Week 8 Assignment

The due date for submitting this assignment has passed. Due on 2019-03-27, 23:59 IST.
As per our records you have not submitted this assignment.

1) The dynamical system \( \dot{z} = Az + Bu \) equivalent to the differential equation \( x''(t) + ax'(t) + bx(t) = \gamma w(t) \), 1 point

- \( \gamma \neq 0 \), \( a \) and \( b \) are any real numbers
- \( \alpha \), \( \beta \) and \( \gamma \) are any real numbers
- \( a \neq 0 \), \( b \neq 0 \) and \( \gamma \) is any real number
- \( a \), \( \beta \) or \( \gamma \) must be nonzero

No, the answer is incorrect.
Score: 0

Accepted Answers:
- \( \gamma \neq 0 \), \( a \) and \( b \) are any real numbers

2) If \( \dot{y} = Cy + du \) is the companion form of the system \( \dot{z} = Az + Bu \).

Then which of the following is not true

- \( A \) and \( C \) are similar
- The system is controllable
- \( A \) and \( C \) may not be similar
- Eigenvalues of \( A \) and \( C \) are same

No, the answer is incorrect.
Score: 0

Accepted Answers:
- \( A \) and \( C \) may not be similar

3) Consider the system \( \dot{z} = Az + bu \), \( z(0) = x_0 \), where \( A = \begin{bmatrix} 2 & 1 \\ 1 & 0 \end{bmatrix} \), \( b = \begin{bmatrix} 2 \\ 0 \end{bmatrix} \).

If the companion form of the above system is \( \dot{y} = Cy + du \), then the matrices \( C \) and \( d \) are

- \( C = \begin{bmatrix} 0 & 1 \\ 3 & 2 \end{bmatrix} \), \( d = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \)
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No, the answer is incorrect.
Score: 0

Accepted Answers:
- \( C = \begin{bmatrix} 0 & 1 \\ 1 & 2 \end{bmatrix} \), \( d = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \)

Due on 2019-03-27, 23:59 IST.
9) The dynamical system \( \dot{x}_1 = x_2 \) \( \dot{x}_2 = 2x_2 + kx_1 \) where \( k \) is a real number, is

- asymptotically stable if \( k < 0 \)
- stable if \( k < -\sqrt{2} \)
- unstable for all \( k \)
- stable for all \( k \)

No, the answer is incorrect.

Score: 0

Accepted Answers:

unstable for all \( k \)

6) The system \( \dot{x} = 4x + ku \) is asymptotically stable at \( x = 0 \) if

- \( k \neq 0 \) and \( u = x \)
- \( k > 4 \) and \( u = 2x \)
- \( k < -4 \) and \( u = x \)
- \( k = 4 \) and \( u = -x \)

No, the answer is incorrect.

Score: 0

Accepted Answers:

\( k < -4 \) and \( u = x \)

7) The system \( \dot{x}(t) = Ax(t) + Bu(t) \) with observation \( y(t) = Cx(t) \) where

\[
A = \begin{bmatrix} 1 & -1 \\ 2 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}, \quad B = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}, \quad C = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}
\]

- observable but not controllable
- both observable and controllable
- neither observable nor controllable
- controllable but not observable

No, the answer is incorrect.

Score: 0

Accepted Answers:

both observable and controllable

8) Choose the incorrect statement. The control system \( \dot{x} = Ax + Bu \) along with the observation \( y(t) = Cx(t) \)

- is said to be observable if
- the knowledge on the input \( u(t) \) and the observation \( y(t) \) for \([t_0, T]\) is sufficient to determine the initial state \( x(t_0) \)
- the observable Gramian matrix is nonsingular
- the dual system is controllable
the system is controllable

No, the answer is incorrect.

Accepted Answers:
the system is controllable

9) The feedback control \( u = Kx \) for the system \( \dot{x} = Ax + Bu \) where \( x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \),

\[
A = \begin{bmatrix} 2 & 4 \\ 0 & 5 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 1 \\ 1 \end{bmatrix}
\]

such that \( A + BK \) has the eigenvalues \( \{-2, -3\} \) is

- \( -20x_1 + 5x_2 \)
- \( 20x_1 + 8x_2 \)
- \( -20x_1 + 8x_2 \)
- \( -20x_1 - 8x_2 \)

No, the answer is incorrect.

Score: 0

Accepted Answers:
\( -20x_1 + 8x_2 \)

10) The system \( \dot{z}(t) = Ax(t) + Bu(t) \), where \( A = \begin{bmatrix} 2 & 2 & 3 \\ 1 & 3 & 3 \\ -1 & -2 & -2 \end{bmatrix} \), \( B = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} \) is controllable if \( f \) the system \( \dot{z}(t) = Jz \)

(\( z = P^{-1}x \)) is controllable, where \( D = P^{-1}B \) and \( J = P^{-1}AP \) the Jordan canonical form of \( A \) is

- \( J = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix} \)
- \( J = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix} \)
- \( J = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix} \)
- \( J = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix} \)

No, the answer is incorrect.

Score: 0

Accepted Answers:
\( J = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix} \)