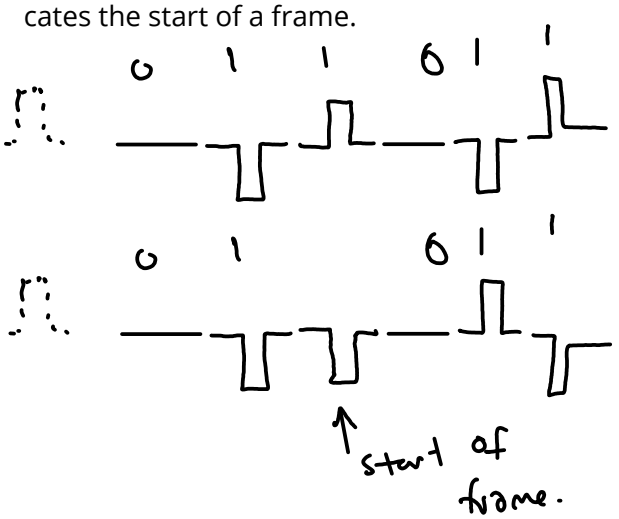
Framing

Exercise 1: Draw the waveform for an AMI-RZ encoded sequence of bits '011011' assuming the previous mark was transmitted as a positive pulse. Draw the waveform assuming the second '1' indicates the start of a frame.



Exercise 2: Preambles such as this allow multiple transmission formats to be used in a backwards-compatible way. What might be some disadvantages of using such a preamble? *Hint: to be decoded by old ("legacy") devices the preamble must be transmitted at the lowest possible data rate. This can be 100 times slower than the fastest devices.*

1 Mb/s: 802.11 preamble

54 Mb/s: 11g

192 bit preamble ⇒ 192 μs.

in 192 μs .192 × 54 ≃ 9k bits

disadvantage: overhead.

Exercise 3: In this case, by how much does the use of escape characters slow down a link transmitting a continuous stream of escape characters?

by factor 2

divides speed by 2

flag : 7E
esc. : 7D

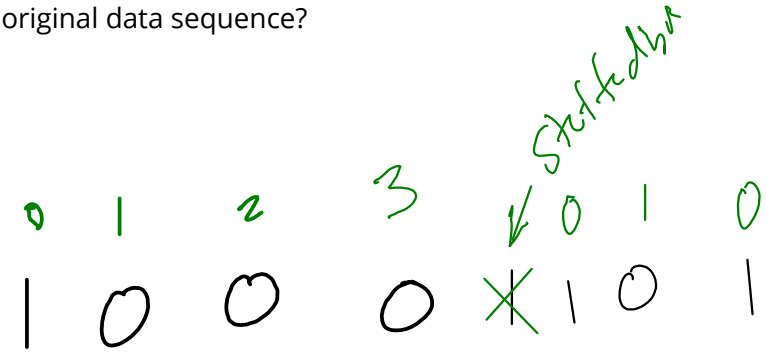
Exercise 4: What sequence of bytes would be sent to transmit a PPP-encapsulated frame containing the bytes `0xff 0x03 0x7d 0x1b 0x7e`?

FF 03 7D 1B 7E

0x 7D 01111101
(+) 0x 20 00100000
0x5D 01011101

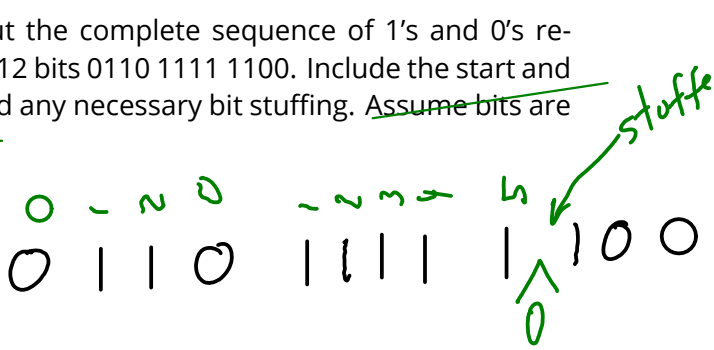
7E FF 03 7D 7D 1B 7D 7E ⟵ after XOR w/ 0x20.
7E FF 03 7D 5D 1B 7D 5E 7E

Exercise 5: You receive the sequence of bits 10001101 and are told that bit stuffing was used to limit runs of 0 to three or fewer. What was the original data sequence?



0~3
10001

Exercise 6: Write out the complete sequence of 1's and 0's required to transmit the 12 bits 0110 1111 1100. Include the start and end flag sequences and any necessary bit stuffing. ~~Assume bits are transmitted lsb-first.~~



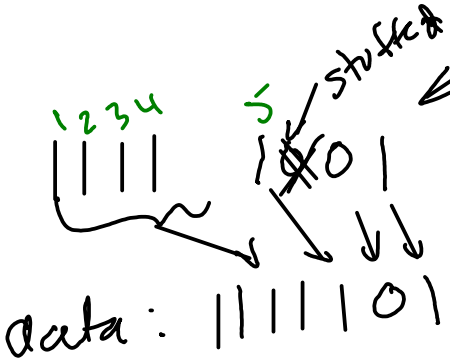
0111 1110

0111 1110

Exercise 7: An HDLC receiver sees the sequence 1000 0111 1110 1111 1001 0111 1110 0110. What data bits were contained within the frame?

another frame

bits inside frame.



Exercise 8: A physical layer transmits 3 bits per symbol. A frame of 128 bytes is being transmitted. How many padding bits will have to be added to the frame?

$128 \times 8 = 1024$

$2^7 \cdot 2^3 = 2^{7+3} = 2^{10}$

$\frac{1024}{3} = 341.33\ldots$

∴ need to round up to next multiple of 3

$342 \times 3 = 1026$ bits to send

$1026 - 1024$ bits in frame

2 padding bits

Send 342