Unit 5 - Week 4 - Multipath Fading Environment

Assignment 4

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

Due on 2019-08-28, 23:59 IST.

1) Consider a cellular system designed with omnidirectional cells and with the farthest point of the cell at a distance R and average signal power received at the cell edge $\bar{P}_r(d) = P_{min}$, where P_{min} is the receiver sensitivity. If the log-normal shadowing has a Gaussian distribution with variance σ=6 dB, then the Outage Probability P_{outage} will be *1 point*

- 1.0
- 0.0
- 0.5
- Insufficient information to make the statement

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.5

2) Consider the path-loss model for a log-normal shadowing characterized statistically by a standard deviation of 6 dB. What should be the β margin, if the desired Pr(outage) = 2% ? You may use Q function table from here: http://wireless.ece.ufl.edu/eel5544/handouts/q_function.pdf *1 point*

- 18.54 dB
- 7.68 dB
- 12.3 dB
- None of the above

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

3) If the log-normal shadowing has a Gaussian distribution with variance σ=6 dB, what should be the margin β at the cell-edge in order to ensure that P_{outage}=0.2? Given that Q(0.84)=0.2 *1 point*

- 5.04 dB
- 1.2 dB
- 1.43 dB
- Insufficient information to compute the margin β

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

4) Consider a multipath channel/system defined by *1 point*
$y(t) = e^{-at}x(t) + 3e^{(bt-c)}x^2(t-t_0)$

where x(t) is the input to the system and y(t) is the corresponding output and a, b, c, t_0 are positive constants. The system is

- Linear and Time-Invariant
- Linear and Time-Variant
- Non - Linear but Time-Invariant
- Non-linear and Time-Variant

No, the answer is incorrect.
Score: 0
Accepted Answers:
Non-linear and Time-Variant

5) In which of the following scenarios will the assumption of Rayleigh fading channel be valid? *1 point*

- In indoor environments
- In Satellite Communication systems
- In the presence of narrow antenna beams
- In the absence of Line of Sight component

No, the answer is incorrect.
Score: 0
Accepted Answers:
In the absence of Line of Sight component

6) Consider a Rayleigh pdf channel type with σ = 2. What are the mean and RMS values of the distribution respectively? *1 point*

- 2.51 and 2.83
- 0 and 1.31
- 3.76 and 4.24
- 2.51 and 1.31

No, the answer is incorrect.
Score: 0
Accepted Answers:
2.51 and 2.83

7) Consider a mobile communication system. Which of the following characteristic(s) should the system possess so that frequency hopping is not required? *1 point*

- a) Signal bandwidth must be sufficiently wide to resolve multipath components
- b) Receiver must be able to co-phase and combine the multipath components
- c) Both (a) and (b)
- d) None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
c) Both (a) and (b)

8) Which of the following is/are multiplicative impairment(s)? *1 point*

- a) Thermal noise in receiver
- b) Rayleigh Fading
- c) Both (a) and (b)
- d) None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
b) Rayleigh Fading

9) A user is travelling in a car that is moving towards the base-station to which he is connected to, at a constant velocity v = 50 kmph. At some point of time the user is nearest to the base-station, and moments later he crosses the BS and starts moving away from his base-station. *1 point*

Which of the following is true about the magnitude of Doppler shift?

- It decreases as the user moves towards the BS and keeps decreasing as the user crosses the BS with a constant velocity.
- It decreases first, goes to a zero when the user is nearest to the BS, and keeps increasing once he crosses the BS
- It remains constant all the time.
- It increases first, reaches a maximum value when the user is nearest to his BS and starts falling when the user crosses the BS

No, the answer is incorrect.
Score: 0
Accepted Answers:
It decreases first, goes to a zero when the user is nearest to the BS, and keeps increasing once he crosses the BS

10) In the lecture, a Tse and Viswanath book example was discussed where receiver antenna was moving away from the fixed transmitter. Let the initial distance between the transmitter and the receiver be r_0 = 500 metres. The speed of the receiver is v = 60 kmph and the transmitting frequency is f_c = 900 MHz. What is the maximum Doppler shift (magnitude)? *1 point*

- 50 Hz
- 30 Hz
- 80 Hz
- 180 Hz

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

11) In the lectures, a Tse and Viswanath book example was discussed where receiver antenna is fixed between the transmitter and a reflecting wall. Let the distance between the transmitter and the reflecting wall be d = 3 Km. The distance between the transmitter and receiver is r = 1 km. The transmitting frequency is f_c = 900 MHz. What is the coherence distance? *1 point*

- 0.167 meters
- 0. 0834 meters
- 0.334 meters
- 0. 0.0417 meters

No, the answer is incorrect.
Score: 0
Accepted Answers:
0. 0834 meters

12) In the 11th question, what is the delay spread of the channel? *1 point*

- 6.67 us
- 3.33 us
- 20 us
- 13.34 us

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

13) In the 11th question, what is the coherence bandwidth of the channel? *1 point*

- 50 KHz
- 149.9 KHz
- 74.96 KHz
- 300.3 KHz

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

14) In the lectures, a Tse and Viswanath book example was discussed where receiver antenna is moving between the transmitter and a reflecting wall. Let the distance between the transmitter and the reflecting wall be d = 3 Km. The distance between the transmitter and receiver is r = 1 km and the receiver is moving towards the wall with speed v = 60 kmph. The transmitting frequency is f_c = 900 MHz. What is the range of maximum Doppler Spread? *1 point*

- 149.92 Hz
- 100 Hz
- 74.96 Hz
- 50 Hz

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

15) If X and Y are IID Gaussian Random Variables with zero mean and variance σ^2, and W and ∅ are two RVs satisfying $W \triangleq X^2 + Y^2$, and $\emptyset = arctan\frac{Y}{X}$. Express X and Y in terms of W and ∅ *1 point*

- $X = W cos(\phi), Y = W sin(\phi)$
- $X = \sqrt{W} cos(\phi), Y = \sqrt{W} sin(\phi)$
- $X = W sin(\phi), Y = W cos(\phi)$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$X = \sqrt{W} cos(\phi), Y = \sqrt{W} sin(\phi)$

16) In the 15th question, the joint pdf $f_{(X,Y)}(x, y)$ is *1 point*

- $\frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(x^2+y^2)}{2\sigma^2}}$
- $\frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(x^2 y^2)}{2\sigma^2}}$
- $\frac{1}{2\pi\sigma^2} e^{-\frac{(x^2+y^2)}{2\sigma^2}}$
- $\frac{1}{2\pi\sigma^2} e^{-\frac{(x^2 y^2)}{4\sigma^2}}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{2\pi\sigma^2} e^{-\frac{(x^2+y^2)}{2\sigma^2}}$

17) In the 15th question, consider the transformation of variables from (X,Y) → (W,ϕ). The expression for the Jacobian matrix is *1 point*

- $\begin{bmatrix} \frac{1}{2\sqrt{W}} cos(\emptyset) & \frac{1}{2\sqrt{W}} sin(\emptyset) \\ -\sqrt{W} sin(\emptyset) & \sqrt{W} cos(\emptyset) \end{bmatrix}$
- $\begin{bmatrix} \sqrt{W} cos(\emptyset) & \sqrt{W} sin(\emptyset) \\ -\sqrt{W} sin(\emptyset) & \sqrt{W} cos(\emptyset) \end{bmatrix}$
- $\begin{bmatrix} cos(\emptyset) & sin(\emptyset) \\ -W sin(\emptyset) & W cos(\emptyset) \end{bmatrix}$
- $\begin{bmatrix} \frac{1}{2\sqrt{W}} cos(\emptyset) & \frac{1}{2\sqrt{W}} sin(\emptyset) \\ -\frac{1}{2\sqrt{W}} sin(\emptyset) & \frac{1}{2\sqrt{W}} cos(\emptyset) \end{bmatrix}$

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

18) In the 15th question, using transformation of variables, the joint pdf $f_{(W,\emptyset)}(w, \emptyset)$ is *1 point*

- $\frac{1}{2\pi\sigma^2} e^{-\frac{w}{2\sigma^2}}$
- $\frac{1}{4\pi\sigma^2} e^{-\frac{w}{2\sigma^2}}$
- $\frac{1}{4\pi\sigma^2} e^{-\frac{w^2}{2\sigma^2}}$
- $\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{w}{2\sigma^2}}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{4\pi\sigma^2} e^{-\frac{w}{2\sigma^2}}$

19) In the 15th question, assuming that the Random Variable ∅ has a uniform distribution i.e., $f_\emptyset(\emptyset)$= $\frac{1}{2\pi}$ in the interval [0,2π], the marginal pdf $f_W(w)$ is *1 point*

- $\frac{1}{4\pi\sigma^2} e^{-\frac{w}{2\sigma^2}}$
- $\frac{1}{2\pi\sigma^2} e^{-\frac{w}{2\sigma^2}}$
- $\frac{1}{2\sigma^2} e^{-\frac{w^2}{2\sigma^2}}$
- $\frac{1}{2\sigma^2} e^{-\frac{w}{2\sigma^2}}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{2\sigma^2} e^{-\frac{w}{2\sigma^2}}$