1. What is the minimum number of redundant bits \( r \) needed for a Hamming code for correcting all possible one bit errors, if the message size \( m \) is 27 bits? (3 points)

2. The output of a communication channel, employing \((4,7)\) hamming code (syndrome code) is a sequence of bits 1111010. Decode the 4 bit message that was sent. Did a transmission error occur? Assume that the underlined bits are used as parity bits and even parity is used (5 points)

3. A data link layer employing an error detection code using some polynomial \( G(x) \) receives a stream of bits or a polynomial \( T(x) \). It was determined that \( G(x) \) divides \( T(x) \) with no remainder. What are the possible conclusions? (3 points)

4. Compute the CRC for a message \( M(x) = 11001110101101 \) if the generator polynomial is \( G(x)=10110 \) (5 points)
5. What is the similarity between ABP (alternating bit protocol) and SRP protocol? (3 points)

6. What is the optimal window size for a data link layer employing SRP with the following parameters: (5 points)
   1. Data rate 10 Mbps
   2. Packet size 200 bits
   3. Channel length 3000 m
   4. Processing time $4 \mu s$
   (Make reasonable assumptions if any parameter(s) required for the calculation is missing)

7. In an SRP protocol with a window size of 5, the packets are numbered using numbers 0 to 9. The receiver receives packets numbered 0, 1, 2, 3, 4, 5, 6 and acknowledges their receipt (with acknowledgment numbers 0, 1, 2, 3, 4, 5, 6). What should the receiver do in the following cases - (store or discard)? Explain. (6 points)
   1. The next packet received by the receiver is numbered 5.
   2. The next packet received by the receiver is numbered 0.
   Hint: The receiver stores a packet only if it has not seen the packet earlier. However every packet is acknowledged.