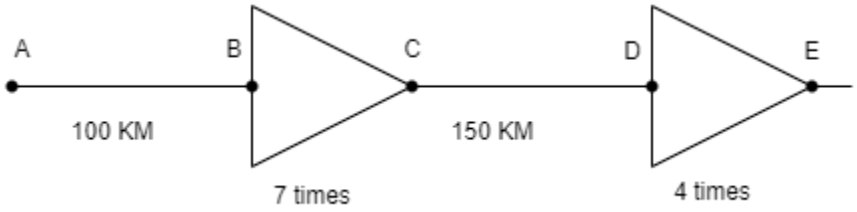
Assignment - 02
Deadline: March 02, 2024, 11:59 PM

Submission Link: https://forms.gle/azNf5FCCXFZ4MtF2A

Q1. Suppose the signal power is 5 MW at point A. The power loss rate at the wire from A to B is 5 kW/km and from C to D is 5 mW/km. **Calculate** the total change of signal power in **decibel(dB)** and comment if the power is being amplified/attenuated.



Q2. Consider a communication channel that requires sending 10 GB within 2400 seconds. The link operates on signals with frequency range from 90 KHz to 5 MHz. Let us assume that the channel is noise-free.

a. **Determine** the number of voltage levels needed to fulfill the requirement.

b. **Discuss** what would be the advantage/disadvantage of using half this number of signal levels.

c. In practice, there is no noise free channel. Suppose, the strength of the noise power is 20mW which is 60 times weaker than the signal power. **What** will be the channel capacity considering the noise?

Q3. What is the total delay (latency) for a frame of size 5 million bits being sent on a link with 5 routers each having a queuing time of 5 μs and a processing time of 3 μs? The length of the link is 3000 Km. The speed of light inside the link is 2×10^8 m/s. The link has a bandwidth of 1.5 Gbps. **Which component of the total delay is dominant? Which one is negligible?**

Below problems are for practice before midterm (Ungraded, optional submission)

Q1. A non-periodic composite signal contains frequencies from 5 to 40 KHz. The peak amplitude is 10 V for the lowest and the highest frequency signals and 30 V for the 20 KHz signal. Assuming that the amplitudes change gradually from the minimum to the maximum and then maximum to the minimum, **draw the frequency spectrum.**

Q2. A periodic signal has a bandwidth of 20 Hz. The highest frequency is 60 Hz. **What** is the lowest frequency? **Draw the spectrum** if the signal contains all frequencies of the same amplitude.

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Q3. Discuss Data Rate Limits and its factors.

Q4. A signal with 200 milliwatts of power passes through 10 devices, each with an average noise of 2 microwatts. **What is the SNR? What is the SNRdB?**

Q5. Which one is more desirable or expected between a high SNR and a low SNR? **Explain** the reason.

Q6. How many **bits per level** are needed if a digital signal has :

a. 67 levels
b. 128 levels
c. 198 levels

Q7. A file contains 2 million bytes. How long does it take to download this file using a 55-Kbps channel? 1.5-MBps channel?