

Data Transfer HW 1

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In The Name Of God



Homework 1

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0.1 Question 1

0.1.1 A

$$P_{tx} = 10$$

$$Att = -20db$$

$$P_{rx} = ?$$

$$att = 10 * \log_{10} \left(\frac{P_{rx}}{P_{tx}} \right) \implies -20 = 10 * \log_{10}(\alpha) \implies \alpha = 10^{-2}$$

$$\alpha = \left(\frac{P_{rx}}{P_{tx}} \right) \implies \left(\frac{P_{rx}}{10} \right) = \frac{1}{100} \implies P_{rx} = \frac{1}{10}$$

0.1.2 B

0.2 Question 2

$$TotalAttenuation = -12 + 35 - 10 = 13db$$

$$+13 = 10 * \log_{10} \left(\frac{P_{rx}}{4} \right) \implies 10^{1.3} = \left(\frac{P_{rx}}{4} \right) \implies P_{rx} = 79.8$$

0.3 Question 2

0.3.1 A

$$Nyquist : C = 2 * W * m$$

$$m = \log_2 M$$

$$M = 32 \implies C = 2 * 10K * \log_2 32 \implies C = 2 * 10K * 5 = 100kb/s$$

$$C = 10^5$$

0.3.2 B

$$C = BW * \log_2 \left(1 + \frac{S}{N} \right) \implies 100K = 10K * \log_2 \left(1 + \frac{S}{N} \right) \implies 10 = \log_2 \left(1 + \frac{S}{N} \right) \implies 2^{10} = 1 + \left(\frac{S}{N} \right) \implies \left(\frac{S}{N} \right) = 1023$$

$$SNR = 10 * \log_{10}(\frac{S}{N}) \implies SNR = 10 * \log_{10} 1023 \implies SNR \approx 30db$$

0.3.3 C

$$C_{new} = 2 * C_{old} \implies C_{new} = 2 * 100kb = 200kb = 2 * 10^5 b$$

$$2 * 10^5 = 10^4 * \log_2(1 + \frac{S}{N}) \implies 20 = \log_2(1 + \frac{S}{N}) \implies \frac{S}{N} + 1 = 2^{20} \implies \frac{S}{N} = 2^{20} - 1$$

$$SNR = 10 * \log_{10} \frac{S}{N} \implies SNR = 10 * \log_{10} 2^{20} - 1 \approx 60db \implies SNR \approx 60db$$

0.4 Question 4

WaitingForHanie

0.5 Question 5

$$\log_{10}(\frac{E_b}{N_0}) = 4.2db$$

$$E_b = S * T_b = \frac{S}{R} \implies (\frac{E_b}{N_0}) = (\frac{S}{RN_0}) = (\frac{S}{RKT})$$

$$\implies 10\log_{10}(\frac{E_b}{N_0}) = 10\log_{10}(S) - 10\log_{10}(RKT) \implies 10\log_{10}(S) = 10\log_{10}(RKT) + 10\log_{10}(\frac{E_b}{N_0}) \implies$$

$$10\log_{10}(S) = 10\log_{10}(RKT) + 4.2 \implies 10\log_{10}(S) = 10\log_{10}(270 * 3600 * 1.38 * 10^{-23}) + 4.2 \implies$$

$$10\log_{10}(S) = -164.67 \implies \log_{10}(S) = -16.467 \implies S = 10^{-16.46} \approx 10^{-16}$$

0.6 Question 6

0.7 Question 7

0.8 Question 8

0.9 Question 9
