Unit 8 - Week 7
Assignment 7

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment. Due on 2018-09-26, 23:59 IST.

1) Consider a Gaussian channel with bandwidth of 10 GHz. If the transmit power is 20 Watt and power spectral density of noise is 0.01 Watt/Hz, what is the capacity of this channel?

- 1.44 mega bits per second
- 1.04 mega bits per second
- 134 kilo bits per second
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
None of the above

2) The capacity of a Gaussian channel with noise variance $\mathcal{N}$, without any power constraint is:

- $0$
- $\frac{1}{2} \log \left( 1 + \frac{P}{\mathcal{N}} \right)$ where $P < \infty$
- $\infty$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
None of the above

3) The capacity of a Gaussian channel with noise spectral density $\mathcal{N}_0/2 = 10^{-2}$ Watt/Hz, power $P = 20$ Watt, without any bandwidth constraint is:

- 0 bits per second
- 2.88 kilo bits per second
- $\infty$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
None of the above

4) In a Gaussian channel, the received signal $Y$ is given as $Y = X + Z$, where signal $X \sim \mathcal{N}(0, 18)$ noise $Z \sim \mathcal{N}(1, 5)$. What is the capacity of this channel in bits per second?

- 0.74
- 0.5
- 1

No, the answer is incorrect.
Score: 0
Accepted Answers:
None of the above
5) Let us consider 4 independent Gaussian channels in parallel with a total power constraint of 5 Watt. The noise levels of these channels are given as \((N_1, N_2, N_3, N_4) = (1, 2, 3, 5)\) Watt. What is the optimal power allocation \((P_1, P_2, P_3, P_4)\)?

- \(\left(\frac{8}{3}, \frac{5}{3}, \frac{2}{3}, 0\right)\)
- \((2, 1.5, 1.5, 0)\)
- \((2.5, 1.5, 1.0, 0)\)
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers: 1

6) What is the capacity of the Gaussian channel in Q-5?

- 1.31 bits per second
- 1.52 bits per second
- 1.38 bits per second
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers: 1.52 bits per second

7) Let us consider two correlated Gaussian channels with output \(Y_j = X_j + Z_j\), \(j \in \{1, 2\}\). The input \(X\) is distributed as \(\mathcal{N}(0, K_X)\) and noise \(Z\) is distributed as \(\mathcal{N}(0, \begin{bmatrix} 1 & 0.5 \\ 0.5 & 1 \end{bmatrix})\). For an average power constraint of 1 Watt, what will be the optimal value of matrix \(A = Q^t K_X Q\) which achieves capacity?

- \(\begin{bmatrix} 1.5 & 0 \\ 0 & 0.5 \end{bmatrix}\)
- \(\begin{bmatrix} 0 & 0.5 \\ 1.5 & 0 \end{bmatrix}\)
- \(\begin{bmatrix} 0.5 & 0 \\ 0 & 1.5 \end{bmatrix}\)
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
8) In Q-7, what will be the channel capacity (in bits per transmission)?

- 5.5
- 5.1
- 3.9
- 1.2

No, the answer is incorrect.
Score: 0
Accepted Answers:
- 1.2

9) Consider an ordinary Gaussian channel with two correlated looks at $X$, i.e., $Y_j = X + Z_j, j \in \{1, 2\}$ with a power constraint $P$ on $X$, and $(Z_1, Z_2) \sim N\left(0, \begin{bmatrix} \frac{N}{N} & \frac{N\rho}{N} \\ \frac{N\rho}{N} & \frac{N}{N} \end{bmatrix} \right)$. Find the capacity of the channel for $\rho = 1$.

- $\frac{1}{2} \log \left(1 + \frac{P}{N}\right)$
- $\frac{1}{2} \log \left(1 + \frac{2P}{N}\right)$
- 0
- $\infty$

No, the answer is incorrect.
Score: 0
Accepted Answers:
- $\frac{1}{2} \log \left(1 + \frac{P}{N}\right)$

10) For the Gaussian channel given in Q-9, what is the capacity for $\rho = -1$?

- $\frac{1}{2} \log \left(1 + \frac{P}{N}\right)$
- $\frac{1}{2} \log \left(1 + \frac{2P}{N}\right)$
- 0
- $\infty$

No, the answer is incorrect.
Score: 0
Accepted Answers:
- $\infty$