Week 5 Tutorial

Question 1. *Consider the linear discrete-time system described by the equations*

$$x^+[k] = Ax[k] + Bu[k]$$
$$y[k] = Cx[k] + Du[k]$$

For each of the following cases, determine the stability properties of the system and justify your conclusion:

(a) *When* $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, *what can you conclude about the stability properties of the system?*

(b) *When* $A = \begin{bmatrix} 2 & -1 \\ 1 & 0 \end{bmatrix}$, *what can you conclude about the stability properties of the system?*

Question 2. *Consider the linear continuous-time system described by the equations*

$$\dot{x}_1 = -x_1$$
$$\dot{x}_2 = -x_1$$
$$\dot{x}_3 = -x_1$$

What can you conclude about the stability of the system?

Question 3. *Consider the linear continuous-time system described by the equations*

$$\dot{x}(t) = Ax(t) + Bu(t)$$
$$y(t) = Cx(t) + Du(t)$$

For each of the following cases, determine the stability properties of the system and justify your conclusion:

(a) *When* $A = \begin{bmatrix} 0 & 0 & 0 \\ -1 & 0 & 0 \\ -1 & 0 & 0 \end{bmatrix}$, *what can you conclude about the stability properties of the system?*

(b) *When* $A = \begin{bmatrix} -3 & 4 & -4 \\ 0 & 5 & -1 \\ 0 & 4 & -7 \end{bmatrix}$, *what can you conclude about the stability properties of the system?*