Assignment-6

The due date for submitting this assignment has passed.

Due on 2021-03-03, 23:59 IST.

As per our records you have not submitted this assignment.

1) Consider a wide matrix $\mathbf{A}$, with full row rank. Its pseudo-inverse is given as *1 point*

- $(\mathbf{A}\mathbf{A}^T)^{-1}\mathbf{A}^T$
- $\mathbf{A}^T(\mathbf{A}\mathbf{A}^T)^{-1}$
- $\mathbf{A}(\mathbf{A}\mathbf{A}^T)^{-1}$
- $(\mathbf{A}^T\mathbf{A})^{-1}\mathbf{A}^T$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\mathbf{A}^T(\mathbf{A}\mathbf{A}^T)^{-1}$

2) Consider the least-norm (LN) problem $\min \|\bar{\mathbf{x}}\|$, with the constraint that $\bar{\mathbf{y}} = \mathbf{A}\bar{\mathbf{x}}$, where $\mathbf{A}$ is a wide matrix with full row rank. The solution $\hat{\bar{\mathbf{x}}}$ for this LN problem is *1 point*

- $\bar{\mathbf{y}}(\mathbf{A}\mathbf{A}^T)^{-1}\mathbf{A}^T$
- $\mathbf{A}^T(\mathbf{A}\mathbf{A}^T)^{-1}\bar{\mathbf{y}}$
- $(\mathbf{A}^T\mathbf{A})^{-1}\mathbf{A}^T\bar{\mathbf{y}}$
- $\mathbf{A}(\mathbf{A}\mathbf{A}^T)^{-1}\bar{\mathbf{y}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\mathbf{A}^T(\mathbf{A}\mathbf{A}^T)^{-1}\bar{\mathbf{y}}$

3) Consider the matrix $\mathbf{A}$ defined as *1 point*

$$\mathbf{A} = \begin{bmatrix} 1 & 1 & -1 & -1 \\ 1 & -1 & 1 & -1 \end{bmatrix}$$

The pseudo-inverse of the matrix $\mathbf{A}$ is

- $\frac{1}{4}\begin{bmatrix} 1 & 1 & -1 & -1 \\ 1 & -1 & 1 & -1 \end{bmatrix}$
- $\begin{bmatrix} 1 & 1 \\ 1 & -1 \\ -1 & 1 \\ -1 & -1 \end{bmatrix}$
- $\begin{bmatrix} 1 & 1 & -1 & -1 \\ 1 & -1 & 1 & -1 \end{bmatrix}$
- $\frac{1}{4}\begin{bmatrix} 1 & 1 \\ 1 & -1 \\ -1 & 1 \\ -1 & -1 \end{bmatrix}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{4}\begin{bmatrix} 1 & 1 \\ 1 & -1 \\ -1 & 1 \\ -1 & -1 \end{bmatrix}$

4) Consider the linear system of equations $\bar{\mathbf{y}} = \mathbf{A}\bar{\mathbf{x}}$, where *1 point*

$$\mathbf{A} = \begin{bmatrix} 1 & 1 & -1 & -1 \\ 1 & -1 & 1 & -1 \end{bmatrix}, \bar{\mathbf{y}} = \begin{bmatrix} -2 \\ 3 \end{bmatrix}$$

The least norm solution for this system of equations is

- $\frac{1}{4}\begin{bmatrix} 2 \\ 3 \\ -3 \\ -2 \end{bmatrix}$
- $\frac{1}{4}\begin{bmatrix} 2 \\ -3 \\ -1 \\ 2 \end{bmatrix}$
- $\frac{1}{4}\begin{bmatrix} 1 \\ -5 \\ 5 \\ -1 \end{bmatrix}$
- $\frac{1}{4}\begin{bmatrix} -2 \\ 3 \\ -1 \\ -2 \end{bmatrix}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{4}\begin{bmatrix} 1 \\ -5 \\ 5 \\ -1 \end{bmatrix}$

5) Consider the matrix $\mathbf{C} = \begin{bmatrix} \bar{\mathbf{h}} & \bar{\mathbf{g}} \end{bmatrix}$. The optimal beamformer $\bar{\mathbf{w}}$, such that $\bar{\mathbf{h}}$ is the channel vector of the desired user and $\bar{\mathbf{g}}$ is the channel vector of the interfering user, is given as *1 point*

- $\mathbf{C}(\mathbf{C}^H\mathbf{C})^{-1}\begin{bmatrix} 1 \\ 0 \end{bmatrix}$
- $\mathbf{C}(\mathbf{C}^H\mathbf{C})^{-1}\begin{bmatrix} 0 \\ 1 \end{bmatrix}$
- $(\mathbf{C}^H\mathbf{C})^{-1}\mathbf{C}\begin{bmatrix} 1 \\ 0 \end{bmatrix}$
- $(\mathbf{C}\mathbf{C}^H)^{-1}\mathbf{C}\begin{bmatrix} 1 \\ 0 \end{bmatrix}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\mathbf{C}(\mathbf{C}^H\mathbf{C})^{-1}\begin{bmatrix} 1 \\ 0 \end{bmatrix}$

6) The optimal beamformer $\bar{\mathbf{w}}$, such that $\bar{\mathbf{h}} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$ is the channel vector of the desired user and $\bar{\mathbf{g}} = \begin{bmatrix} -1 \\ 2 \\ -3 \\ 1 \end{bmatrix}$ is the channel vector of the interfering user, is given as *1 point*

- $\frac{1}{59}\begin{bmatrix} 14 \\ 13 \\ 12 \\ 16 \end{bmatrix}$
- $\frac{1}{59}\begin{bmatrix} 14 \\ 17 \\ 19 \\ 16 \end{bmatrix}$
- $\frac{1}{59}\begin{bmatrix} 11 \\ 17 \\ 12 \\ 16 \end{bmatrix}$
- $\frac{1}{59}\begin{bmatrix} 14 \\ 17 \\ 12 \\ 16 \end{bmatrix}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{59}\begin{bmatrix} 14 \\ 17 \\ 12 \\ 16 \end{bmatrix}$

7) The acronym SVD stands for *1 point*

- Simple value deconstruction
- Singular value decomposition
- Salient visual demonstration
- Silent vertical Doppler

No, the answer is incorrect.
Score: 0

Accepted Answers:
Singular value decomposition

8) For a wide full row rank matrix $\mathbf{A}$ of size $M \times N$, with $M < N$, the number of solutions for the system of equations $\mathbf{A}\bar{\mathbf{x}} = \bar{\mathbf{b}}$ is *1 point*

- 1
- ∞
- 0
- 2

No, the answer is incorrect.
Score: 0

Accepted Answers:
∞

9) Consider the matrix $\mathbf{C} = \begin{bmatrix} \bar{\mathbf{h}} & \bar{\mathbf{g}} \end{bmatrix}$ with the optimal beamformer $\bar{\mathbf{w}}$ designed such that $\mathbf{C}(\mathbf{C}^H\mathbf{C})^{-1}\begin{bmatrix} 0 \\ 1 \end{bmatrix}$. For this beamformer, the gain corresponding to user with channel vector $\bar{\mathbf{g}}$ is *1 point*

- 1
- 0
- 2
- ∞

No, the answer is incorrect.
Score: 0

Accepted Answers:
1

10) In the SVD, the columns of the matrix $\mathbf{V}$ satisfy *1 point*

- $\bar{\mathbf{v}}_i^H\bar{\mathbf{v}}_j = 0$ for $i \neq j$ but NOT necessarily $\|\bar{\mathbf{v}}_i\|^2 = 1$
- Both $\bar{\mathbf{v}}_i^H\bar{\mathbf{v}}_j = 0$ for $i \neq j$ and $\|\bar{\mathbf{v}}_i\|^2 = 1$
- $\|\bar{\mathbf{v}}_i\|^2 = 1$ but NOT necessarily $\bar{\mathbf{v}}_i^H\bar{\mathbf{v}}_j = 0$ for $i \neq j$
- Neither $\|\bar{\mathbf{v}}_i\|^2 = 1$ nor necessarily $\bar{\mathbf{v}}_i^H\bar{\mathbf{v}}_j = 0$ for $i \neq j$

No, the answer is incorrect.
Score: 0

Accepted Answers:
Both $\bar{\mathbf{v}}_i^H\bar{\mathbf{v}}_j = 0$ for $i \neq j$ and $\|\bar{\mathbf{v}}_i\|^2 = 1$