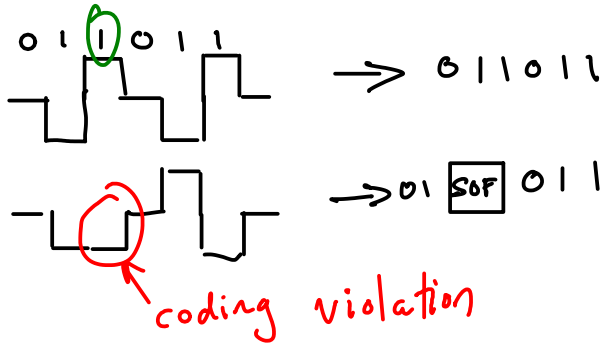
Lecture 8

Exercise 1: Draw the waveform for an AMI-NRZ 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.



$$\frac{-1+1-1+1}{6} = 0$$

$$\frac{-1-1+1-1}{6} = -\frac{1}{3}$$

Exercise 2: What is the average (DC) value for the two cases in the previous exercise assuming the pulse voltage is ±1V?

Exercise 3: What might be some advantages of using a preamble? What might be some disadvantages?

advantage – backwards compatibility

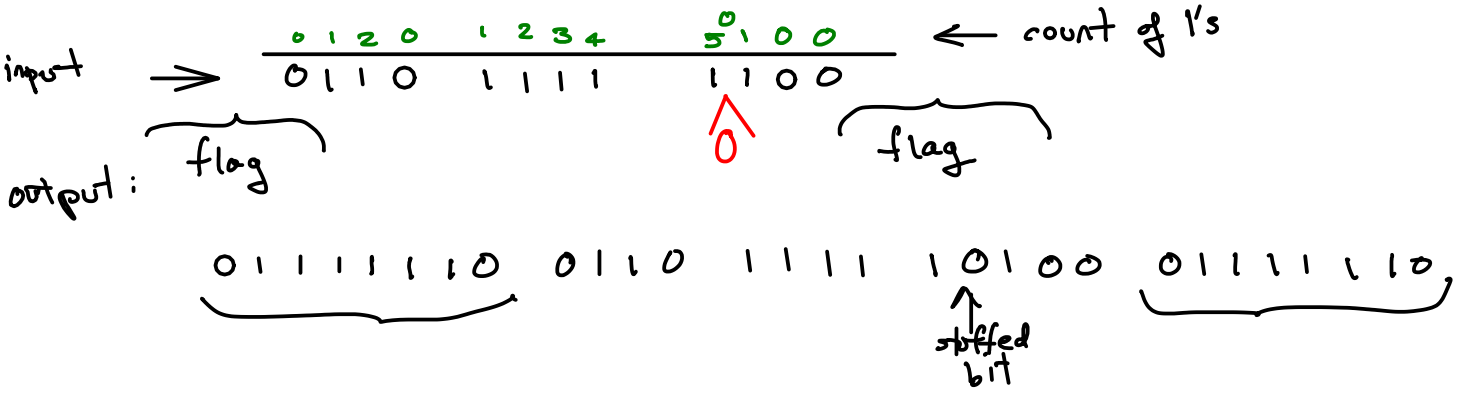
disadv. – extra complexity (h/w --)

– overhead,

Exercise 4: By how much does the use of escape characters slow down a link transmitting a continuous stream of escape characters?

by a factor of 2 because each ESC is converted into 2 (ESC - Esc).

Exercise 5: 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.

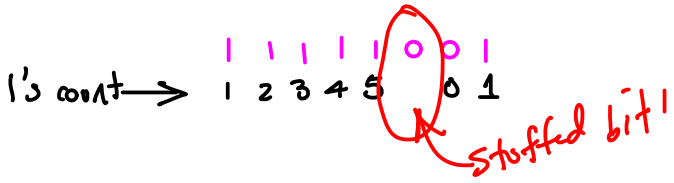


Exercise 6: An HDLC receiver sees the sequence 1000 0111 1110 1111 1001 0111 1110 0110. What data bits were contained within the frame?

① look for start flag: 0111 1110

② look for end flag: 0111 1110

③ extract data & remove bit stuffing:



actual data: 11111,01

Exercise 7: 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?

$128 \text{ bytes} \times 8 \text{ bits/byte} = 2^7 \times 2^3 = 2^{10} = 1024 \text{ bits}$

$\frac{1024 \text{ bits}}{3 \frac{\text{bits}}{\text{symbol}}} \text{ symbols} = 341.3$

342 x 3

transmit 342 symbols with = 1826 bits

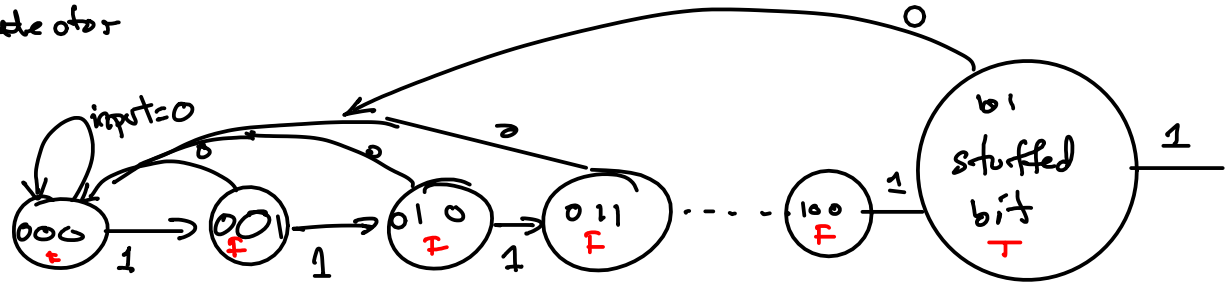
1026
− 1024
2

padding bits at the end of the frame.

Exercise 8: How many states are required to implement a circuit that detects stuffed bits in an HDLC frame? Draw the state transition diagram showing the states, the input conditions that cause the state transitions and the outputs for each of these transitions. What is the minimum number of *bits* of state required to implement the detector?

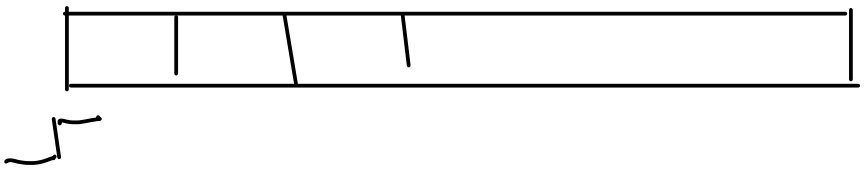
need ≥ 6 states to count

Stuffed bit detector



outputs: T: "this is a stuffed bit"
F: "this is not a stuffed bit"

state	output
000	F
001	F
⋮	
101	T



for 6 states need 3 bit ($2^3 = 8$)