

Please be sure to show all your work and write down any assumptions you make.

1. Performance (15 points):
Problem 1.13 from Peterson and Davie, 2nd edition.
2. Channel Capacity (15 points):
 - (a) Suppose that a digitized black and white TV signal is to be transmitted from a source that uses a matrix of 480x640 pixels, where each pixel can take on 64 intensity values (grayscale). Assume that 30 pictures are sent per second. Find R , the source rate of the signal (bps).
 - (b) Assume that the TV picture is to be transmitted over a channel with a 4.5 MHz bandwidth and a 35 dB signal-to-noise ratio. Find the capacity of the channel (bps). Is this capacity sufficient to meet the above application's bandwidth needs?
3. Encoding Algorithms (15 points):
Problem 2.2 from Peterson and Davie, 2nd edition. Also show the resulting signal for the bit sequence if Manchester encoding were used instead of 4B/5B encoding.
4. Framing (10 points):
Problem 2.5 from Peterson and Davie, 2nd edition.
5. Error Detection (15 points):
Suppose you build a network card that generates a 4-bit CRC code for error detection, using the polynomial $X^4 + X^3 + 1$.
 - (a) What message would be sent, assuming you wanted to transmit the bit sequence 100110111001?
 - (b) Assume that bit 7 (numbered from the left, starting at 0) is inverted due to noise on the transmission link. What is the result of the receiver's CRC calculation? How does the receiver know that an error has occurred?
6. Reliable Delivery (15 points):
Problem 2.28 from Peterson and Davie, 2nd edition.
7. Reliable Delivery (15 points):
Suppose you are designing a sliding window protocol for a 100 Mbps point-to-point link to the moon (as in the first homework problem), which has a one-way latency of 1.25 seconds. Assuming that each frame carries 1 KByte of data, what is the minimum number of bits you need for the sequence number?