① A) $P_{n+1} = m P_n + m P_n - x$ 1200

$P_0 = \bar{P} = 12230$

$\bar{P} = m\bar{P} + m\bar{P} - \boxed{x}$

$\bar{P} = 12230$

$P_{n+1} = m P_n + S$ -1200

$\Rightarrow \boxed{P_{n+1} = C P_n}$ ✓

$\bar{P} = m\bar{P} + S$

$\bar{P} = \frac{S}{1-m} = 130$

Eq ~~no~~ só acontece p/ $\underline{R = 1}$

$\bar{P} = c\bar{P}$

$\bar{P}(1-c) = 0$

$\bar{P} = 0$ p/ qq R

$P_{n+1} = \overset{1}{R} P_n$

$P_{n+1} = P_n$

$P_n = CR^n + \bar{P}$

$$\bar{P} = m\bar{P} + m\bar{P} - X$$

$$X = \bar{P}(m-1)$$

$$X = C\bar{P}$$

$$\boxed{P_0 = 12230}$$

$$\bar{P} = P_0 = 12230$$

(2)

A) $P_{n+1} = \underline{\quad} P_n + \underline{\quad} + P$

$$\boxed{P_{n+1} = \underline{\quad} P_n} \longrightarrow P_{n+1} = C\,P_n$$

$$\underbrace{P_n = C R^n}$$

B) Cresc / decresc.

C) colocar ou retirar

$$\boxed{\bar{P} = P_0 = 12230}$$

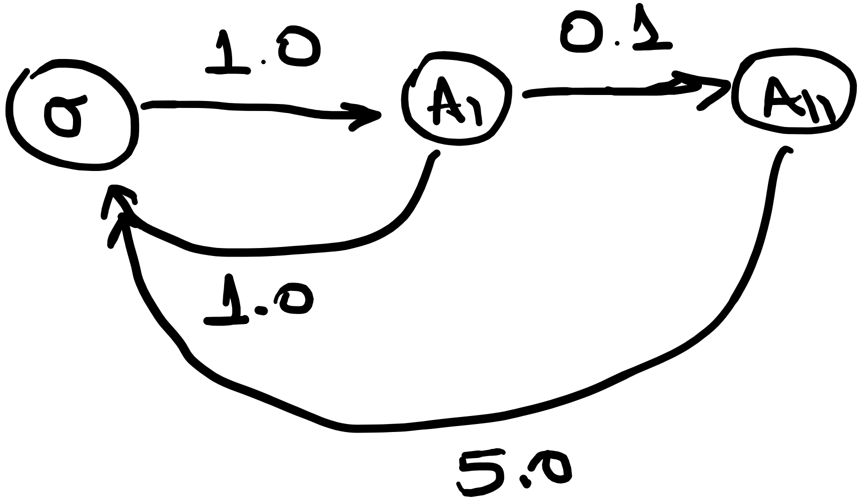
$$P_1 = P_0 = 12230$$

$$P_{n+1} = C P_n \pm x$$

$$P_1 = C P_0 + x$$

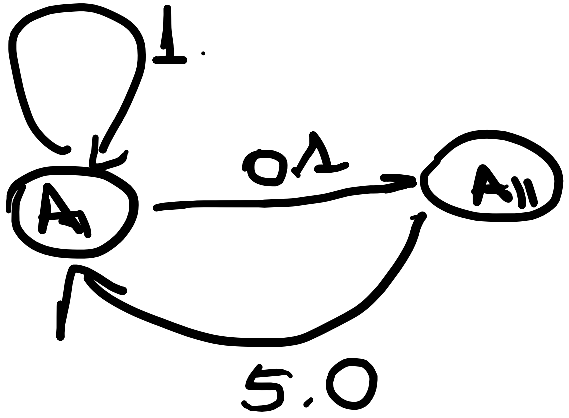
$$P_2 = C P_1 + x = C(C P_0 + x) + x$$

3 Estágios



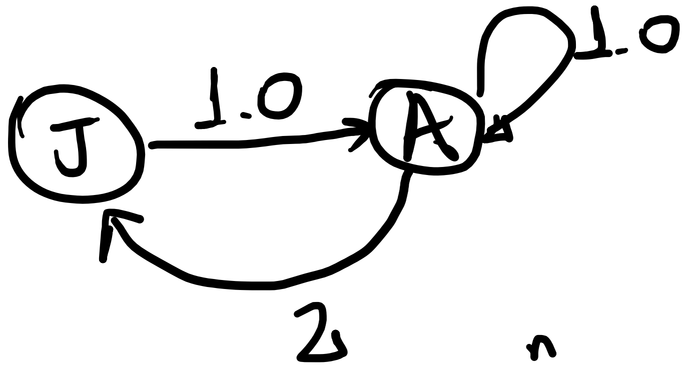
3ª ordem

2 estágios



→ 2ª ordem

④



$$\boxed{P_{n+1} = P_n + \_\_\, P_{n-1}}$$

$$\begin{cases} J_{n+1} = \_\_\, A_n \\ A_{n+1} = \_\_\, J_n + \_\_\, A_n \end{cases}$$

$$CR^n$$

$$\mathbb{A} = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}$$

$$CR^{n+1} = \_\, CR^n + CR^{n-1} \qquad \vec{v}_{n+1} = \mathbb{A}\vec{v}_n \qquad v = \begin{pmatrix} J \\ A \end{pmatrix}$$

$$R^2 = \_\, R + \_\_$$

$$\mathbb{A}\vec{v} = \lambda\vec{v}$$

R_+

R_-

$$\mathbb{A}\vec{v} - \lambda\vec{v} = 0$$

$$(\mathbb{A} - \lambda\mathbb{I})\vec{v} = 0$$

$$P_n = C_+R_+^n + C_-R_-^n$$

P_0 c P_1

$$\underbrace{\begin{vmatrix} a_{11}-\lambda & a_{12} \\ a_{21} & a_{22}-\lambda \end{vmatrix}}_{\det = 0} = 0$$

$$(a_{11}-\lambda)(a_{22}-\lambda) - a_{12}a_{21} = 0$$

$$\lambda^2 + (a_{22}+a_{11})\lambda - \dots = 0$$

$$\lambda_1 \quad \lambda_2$$

$\underline{\lambda_1}$ e $\underline{\lambda_2}$

$v^{(1)}$ $\quad v^{(2)}$

$\lambda_1 \quad \lambda_2$

$v^{(1)} \quad v^{(2)}$

$$(\mathbb{A} - \lambda \mathbb{I})\vec{v} = 0$$

$$\begin{pmatrix} 4v_2 \\ v_2 \end{pmatrix}$$

$$\begin{pmatrix} a_{11}-\lambda & a_{12} \\ a_{21} & a_{22}-\lambda \end{pmatrix}\begin{pmatrix} v_1 \\ v_2 \end{pmatrix} = 0$$

$$P_n = C_+ \lambda_+^n v_+ + C_- \lambda_-^n v_-$$

$\Rightarrow (a_{11}-\lambda)v_1 + a_{12}v_2 = 0$

$\Rightarrow a_{21}v_1 + (a_{22}-\lambda)v_2 = 0$

v_1

v_2

$v_1 = 4v_2$

$$\boxed{* \; P_{n+1} = \underbrace{a}P_n + \underbrace{b}P_{n-1}}$$

P_0	J
P_1	A
	JJA
	JJAAA

solução geral: $P_n = \underline{C R^n}$

A) $P_{n+1} = f(P_n, P_{n-1})$

B) $P_n = g(n)$

$P_0 = 1$

$P_1 = 1$

$$P_{n+1} = CR^{n+1}$$

$$P_n = CR^n$$

$$P_{n-1} = CR^{n-1}$$

$$* \quad \cancel{C}R^{n+1} = a\cancel{C}R^n + b\cancel{C}R^{n-1}$$

$$\frac{R^{n+1}}{R^{n-1}} = \frac{aR^n + bR^{n-1}}{R^{n-1}}$$

$$R^2 = aR + b$$

$$\underbrace{R^2 - aR - b = 0}$$

$$R_+ \quad R_-$$

$$P_n = C_+R_+^n + C_-R_-^n$$

$$P_n = C_+ R_+^n + C_- R_-^n$$

$$P_0 = C_+ + C_-$$

$$P_1 = C_+ R_+ + C_- R_-$$

$$P_2 = C_+ R_+^2 + C_- R_-^2$$

Total

$\rightarrow P_0 = 1J = 1$

$\rightarrow \rightarrow P_1 = 1A = 1$

$\rightarrow P_2 = JJA = 3$

$P_0 = 1A = 1$

$P_1 = JJA = 3$

5 A) Pto eq

$$P_{n+1} = P_n e^{1.1\left(1 - P_n/1500\right)}$$

$$\underbrace{\qquad\qquad}_{f(P)}$$

$$P_{n+1} = P_n = \bar{P}$$

$\bar{P}$

$\bar{P} = 0$

$$\left|\frac{df}{dP}\right| < 1 \rightarrow \text{Estável}$$

$$\left|\frac{df}{dP}\right| > 1 \ \text{Instável}$$

Estabilidade

$$\rightarrow \left.\frac{df}{dP}\right|_{\bar{P}=0}$$

> 1 < 1

$$\left.\frac{df}{dP}\right|_{\bar{P}=\ldots}$$

$|-2| = 2$ $|5| = 5$

$|-5| = 5$

⑤ c)

$$P_{n+1} = 800\, e^{11(1 - 800/1500)}$$

$$P_{n+1} = 800 +$$

$$P_{n+2} = 800 + \quad +$$

$$\begin{pmatrix} S \\ G \\ T \end{pmatrix}_{n+1} = \underbrace{\begin{pmatrix} 0{,}25 & & \\ & & \\ & & \end{pmatrix}}\begin{pmatrix} S \\ G \\ T \end{pmatrix}_{n}$$

$\lambda_1 = x$

$\lambda_2 = \rho = y$

$\lambda_3 = \rho = y$

$\underline{x}$ $\cancel{y}$

$$S = S + 0{,}25\,G + 0{,}08\,T$$

$$G = S$$

$$T = S$$

$\lambda_1 = \mathbb{R}e$

$\lambda_2 = a^{=0} + bi$

$\lambda_3 = a^{=0} - bi$

$\rho = \sqrt{a^2 + b^2}$

$\rho = \sqrt{b^2}$