

1. Consider a binary data stream `1101011`. Draw the Polar NRZ-L encoding for this data stream. Then, illustrate the encoding using Polar RZ. Explain how the two methods differ in terms of signal levels and energy usage.
2. A data frame with the binary sequence `101101` is to be transmitted, and a CRC is to be calculated using the divisor polynomial `1101`.
 - i) Perform binary division and determine the CRC bits that need to be appended.
 - ii) Show the complete transmitted frame (original data + CRC).
 - iii) Verify the transmission by recalculating the CRC at the receiver's end to ensure no error.
3. Given a 7-bit Hamming code received as `1011101`, determine if there is an error in the received data. If there is an error, correct it and provide the original 4-bit data.
4. Suppose a Stop-and-Wait ARQ protocol is used with a frame size of 1000 bits and a transmission rate of 1 Mbps over a channel with a round-trip time (RTT) of 30 ms. Calculate the efficiency of this protocol under these conditions.
5. A company has been assigned an IP block with a network address `192.168.10.0/24`. The company wants to create four subnets.
 - i. Determine the subnet mask for each subnet.
 - ii. Calculate the range of IP addresses for each subnet.
 - iii. Identify the broadcast address for each subnet.
6. Consider a Go-Back-N ARQ protocol with a window size of 4. The sender wants to transmit frames numbered `0, 1, 2, ...`. If the third frame (Frame 2) is lost during transmission, explain:
 - a) How the protocol will handle the lost frame.
 - b) The sequence of acknowledgments received by the sender and the frames retransmitted.
 - c) Illustrate the retransmission process with a timeline for clarity.