Unit 9 - Week 8 - Fading Channels - Diversity and Capacity

Assignment 8

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

Due on 2019-09-25, 23:59 IST.

1) A receiver has 2 Antennas and performs Maximal ratio combining to improve the BER. Both the receivers are uncorrelated and follow Rayleigh distribution. One of the antennas has an average SNR of 4dB and the other has 5dB average SNR. Find the average SNR after MRC. *1 point*

- 0.6504
- 9
- 5.674
- 1

No, the answer is incorrect.
Score: 0
Accepted Answers:
5.674

2) Given that DBPSK modulation scheme is being used, find the BER performance of the above system. *1 point*

- 0.0342
- 0.3059
- 0.0684
- 0.1529

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.0342

3) In the above question, the branch with 4 dB SNR has Nakagami-m fading with m = 2. Find the new BER when DBPSK modulation scheme is used. *1 point*

- 0.0236
- 0.1065
- 0.0533
- 0.0472

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.0236

4) Will there be any difference in Average SNRs with conditions given in question 1 and question 3? *1 point*

- Yes
- No
- Cannot be determined
- None of the above

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

5) In Question 1, if EGC is performed instead of MRC, find the average SNR after combining *1 point*

- 3.542
- 5.051
- 4.246
- 5.674

No, the answer is incorrect.
Score: 0
Accepted Answers:
5.051

6) BER depends on which of the following? *1 point*

- Modulation scheme
- Type of Fading
- Antenna diversity
- All of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
All of the above

7) Which of the following statements is incorrect? *1 point*

- Diversity gain is present in both fading and non-fading environments
- Antenna gain is present in non-fading environment
- Antenna gain causes a shift in the BER curve
- Diversity gain improves the statistics of the SNR in a way that reduces the BER

No, the answer is incorrect.
Score: 0
Accepted Answers:
Diversity gain is present in both fading and non-fading environments

8) For the Alamouti scheme discussed in lecture, the diversity order was found out to be 2. Consider a modified Alamouti scheme where 2 receiver antennas are present. One can write down the matrix equations for the second receiver antenna similar to the case in which only one receiver antenna is present and combine the matrix equations for the two receiver antennas to get a single matrix equation for the entire system. What will be the diversity order for this new system? *1 point*

- 2
- 4
- 8
- 16

No, the answer is incorrect.
Score: 0
Accepted Answers:
4

9) What is the maximum array gain factor that can be obtained in the presence of M receiver antennas? *1 point*

- $1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\ldots.+\frac{1}{M}$
- $\frac{M}{\sqrt{2}}$
- $1+(M-1)\frac{\pi}{4}$
- M

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

10) Which of the following is true regarding Channel State Information (CSI) for a TDD system? *1 point*

- CSI can be estimated by the transmitter
- CSI is not needed to the transmitter
- CSI needs to be fed back from the receiver to the transmitter
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
CSI can be estimated by the transmitter

11) Which type of diversity schemes has both diversity gain as well as array gain? *1 point*

- Transmitter diversity schemes
- Receiver diversity schemes
- Both (a) and (b)
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
Receiver diversity schemes

12) Consider a channel with SNR = 12.56 dB. What is the capacity of the channel per unit bandwidth? *1 point*

- 4.25 bits/sec/Hz
- 1.279 bits/sec/Hz
- 3.76 bits/sec/Hz
- 0.8136 bits/sec/Hz

No, the answer is incorrect.
Score: 0
Accepted Answers:
4.25 bits/sec/Hz

13) For a signal with unit average signal power, the capacity of the channel depends on *1 point*

- The modulation scheme
- Receiver sensitivity
- Symbol rate
- All of the above

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

14) Consider a channel with Free-Space path loss. What is the normalised capacity of the channel (bits/sec/Hz) when the transmitter and receiver are separated by a distance of 150m? Assume that SNR w/o fading = 80 dB, Carrier frequency = 900 MHz. *1 point*

- 6.34
- 2.727
- 2.87
- 2.04

No, the answer is incorrect.
Score: 0
Accepted Answers:
2.04

(**Consider for questions 15-19**) Consider a fading channel with instantaneous SNR given by $\alpha^2\Gamma$, where $\Gamma = 20$ dB and α is the instantaneous fading coefficient that varies with time. BW = 30 kHz. The probability distribution of α is as follows: $p_\alpha(0.25) = 0.125,\ p_\alpha(0.5) = 0.25,\ p_\alpha(1) = 0.5,\ p_\alpha(1.5) = 0.125$.

15) What is the average SNR of the channel? *1 point*

- 20 dB
- 25.2 dB
- 19.30 dB
- 33 dB

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

16) Can you find an upper bound on the Channel capacity using Jensen's inequality? *1 point*

- 175.14 kbps
- 64.29 kbps
- 192.84 kbps
- 58.05 kbps

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

17) What is the Ergodic capacity of the channel? *1 point*

- 64.28 kbps
- 175.14 kbps
- 58.05 kbps
- 192.84 kbps

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

18) What should be the SNR of a flat-fading channel that has the same capacity as the Ergodic capacity of the fading channel discussed above? *1 point*

- 17.5 dB
- 34.16 dB
- 19.3 dB
- 56.28 dB

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

19) What is the Ergodic capacity of the channel discussed above, if there is a 5% chance of outage at any time? *1 point*

- 183.2 kbps
- 8.76 kbps
- 9.642 kbps
- 166.38 kbps

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

20) Which of these is a necessary condition for optimal power allocation? *1 point*

- All channels should have a good SNR
- Channel state information known at the transmitter
- Channel state information known at the receiver
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
Channel state information known at the transmitter