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Quiz #8

1) Consider the characteristic equation $\Delta(s) = s^3 + ks^2 + 2s + 3$. Using the Routh-Hurwitz array, we can determine the system is stable for

a) all $k > 0$ b) no value of k c) $0 < k < 1.5$ d) $k > 1.5$

2) Consider the characteristic equation $\Delta(s) = 4s^4 + 3s^3 + ks^2 + s + 3$. Using the Routh-Hurwitz array, we can determine the system is stable for

a) all $k > 0$ b) no value of k c) $k > 31/3$ d) $k > 4/3$

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Problems 3-6 refer to a characteristic equation that leads to the following Routh array

s^5	1	3	2
s^4	1	3	2
s^3	0	0	
s^2	α	β	
s^1			
s^0			

3) One of the factors of $\Delta(s)$ is

a) s^4+3s^3+2s b) s^3+3s^2+2s c) s^5+3s^3+2s d) none of these

4) We should replace the row of zeros with which of the following rows

a) 1 3 b) 4 3 c) 4 6 d) none of these

5) The value of α is a) 1 b) 0 c) 9/2 d) 3/2 e) none of these

6) The value of β is a) 0 b) 1 c) 2 d) 3 e) none of these

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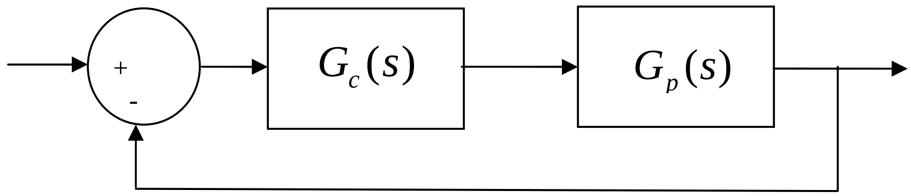
7) Consider the following control system with plant $G_p(s) = \frac{1}{s+1}$ and PI controller $G_c(s) = \frac{k(s+z)}{s}$



Using the Routh array, we can conclude which of the following:

a) $k > 0$ b) $kz > 0$ c) $k > 0$ and $kz > 0$ d) $k > -1$ and $kz > 0$ e) none of these

8) Assuming we have a characteristic equation that leads to the following Routh array:

s^4	1	2	1
s^3	1	2	
s^2	0	1	
s^1			
s^0			

Is this system stable? a) yes b) no c) I don't really care

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9) For the 2x2 matrix $P=\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, the inverse of this matrix, P^{-1}, is which of the following:

a) $P^{-1}=\dfrac{1}{ad-bc}\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ b) $P^{-1}=\dfrac{1}{ad-bc}\begin{bmatrix} d & b \\ c & a \end{bmatrix}$ c) $P^{-1}=\dfrac{1}{ad+bc}\begin{bmatrix} d & b \\ c & a \end{bmatrix}$

d) $P^{-1}=\dfrac{1}{ad+bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$ e) $P^{-1}=\dfrac{1}{ad-bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$ f) none of these

10) For the following state variable model

$$\dot{q}(t)=\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}q(t)+\begin{bmatrix} 0 \\ 1 \end{bmatrix}u(t)$$
$$y(t)=[1 \quad 2]q(t)$$

The poles of the system are at

a) -1 and -3 b) -2 and -2 c) 1 and 3 d) 0 and 1 e) 2 and 2

11) For the following state variable model

$$\dot{q}(t)=\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}q(t)+\begin{bmatrix} 0 \\ 1 \end{bmatrix}u(t)$$
$$y(t)=[1 \quad 2]q(t)$$

The poles of the system are at

a) -1 and -2 b) -1 and -1 c) 1 and 3 d) 0 and 1 e) 1 and 2