MEM 633 Robust Control I HW #5 Nov. 2021

1. Find a minimal controller-form (NOT a block controller form) realization of

$$H(s)=\begin{bmatrix} \dfrac{1}{(s-1)^2} & \dfrac{1}{(s-1)(s+3)} \\ \dfrac{-6}{(s-1)(s+3)^2} & \dfrac{s-2}{(s+3)^2} \end{bmatrix}$$

2. Let

$$A_c=\begin{bmatrix} -a_1 & -a_2 & -a_3 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

Show that the unimodular matrices

$$U(s)=\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & s \\ 1 & s+a_1 & s^2+a_1 s+a_2 \end{bmatrix}, \quad V(s)=\begin{bmatrix} 0 & -1 & s^2 \\ -1 & 0 & s \\ 0 & 0 & 1 \end{bmatrix}$$

will convert $sI-A_c$ to its Smith form. Generalize the above result to its matrix case; i.e., each element in A_c is replaced by a corresponding nxn matrix.