Unit 8 - Principles of MIMO Wireless Communication (Continued)

Assignment-7

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-10-16, 23:59 IST.

1) Consider the channel matrix $\mathrm{H} = \begin{bmatrix} 1 & 2 \\ 1 & -2 \end{bmatrix}$. The matrix $\mathbf{U}$ in the SVD of this channel matrix is given as, *1 point*

- $\begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{bmatrix}$
- $\begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{bmatrix}$
- $\begin{bmatrix} 1 & 1 \\ -1 & 1 \end{bmatrix}$
- $\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{bmatrix}$

2) Consider total transmit power $P = 9$ dB, noise power $= -3$ dB in a 2×2 MIMO channel with channel matrix $\mathrm{H} = \begin{bmatrix} 1 & 2 \\ 1 & -2 \end{bmatrix}$. The optimal power value for the second channel is, *1 point*

- 8 dB
- 6.121 dB
- 4.948 dB
- 5.9176 dB

No, the answer is incorrect.
Score: 0
Accepted Answers:
5.9176 dB

3) The special case of a MIMO system with a single receive antenna and multiple transmit antennas is termed as *1 point*

- MIMO – Multiple Input Multiple-Output
- MISO – Multiple Input Single Output
- SIMO – Single Input Multiple Output
- SISO – Single Input Single Output

No, the answer is incorrect.
Score: 0
Accepted Answers:
MISO – Multiple Input Single Output

4) In a 3×2 MIMO system with IID noise elements and dB noise variance $\sigma^2 = -6$ dB, the noise covariance is given as *1 point*

- $0.25\ \mathbf{I}_{3\times3}$
- $0.25\ \mathbf{I}_{2\times2}$
- $0.50\ \mathbf{I}_{3\times3}$
- $0.50\ \mathbf{I}_{2\times2}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$0.25\ \mathbf{I}_{3\times3}$

5) Consider the MIMO channel matrix $\mathrm{H} = \begin{bmatrix} 1 & -1 \\ 2 & 2 \\ -1 & 3 \end{bmatrix}$. The corresponding zero-forcing receiver matrix is, *1 point*

- $\begin{bmatrix} 1 & -1 \\ 2 & 2 \\ -1 & 3 \end{bmatrix}$
- $\mathbf{I}_{3\times3}$
- $\begin{bmatrix} \frac{1}{6} & \frac{1}{3} & -\frac{1}{6} \\ -\frac{1}{14} & \frac{1}{7} & \frac{3}{14} \end{bmatrix}$
- $\begin{bmatrix} \frac{1}{6} & \frac{2}{3} & -\frac{1}{6} \\ -\frac{1}{14} & \frac{2}{7} & \frac{1}{14} \end{bmatrix}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\begin{bmatrix} \frac{1}{6} & \frac{1}{3} & -\frac{1}{6} \\ -\frac{1}{14} & \frac{1}{7} & \frac{3}{14} \end{bmatrix}$

6) Consider a 5×4 MIMO channel with zero-forcing receiver. The dB SNR required for a given BER is *1 point*

- $5 \times \log\left(\frac{3}{4\times BER}\right)$
- $10 \times \log\left(\frac{5}{4\times BER}\right)$
- $10 \times \log\left(-2 \times \ln(2 \times BER)\right)$
- $10 \times \log(BER)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$5 \times \log\left(\frac{3}{4\times BER}\right)$

7) Consider a 1×2 MISO channel with coefficients $h_1 = 1 + 2j$ and $h_2 = 2 - j$. The effective 2×2 matrix at the receiver for the Alamouti Scheme is given as, *1 point*

- $\begin{bmatrix} 1+2j & 2-j \\ 2+j & -1+2j \end{bmatrix}$
- $\begin{bmatrix} -1+2j & 2-j \\ 2-j & -1+2j \end{bmatrix}$
- $\begin{bmatrix} 1+2j & 2-j \\ 2+j & 1+2j \end{bmatrix}$
- $\begin{bmatrix} 1+2j & 2+j \\ 2+j & -1+2j \end{bmatrix}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\begin{bmatrix} 1+2j & 2-j \\ 2+j & -1+2j \end{bmatrix}$

8) In MIMO Singular Value Decomposition of $\mathbf{H}$ for $r > t$, as described in the class lecture, the matrix $\mathbf{U}$ satisfies *1 point*

- $\mathbf{U}\mathbf{U}^H = \mathbf{I}$ only
- $\mathbf{U}^H\mathbf{U} = \mathbf{I}$ only
- $\mathbf{U}$ is a unitary matrix
- $\mathbf{U}$ is a square matrix

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\mathbf{U}^H\mathbf{U} = \mathbf{I}$ *only*

9) Consider dB SNR $= 65$ dB in a 1×4 MISO system. The BER with transmit beamforming is given as, *1 point*

- 2.1875×10^{-25}
- 5.2835×10^{-26}
- 5.2835×10^{-25}
- 2.1875×10^{-26}

No, the answer is incorrect.
Score: 0
Accepted Answers:
2.1875×10^{-26}

10) Consider the MIMO channel matrix $\mathrm{H} = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$. The singular values of this matrix are given as *1 point*

- 3, 4
- 5
- 4, 36
- 6

No, the answer is incorrect.
Score: 0
Accepted Answers:
5