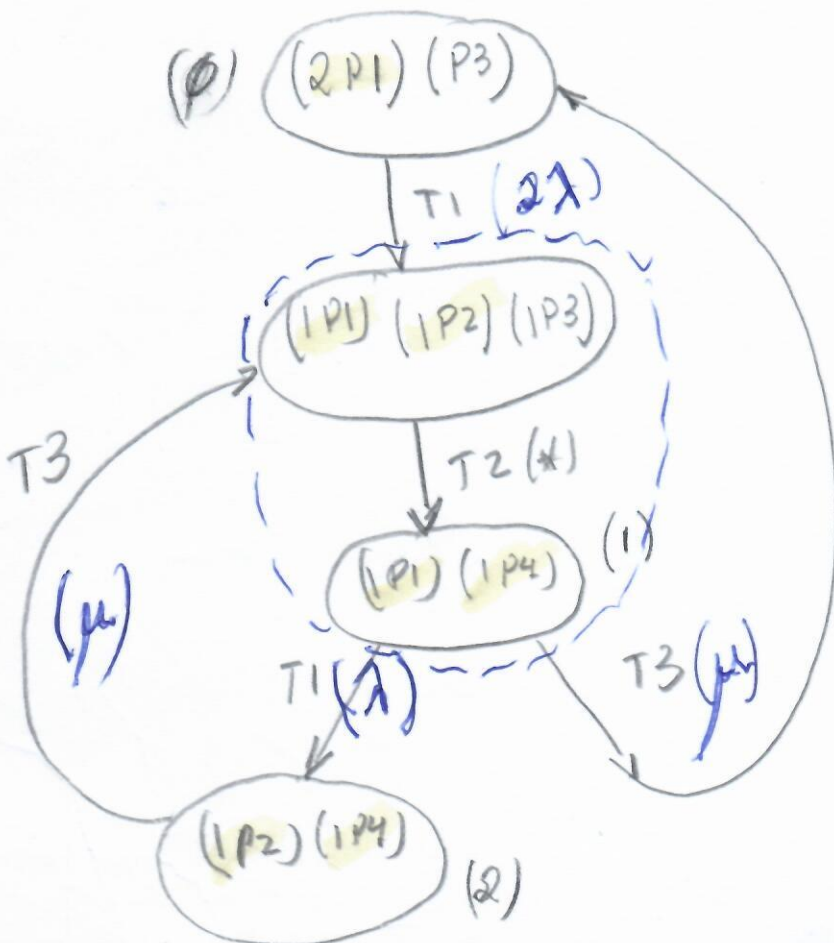
2)

(2)

Opção 2

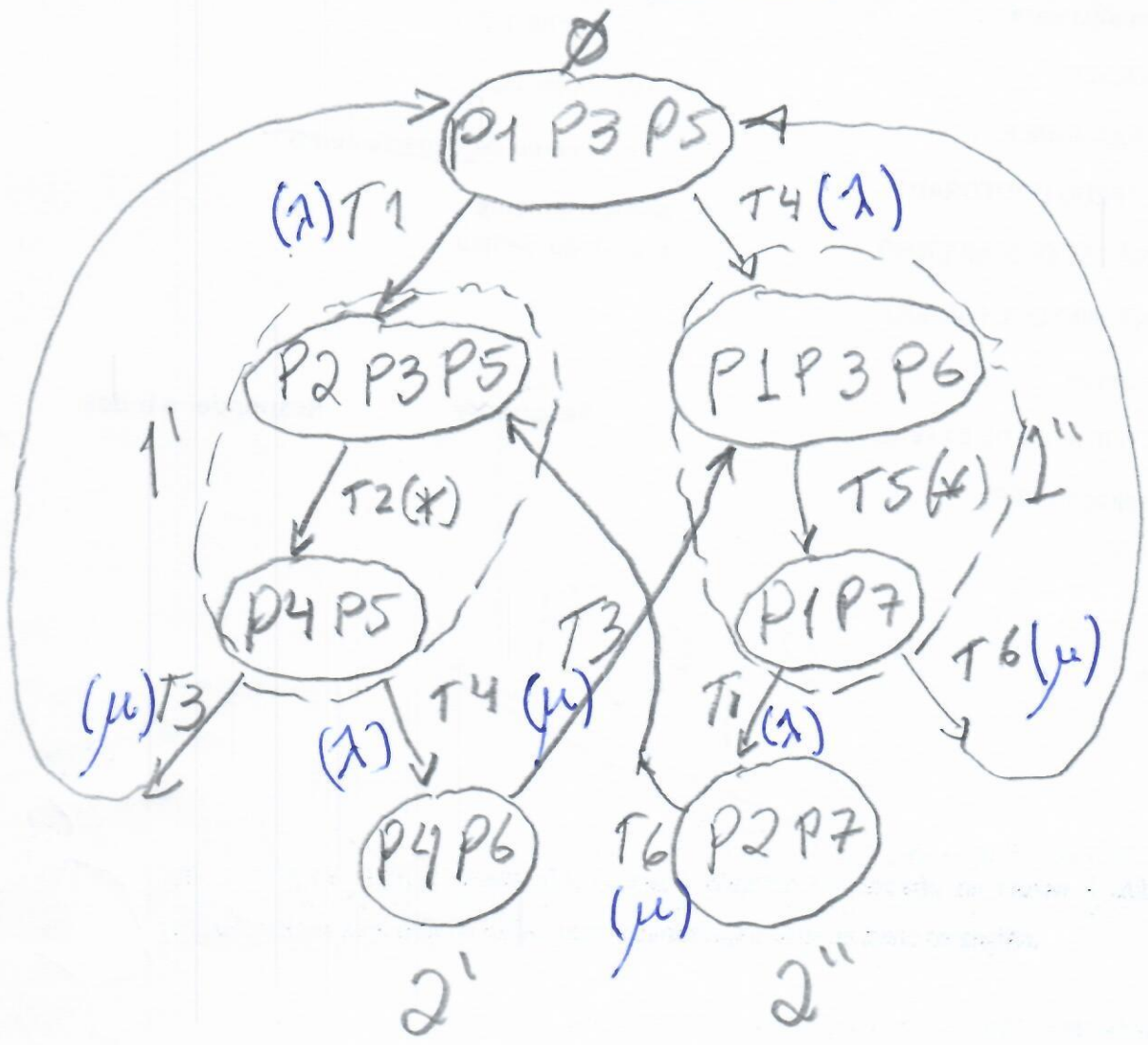
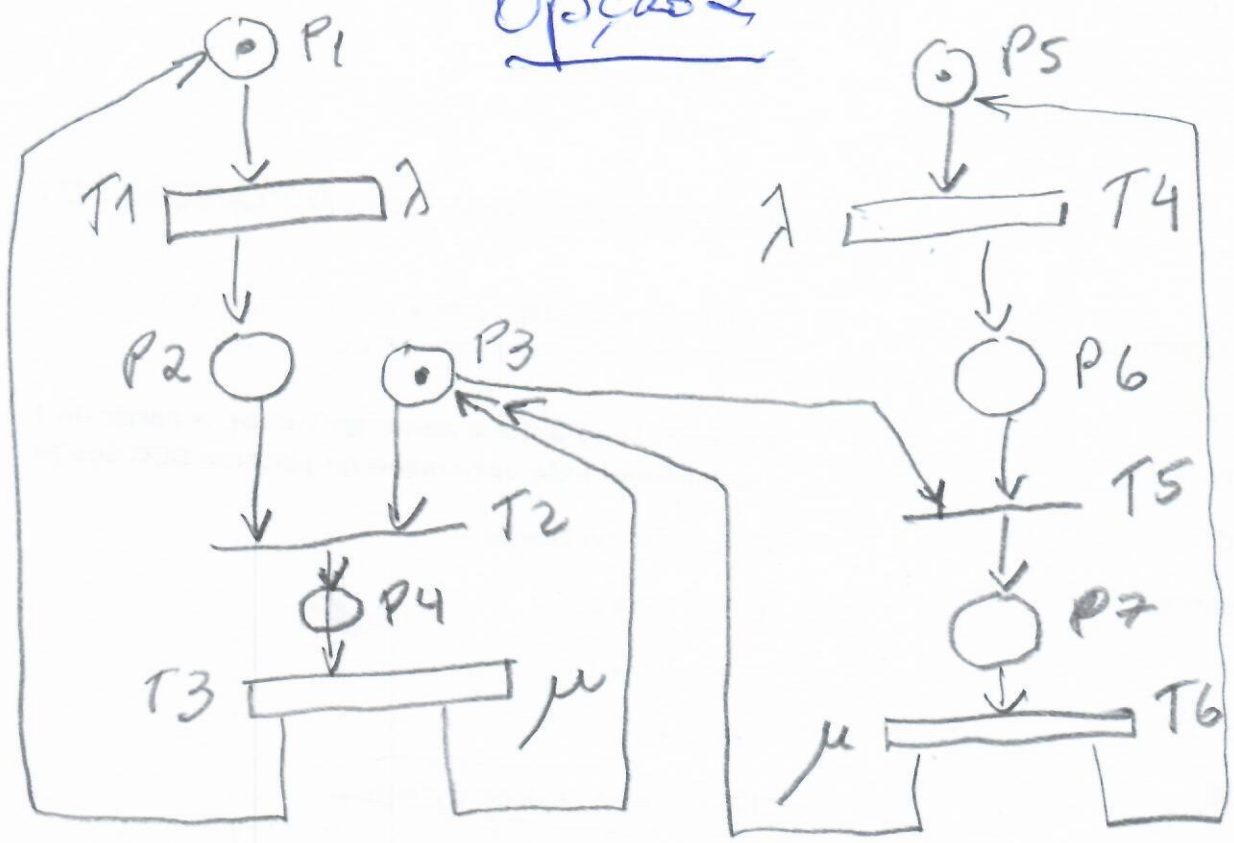


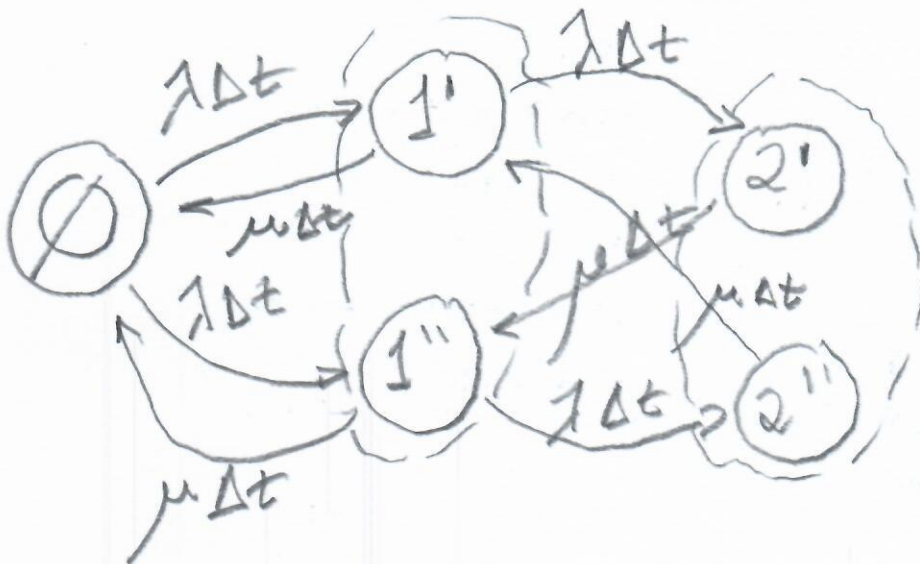
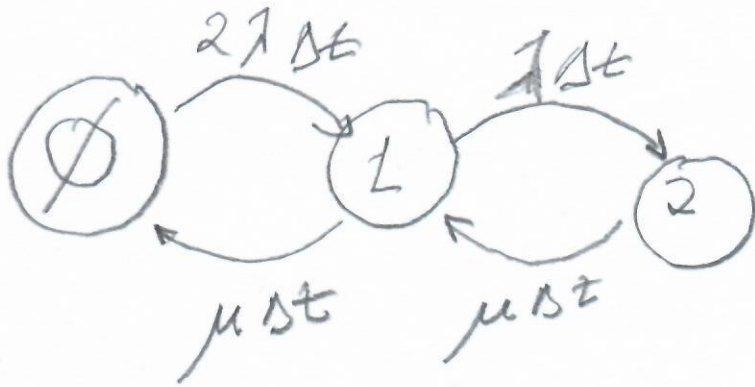
~~40~~
~~2~~ - ~~12~~
 12

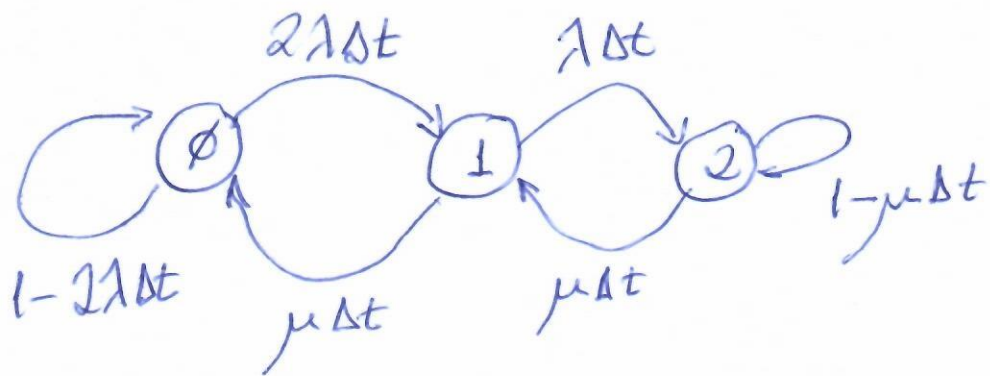


$T_2(*)$ - instantânea

Opção 2







$$\begin{cases} p_0(t+\Delta t) = p_0(t)(1-2\lambda\Delta t) + p_1(t)\mu\Delta t \\ p_1(t+\Delta t) = p_0(t)2\lambda\Delta t + p_1(t)(1-(\lambda+\mu)\Delta t) + p_2(t)\mu\Delta t \\ p_2(t+\Delta t) = p_1(t)\lambda\Delta t + p_2(t)(1-\mu\Delta t) \end{cases}$$

Em regime permanente $\frac{dp_i(t)}{dt} = 0$ $p_i(t) = p$

$$\begin{cases} 0 = -2\lambda p_0 + \mu p_1 \\ 0 = 2\lambda p_0 - (\lambda + \mu)p_1 + \mu p_2 \\ 0 = \lambda p_1 - \mu p_2 \end{cases} \quad p_0 + p_1 + p_2 = 1$$

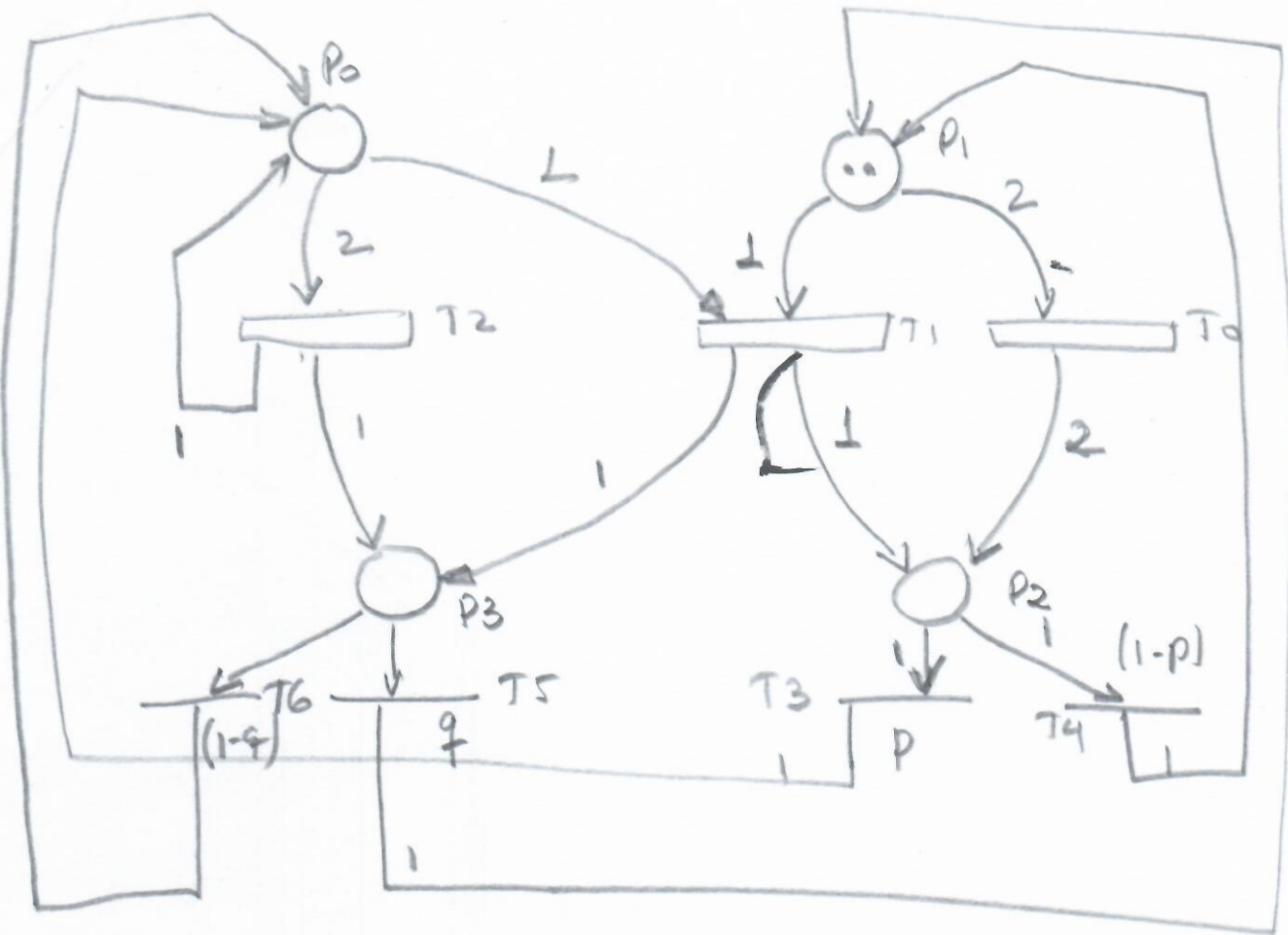
Resolvendo:

$$\underline{p_0 = 0,4} \quad \underline{p_1 = 0,4} \quad \underline{p_2 = 0,2}$$

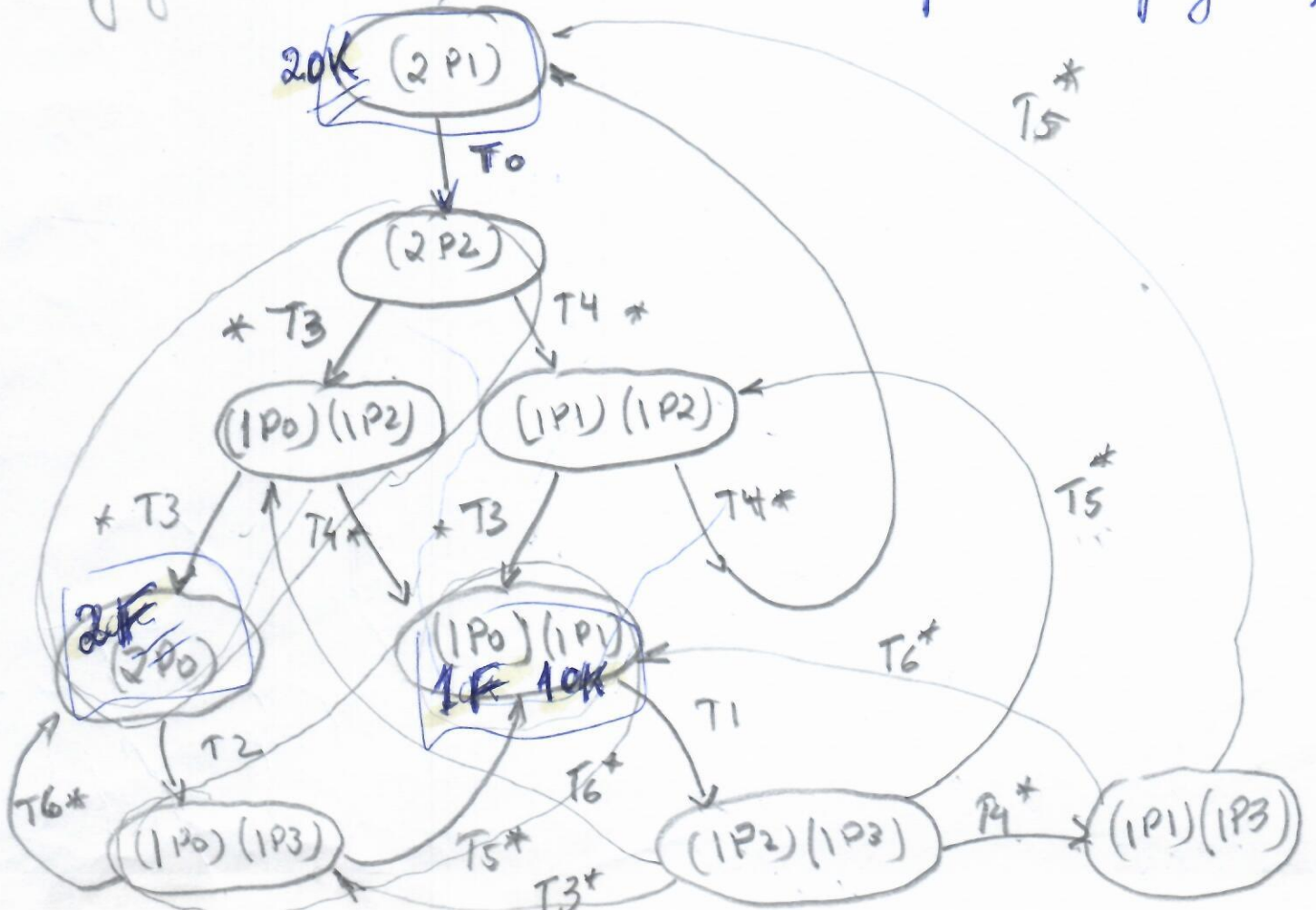
$$NU = p_1 + p_2 = 0,4 + 0,2$$

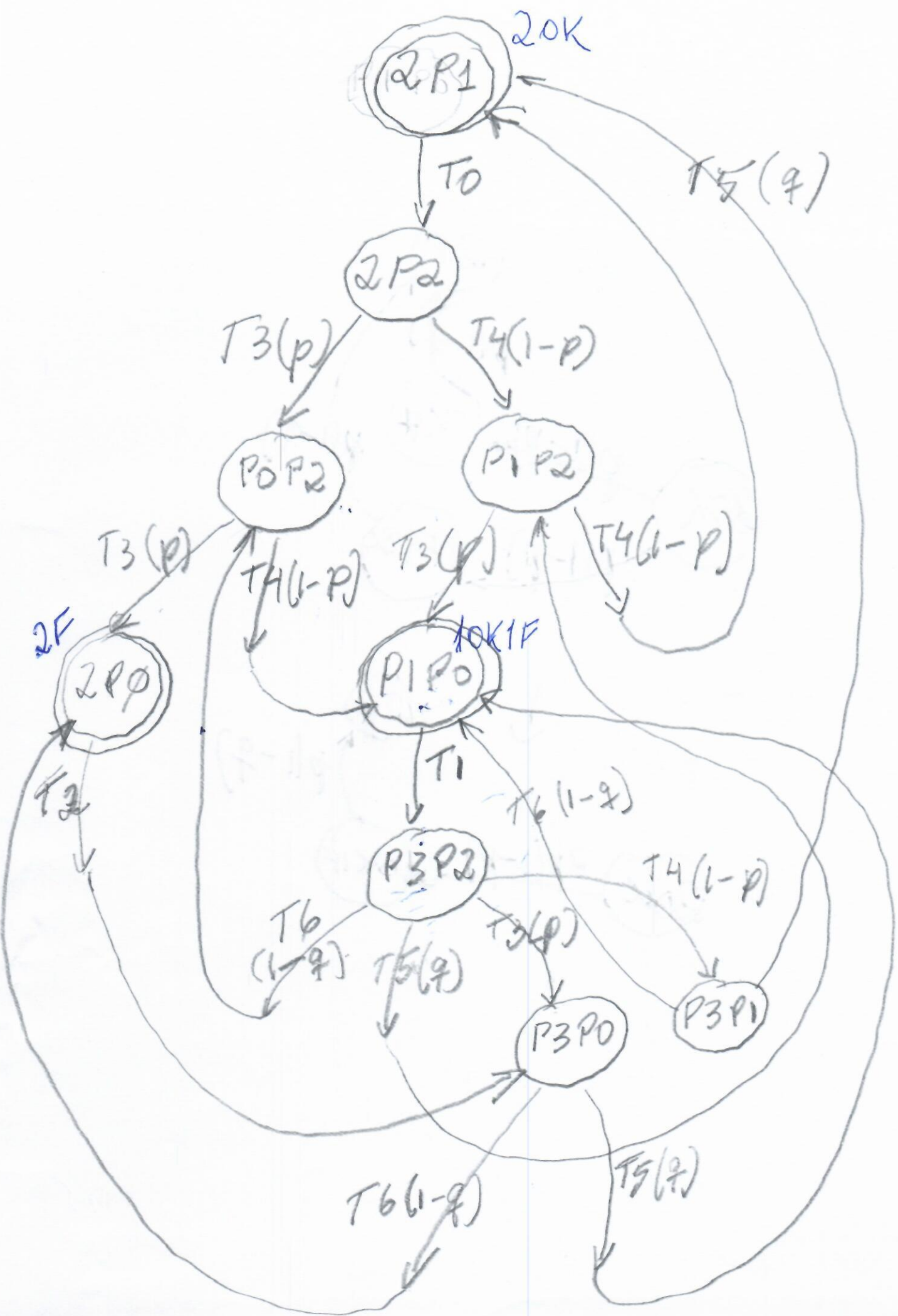
$$\boxed{NU = 0,6} \quad 60\%$$

3) a)

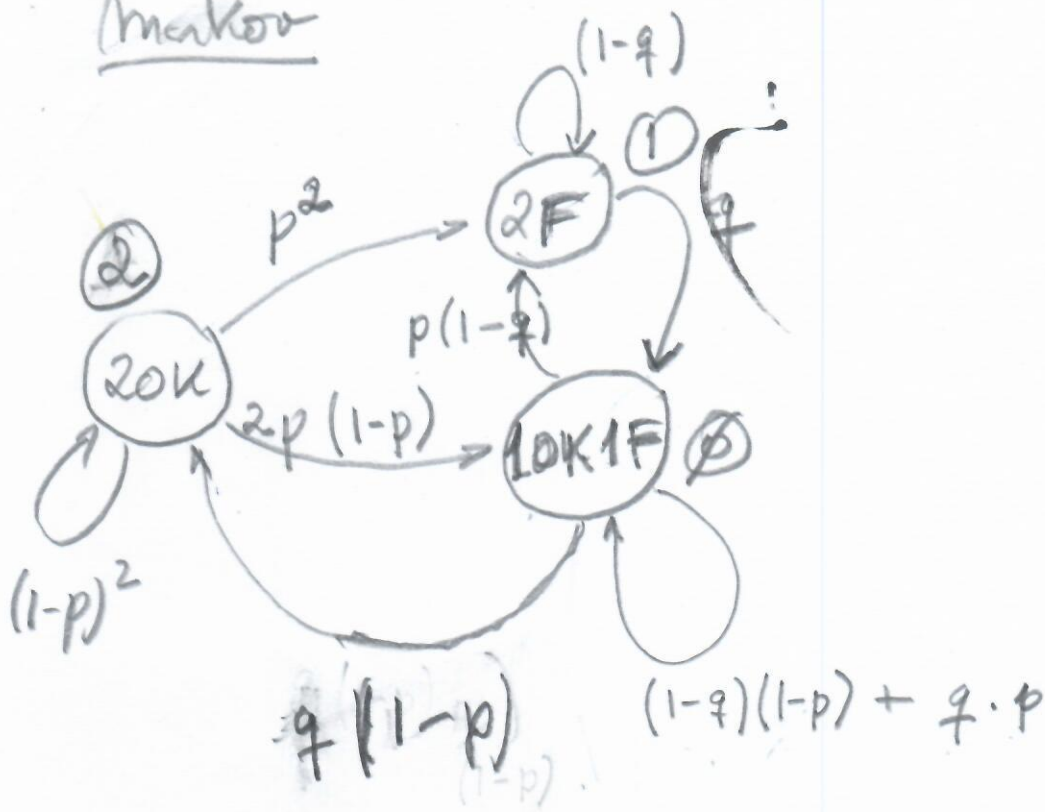


b) Gráfico de alcançabilidade (olhar na próxima página)





Markov



c) $p=0,1$ & $q=0,8$

$$\begin{cases} p_2(k+1) = p_2(k) (1-p)^2 + p_0(k) \cdot q (1-p) \\ p_1(k+1) = p_2(k) \cdot p^2 + p_1(k) \cdot (1-q) + p_0(k) \cdot p(1-q) \\ p_0(k+1) = p_2(k) \cdot 2p(1-p) + p_1(k) \cdot q + p_0(k) \cdot \left((1-q)(1-p) + q \cdot p \right) \end{cases}$$

$$\begin{cases} p_2(k+1) = 0,81 p_2(k) + 0,72 p_0(k) \\ p_1(k+1) = 0,01 p_2(k) + 0,2 p_1(k) + 0,02 p_0(k) \\ p_0(k+1) = 0,18 p_2(k) + 0,8 p_1(k) + 0,26 p_0(k) \end{cases}$$

$p_2(0) = 1 \quad p_1(0) = 0 \quad p_0(0) = 0$

$k=0: p_2(1) = 0,81 \cdot 1 + 0,72 \cdot 0 \rightarrow p_2(1) = 0,81$
 $p_1(1) = 0,01 \cdot 1 + 0,2 \cdot 0 + 0,02 \cdot 0 = 0,01 \quad p_1(1) = 0,01$

$$p_0(1) = 0,18 \cdot 1 + 0,8 \cdot 0 + 0,26 \cdot 0 = 0,18$$

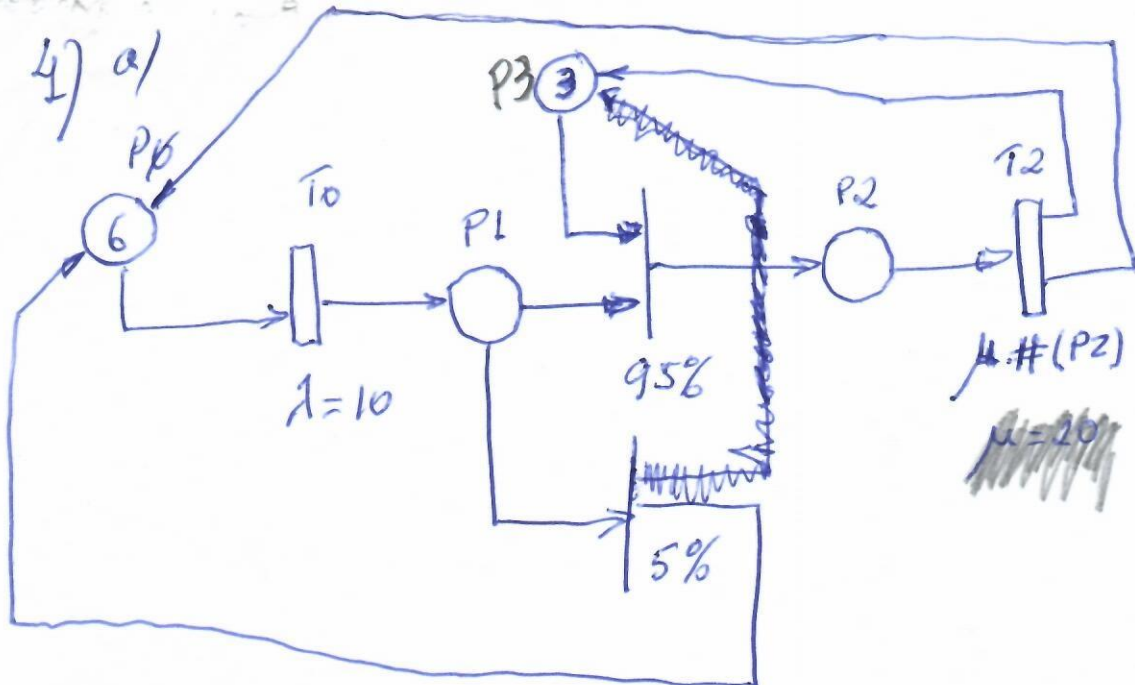
$$\underline{p_0(1) = 0,18}$$

K=1.

$$p_2(2) = 0,81 \cdot 0,81 + 0,72 \cdot 0,18$$

$$p_2(2) = 0,6561 + 0,1296$$

$$\boxed{p_2(2) = 0,7857}$$



b)

$$TMR = \frac{N^{\circ} \text{ médio de Marcas no Sistema}}{\text{Vazão de Entrada}}$$

$$TMR = \frac{6 - (N^{\circ} \text{ médio de marcas em } P0)}{\text{Vazão } T\phi}$$

b)

$$\text{Nível de Utilização} = \frac{N^{\circ} \text{ médio de Marcas em } P2}{3}$$

ou

$$\frac{3 - N^{\circ} \text{ médio de Marcas em } P3}{3}$$