EE 233 Homework 3.

2-23. Consider a system with the transfer function

$$G(z) \;=\; \frac{Y(z)}{U(z)} \;=\; \frac{2}{z(z\;-\;1)}$$

a. Find three different state-variable models of this system.
b. Derive the corresponding transfer function for each state model.

2-26. Consider the system described by

$$x(k\;+\;1) \;=\; \begin{bmatrix} 0 & 1 \\ 0 & 3 \end{bmatrix} x(k) \;+\; \begin{bmatrix} 1 \\ 1 \end{bmatrix} u(k)$$

$$y(k) \;=\; \begin{bmatrix} -2 \\ 1 \end{bmatrix} x(k)$$

a. Find the transfer function $Y(z)/U(z)$.
b. Using any similarity transformation, find a different state model for this system.
c. Find the transfer function of the system from the new state model.
d. Verify that the given A and derived A_w satisfy the properties of the similarity transformations.

20-27. Consider the system in 2-26. A similarity transformation on these equations yields

$$w(k\;+\;1) \;=\; \begin{bmatrix} d_1 & 0 \\ 0 & d_2 \end{bmatrix} w(k) \;+\; B_w u(k)$$

$$y(k) \;=\; C_w w(k)$$

a. Find d_1 and d_2.
b. Find a similarity transformation that results in the diagonal A_w matrix above.
c. Find B_w and C_w.
d. Find the transfer functions of both sets of state equations to verify the results.