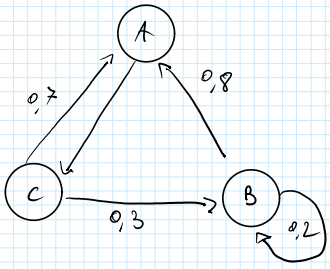
Esame settembre 2009

domenica 7 febbraio 2021 19:44



$\frac{1}{\mu_A} = 5' \rightarrow \mu_A = 0{,}20$ p/m

$\mu_B = 0{,}125$ p/m

$\frac{1}{\mu_C} = 4' \rightarrow \mu_C = 0{,}25$ p/m

$S_A = S_C = 1$

$S_B = 3$

$N = 4$

DOMANDE

$W_{0,A}$?

$P(1,3,0)$

$X_{R_B} \uparrow \quad X_{T_B} \uparrow$

CALCOLO VISIT COUNT

$V_B = 1$

$V_A = 0{,}7\,V_C + 0{,}8\,V_B \rightarrow V_A = 0{,}7\,V_A + 0{,}8 \rightarrow 0{,}3\,V_A = 0{,}8 = V_A = 2{,}7$

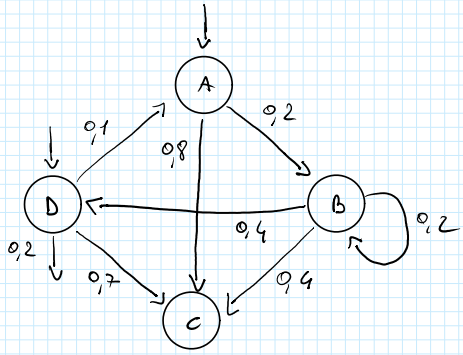
$V_C = V_A \rightarrow V_C = 2{,}7$

CALCOLO X_S

$\lambda_A = \frac{V_A}{\mu_A} = \frac{2{,}7}{0{,}2} = 13{,}5$ p/m

$\lambda_B = \frac{V_B}{\mu_B} = \frac{2{,}7}{0{,}125} = 21{,}6$ p/m

$\lambda_C = \frac{V_C}{\mu_C} = \frac{2{,}7}{0{,}25} = 10{,}8$ p/m



$\lambda_A = 1/2\ \lambda_D$ $\quad S_B = 4$

$S_A = S_C = S_D = 1$

$\mu_A = 20$ p/h $\rightarrow 0{,}333$ p/m

$\mu_B = 30$ p/h $\rightarrow 0{,}5$ p/m

$\mu_C = 15$ p/m $\quad 900$ p/h

$\mu_D = 25$ p/m $\quad 1500$ p/h

DOMANDE

$W_q = ?$

$P(0{,}3, 4{,}2)$?

$X_{R_B} \uparrow \quad X_{T_B} \uparrow$

CALCOLO λ'

$\lambda'_A = \lambda_A + 0{,}1\ \lambda'_D \rightarrow \lambda'_A = 0{,}5\lambda_D + 0{,}1\lambda'_D \rightarrow \lambda'_A = 1\lambda_A + 0{,}1(2\lambda_A + 0{,}1\lambda'_A) \rightarrow 0{,}99\lambda'_A = 1{,}2\lambda_A \rightarrow \lambda'_A = 1{,}21\lambda_A$

$\lambda'_B = 0{,}2\lambda'_A + 0{,}2\lambda'_B \rightarrow 0{,}8\lambda'_B = 0{,}2\lambda'_A \rightarrow \lambda'_B = 0{,}25\lambda'_A \rightarrow \lambda'_B = 0{,}3\lambda_A$

$\lambda'_C = 0{,}8\lambda'_A + 0{,}4\lambda'_B + 0{,}7\lambda'_D \rightarrow \lambda'_C = 0{,}8\lambda'_A + 0{,}4(0{,}25\lambda'_A) + 0{,}7\lambda'_D \rightarrow \lambda'_C = 0{,}9\lambda'_A + 0{,}7\lambda'_D$

$\rightarrow \lambda'_C = 0{,}9\lambda'_A + 0{,}7(2\lambda_A + 0{,}1\lambda'_A) \rightarrow \lambda'_C = 0{,}9\lambda'_A + 1{,}4\lambda_A + 0{,}07\lambda'_A \rightarrow \lambda'_C = 0{,}97\lambda'_A + 1{,}4\lambda_A \rightarrow \lambda'_C = 2{,}57\lambda_A$

$\lambda'_D = \lambda_D + 0{,}4\lambda'_B \rightarrow \lambda'_D = \lambda_D + 0{,}1\lambda'_A \rightarrow \lambda'_D = 2\lambda_A + 0{,}1\lambda'_A \rightarrow \lambda'_D = 2\lambda_A + 0{,}121\lambda_A \rightarrow \lambda'_D = 2{,}12\lambda_A$

$\lambda_A = \lambda$

$\lambda_D = 2\lambda$

$$X_R = \lambda_A + \lambda_D = 3\lambda$$

CALCOLO VISIT COUNT

$$V_A = \frac{\lambda'_A}{X_R} = \frac{1{,}21\cancel{\lambda}}{3\cancel{\lambda}} = 0{,}4$$

$$V_B = \frac{\lambda'_B}{X_R} = \frac{0{,}3\cancel{\lambda}}{3\cancel{\lambda}} = 0{,}1$$

$$V_C = \frac{\lambda'_C}{X_R} = \frac{2{,}57\cancel{\lambda}}{3\cancel{\lambda}} = 0{,}86$$

$$V_D = \frac{\lambda'_D}{X_R} = \frac{2{,}12\cancel{\lambda}}{3\cancel{\lambda}} = 0{,}7$$

$X_R \qquad 3\lambda$

$\rho_D = \frac{\lambda'_D}{X_R} = \frac{2,12\lambda}{3\lambda} = 0,7$

Calcolo X_T

$X_T = \min\left\{\frac{s_3 \mu_3}{\nu_3}\right\} = \left\{\frac{1 \cdot 20}{0,4} ; \frac{4 \cdot 30}{0,1} ; \frac{1 \cdot 800}{0,86} ; \frac{1 \cdot 1500}{0,7}\right\}$

$50 \qquad 1200 \qquad 1044 \qquad 2142$

$X_R < X_T \qquad 3\lambda < 50 \qquad \lambda < 16$

Riscrivo i λ'

$\lambda'_A = 1,21\,(16) = 19,36$ p/m

$\lambda'_B = 0,3\,(16) = 4,8$ p/m

$\lambda'_C = 2,57\,(16) = 41,12$ p/m

$\lambda'_D = 2,12\,(16) = 34$ p/m

Calcolo W_q

$W_q = \sum \nu_i \cdot W_{qi}$

M/M/1 $\qquad W_q = W - W_s \rightarrow \frac{1}{\mu - \lambda'} - \frac{1}{\mu}$

M/M/S $\qquad W_q = \frac{L_i}{\lambda'_i}$

$W_{qA} = \frac{1}{20 - 19,36} - \frac{1}{20} = \frac{1}{0,64} - \frac{1}{20} = 1,56 - 0,05 = 1,5$ h

$W_{qC} = \frac{1}{800 - 41,12} - \frac{1}{800} = \frac{1}{858} - 0,001 = 0,002 - 0,001 = 0,001$ h

$W_{qD} = \frac{1}{1500 - 34} - \frac{1}{1500} = \frac{1}{1466} - 0,0006 = 0,0007 - 0,0006 = 0,0001$ h

$$P_0 = \frac{1}{1 + \left(\frac{4,8}{30}\right) + 0,5\left(\frac{4,8}{30}\right)^2 + 0,17\left(\frac{4,8}{30}\right)^3 + 0,042\left(\frac{4,8}{30}\right)^4 \frac{120}{120 - 4,8}} = \frac{1}{1 + 0,16 + 0,013 + 0,0007 + 0,03} =$$

$$= \frac{1}{1,2037} = 0,83$$

$$L = \frac{1}{5!}\left(\frac{\lambda_B}{\mu_B}\right)^5 P_0 \frac{\rho}{(1-\rho)^2} = \frac{1}{4!}(0,16)^4 \cdot 0,83 \cdot 0,042 = 0,042 \cdot 0,00065 \cdot 0,83 \cdot 0,042 = 9,5 \cdot 10^{-7}$$

$$W_{qB} = \frac{0,00000095}{\quad} = 0,0000002 = 2 \cdot 10^{-7}$$

$\bar{4,8}$

$$W_g = \sum_{i=1}^{4} w_{gi} \cdot \nu_i = 1,5 \cdot 0,4 + 0,001 \cdot 0,1 + 0,0001 \cdot 0,86 + 0,0000002 \cdot 0,7 = 0,6 + 0,0001 + 0,000086 + 0,00000014 =$$

$$= 0,6 \text{ h}$$

CALCOLO $P(0,3,4,2)$

$$P(0,3,4,2) = f_A(6) \cdot f_B(3) \cdot f_C(4) \cdot f_D(2) = 0,03 \cdot \left(\frac{1}{3!} \left(\frac{4,8}{30} \right)^3 \cdot 0,83 \right) \cdot \left(\frac{1}{4!} \left(\frac{41,12}{300} \right)^4 \cdot 0,854 \right) \cdot$$

$$\cdot \left(\frac{1}{2!} \left(\frac{34}{1500} \right)^2 \cdot 0,877 \right) = 0,03 \cdot 0,00057 \cdot 0,0000002 \cdot 0,00024 =$$

$$= 8 \cdot 10^{-16}$$

CALCOLO X_e E X_T DELLA STAZIONE B

$$X_{e_B} = \frac{\lambda'_B}{\nu_B} = \frac{4,8}{0,1} = 48 \qquad X_{T_B} = 1200$$

Posso aumentare X_{e_B} fino ad $X_{T_B} - \varepsilon$. Posso aumentare i λ esterni sempre rimanendo in condizione di stazionarietà