$$\frac{dx_1}{dt} = 2x_1 + 3x_2 \qquad \Longrightarrow \frac{d}{dt}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

$$\frac{dx_2}{dt} = x_1 + 4x_2$$

$$\lambda_1 = \qquad \lambda_2 =$$

$$e^{At} = B_0(t)I + B_1(t)A \Rightarrow e^{\lambda_1 t} = B_0(t)(1) + B_1(t)\cdot\lambda_1$$

$$e^{\lambda_2 t} = B_0(t)(1) + B_1(t)\cdot\lambda_2$$

Ec. Carac. $\det\left(A - \lambda I\right) = 0$

$$\begin{vmatrix} 2-\lambda & 3 \\ 1 & 4-\lambda \end{vmatrix} = 0 \qquad (2-\lambda)(4-\lambda) - (3)(1) = 0$$

$$\lambda^2 - 6\lambda + 5 = 0 \qquad \lambda_1 = 1$$

$$(\lambda - 1)(\lambda - 5) = 0 \qquad \lambda_2 = 5$$

$$e^{t} = B_0 + B_1$$

$$e^{5t} = B_0 + 5B_1$$

$$-e^{t} = -B_0 - B_1$$

$$e^{5t} - e^{t} = 4B_1$$

$$B_1 = \frac{1}{4}e^{5t} - \frac{1}{4}e^{t}$$

$$B_0 = e^{t} - B_1$$

$$B_0 = e^{t} - \frac{1}{4}e^{5t} + \frac{1}{4}e^{t}$$

$$B_0 = -\frac{1}{4}e^{5t} + \frac{5}{4}e^{t}$$

$$e^{At} = B_0(t)I + B_1(t)A$$

$$e^{At} = \left(-\frac{1}{4}e^{5t} + \frac{5}{4}e^{t}\right)\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + \left(\frac{1}{4}e^{5t} - \frac{1}{4}e^{t}\right)\begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$$

$$e^{At} = \begin{bmatrix} -\frac{1}{4}+\frac{2}{4} & \frac{3}{4} \\ \frac{1}{4} & -\frac{1}{4}+\frac{4}{4} \end{bmatrix} e^{5t} + \begin{bmatrix} \frac{5}{4}-\frac{2}{4} & -\frac{3}{4} \\ -\frac{1}{4} & \frac{5}{4}-\frac{4}{4} \end{bmatrix} e^{t}$$

$$e^{At} = \begin{bmatrix} \frac{1}{4} & \frac{3}{4} \\ \frac{1}{4} & \frac{3}{4} \end{bmatrix} e^{5t} + \begin{bmatrix} \frac{3}{4} & -\frac{3}{4} \\ -\frac{1}{4} & \frac{1}{4} \end{bmatrix} e^{t}$$

$$e^{A(0)} = \begin{bmatrix} \frac{4}{4} & 0 \\ 0 & \frac{4}{4} \end{bmatrix} \Rightarrow \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$\frac{d}{dt}e^{At} = \begin{bmatrix} \frac{5}{4} & \frac{15}{4} \\ \frac{5}{4} & \frac{15}{4} \end{bmatrix} e^{5t} + \begin{bmatrix} \frac{3}{4} & -\frac{3}{4} \\ -\frac{1}{4} & \frac{1}{4} \end{bmatrix} e^{t}$$

$$Ae^{At} = \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}\begin{bmatrix} \frac{1}{4} & \frac{3}{4} \\ \frac{1}{4} & \frac{3}{4} \end{bmatrix} e^{5t} + \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}\begin{bmatrix} \frac{3}{4} & -\frac{3}{4} \\ -\frac{1}{4} & \frac{1}{4} \end{bmatrix} e^{t}$$

$$\begin{bmatrix} \frac{5}{4} & \frac{15}{4} \\ \frac{5}{4} & \frac{15}{4} \end{bmatrix} e^{5t} + \begin{bmatrix} \frac{3}{4} & -\frac{3}{4} \\ -\frac{1}{4} & \frac{1}{4} \end{bmatrix} e^{t}$$

$$MatExp := \begin{bmatrix} \frac{3}{4}\mathrm{e}^{t} + \frac{1}{4}\mathrm{e}^{5t} & \frac{3}{4}\mathrm{e}^{5t} - \frac{3}{4}\mathrm{e}^{t} \\ \frac{1}{4}\mathrm{e}^{5t} - \frac{1}{4}\mathrm{e}^{t} & \frac{1}{4}\mathrm{e}^{t} + \frac{3}{4}\mathrm{e}^{5t} \end{bmatrix}$$

$$e^{At} = \begin{bmatrix} \frac{1}{4} & \frac{3}{4} \\ \frac{1}{4} & \frac{3}{4} \end{bmatrix} e^{5t} + \begin{bmatrix} \frac{3}{4} & -\frac{3}{4} \\ -\frac{1}{4} & \frac{1}{4} \end{bmatrix} e^{t}$$

$$\frac{dx_1}{dt} = x_1 + x_2 + x_3 \qquad x_1(0) = 1$$

$$\frac{dx_2}{dt} = x_1 - x_2 + x_3 \qquad x_2(0) = 2$$

$$\frac{dx_3}{dt} = -x_1 + x_2 - x_3 \qquad x_3(0) = 3$$

$$\frac{d}{dt}\bar{x} = A\bar{x} \longrightarrow \bar{x} = e^{At}\bar{x}(0)$$

$$\frac{d}{dt}\bar{x} = A\bar{x} + \bar{b}(t)$$

$$\bar{x} = e^{At}\bar{x}(0) + \int_0^t e^{A(t-\tau)}\bar{b}(\tau)\,d\tau$$

$$\bar{x} = e^{A(t-a)}\bar{x}(a) + \int_a^t e^{A(t-\tau)}\bar{b}(\tau)\,d\tau$$

$$P_{T\&S} = \frac{\sum_{n=1}^{3} T_n + \sum_{j=1}^{5} S_j}{n+j}$$

$$P_{EP} = \frac{\sum_{i=1}^{3} E_i}{3}$$

$$P_{sem} = \frac{P_{T\&S} + P_{EP}}{2}$$

$$C_f = \frac{P_{sem} + E_F}{2}$$