Unit 4 - Multiple Antenna Wireless Systems and Diversity

Assignment-3

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

Due on 2019-09-18, 23:59 IST.

1) Consider a multiple antenna wireless channel with $2L$ antennas such that $h_i = h_{2L-i+1}$ for $1 \leq i \leq L$, with h_i being IID Rayleigh fading channel coefficients. The diversity order of this system is *1 point*

- 1
- $2L$
- L
- $L+1$

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

2) Consider a wireless system with $L = 4$ antennas and the channel coefficients given as, $h_1 = \sqrt{3} + j\sqrt{2}$, $h_2 = \sqrt{5} - j\sqrt{2}$, $h_3 = \sqrt{2} - j\sqrt{5}$ and $h_4 = \sqrt{2} - j\sqrt{5}$. Let the noise variance $\sigma^2 = \frac{1}{4}$ and transmit power be $P = 6\,dB$. The SNR at the output of the MRC is *1 point*

- $28\,dB$
- $23.5\,dB$
- $30.1\,dB$
- $26.51\,dB$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$26.51\,dB$

3) The SNR required to achieve BER $= 10^{-11}$ in a wireless system with $L = 4$ antennas and maximum ratio combining is? (Kindly use the approximation formula for BER) *1 point*

- $28.35\,dB$
- $26.65\,dB$
- $30.45\,dB$
- $29.65\,dB$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$28.35\,dB$

4) Consider an L antenna wireless fading channel. Let a new combiner be defined as $\sum_{i=1}^{L} e^{-j\phi_i} y_i$ with $\phi_i = \angle h_i$, where h_i is the fading coefficient and y_i is the received symbol on antenna i. This is termed as *equal gain combining*. Deep fade occurs in this system when SNR is lower than the threshold *1 point*

- $\frac{1}{\left(\sum_{i=1}^{L} |h_i|\right)}$
- $\left(\sum_{i=1}^{L} |h_i|\right)^2$
- $\frac{L}{\left(\sum_{i=1}^{L} |h_i|\right)^2}$
- $\frac{L}{\left(\sum_{i=1}^{L} |h_i|^2\right)}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{L}{\left(\sum_{i=1}^{L} |h_i|\right)^2}$

5) For a multiple antenna system to be in a deep fade, which of the following must hold *1 point*

- Exactly one link has to be in a deep fade
- More than half the links have to be in deep fade
- At most one link has to be in a deep fade
- All the links have to be in deep fade

No, the answer is incorrect.
Score: 0
Accepted Answers:
All the links have to be in deep fade

6) Consider a wireless system with carrier frequency $f_c = 1.5$ GHz. For independent fading across $L = 6$ antennas, what is the minimum length of the device *1 point*

- 60 cm
- 50 cm
- 100 cm
- 6 m

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

7) The diversity order d of the AWGN channel $y(k) = 2x(k) + n(k)$ is *1 point*

- ∞
- 1
- 0
- 2

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

8) Consider a $L = 3$ receive antenna wireless system with the noise variance $\sigma^2 = -3$ dB on each antenna. Consider the weighting vector with combining weights $w_1 = \frac{1}{\sqrt{2}} + j\frac{1}{\sqrt{2}}$, $w_2 = \frac{1}{\sqrt{2}} - j\frac{1}{\sqrt{2}}$, $w_3 = \sqrt{2} + j\sqrt{2}$. What is the dB noise variance at the output of the maximal ratio combiner *1 point*

- $4.77\,dB$
- $3.01\,dB$
- $4.58\,dB$
- $1.28\,dB$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$4.77\,dB$

9) The gain g at the output of the maximal ratio combiner in a multiple receive antenna wireless system with independent identically distributed Rayleigh fading coefficients for $L = 4$ is distributed as *1 point*

- ge^{-g}
- $2ge^{-g}$
- $\frac{g^2 e^{-g}}{4}$
- $\frac{g^2 e^{-g}}{6}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{g^2 e^{-g}}{6}$

10) The approximate BER for high SNR in a system with $L = 3$ receive antennas is *1 point*

- $\frac{5}{4x(SNR)^3}$
- $\frac{35}{16x(SNR)^4}$
- $\frac{1}{SNR^2}$
- $\frac{1}{SNR^3} e^{-SNR^4}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{5}{4x(SNR)^3}$