지능형통신시스템 HW #2 (Chap 4 ~ 13) 학번: 이름:

P1. Calculate the bandwidth of the light for the following wavelength ranges (assume a propagation speed of 2 m)? You can use the formula f = c / λ to find the corresponding frequency for each wave length.

a) 1000 to 1100 nm b) 1400 to 2000 nm

a) $\left[\frac{2}{1000\cdot 10^{-9}}\right]-\left[\frac{2}{1100\cdot 10^{-9}}\right]$ b) $\left[\frac{2}{1400\cdot 10^{-9}}\right]-\left[\frac{2}{2000\cdot 10^{-9}}\right]$

P2. Data must be transmitted at a rate of 5.12 Mbps using a noise-free channel with a bandwidth of 10 kHz. How many signal levels are needed?

bitrate = 2× bandwidth × $\log_2 L$
5.12 Mbps = 2 × 10 kHz × $\log_2 L$
5120 kbps = 2 × 10 kHz × $\log_2 L$
$\log_2 L = \frac{5120}{20}$
$\therefore L = 2^{256}$

P3. There is a channel with a bandwidth of 4 MHz. The SNR of this channel is 127. What is the appropriate transmission rate and signal level? (The unit is Mbps.)

$C = B \log_2(1+SNR)$
$C = 4\text{MHz} \log_2(1+127)$
$= 4 \log_2 128$
$= 28$
28 Mbps.

$28\cdot 10^6 \text{ bps} = 2\cdot 4\cdot 10^6 \cdot \log_2 L$
$\log_2 L = \frac{7}{2} = 3.5$
$\therefore L = 8$
8 signal levels

P4. (a) What is the Hamming distance for each of the following codewords?

(b) Answer the minimum hamming distance. 1

1) d(10010, 00101) 10010 ⊕ 00101 = 10111 (4)
2) d(10111, 10110) 10111 ⊕ 10110 = 00001 (1)
3) d(01010, 11011) 01010 ⊕ 11011 = 10001 (2)
4) d(00100, 11000) 00100 ⊕ 11000 = 11100 (3)

P5. Assuming even parity, find the parity bits of the following data.

1) 1000110 1
2) 0100001 0
3) 1111110 0
4) 1101001 0

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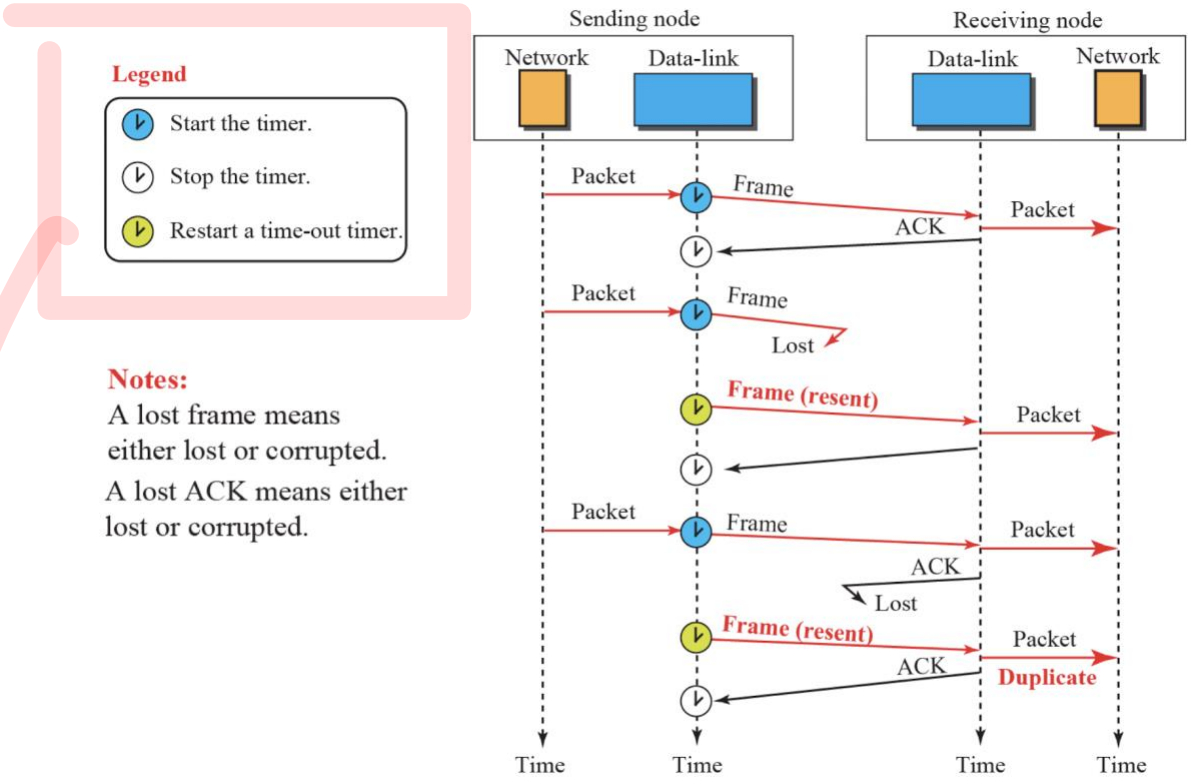
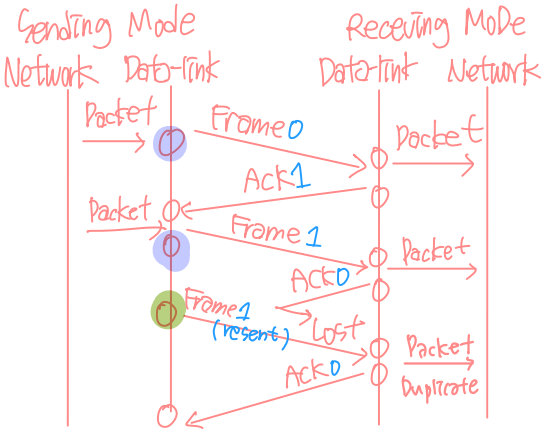
P6. Create a codeword using the CRC circular code using the following dataword and divisor.

1) dataword: 1100111, divisor: 110 1100111 001
2) dataword: 1001111, divisor: 1110 1100111 111
3) dataword: 101001111, divisor: 10 101001111 01
4) dataword: 111 111 1, divisor: 11011 111 1111 01000

P7. Using the following scenario, redraw the given picture.

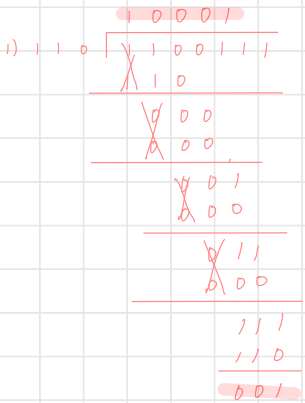


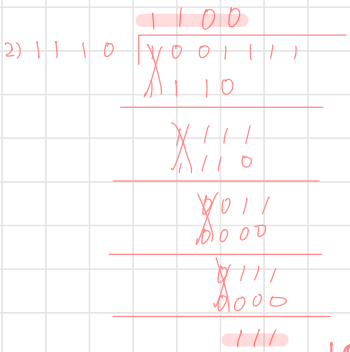
1) The first frame is sent and acknowledged.
2) The second frame is sent and it is acknowledged, but the acknowledgment (ACK) is lost.
3) The second frame is resent due to the missing ACK but times out.
4) The second frame is sent again and this time it's successfully acknowledged.

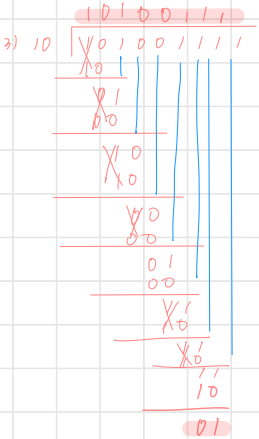


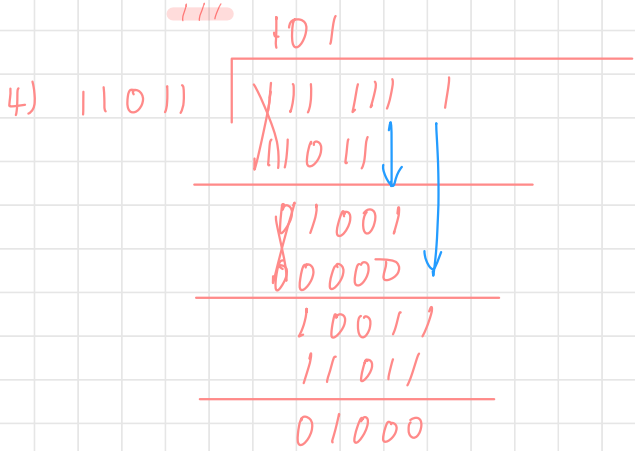
P6. Create a codeword using the CRC circular code using the following dataword and divisor.

1) dataword: 1100111, divisor: 110
2) dataword: 1001111, divisor: 1110
3) dataword: 101001111, divisor: 10
4) dataword: 111 111 1, divisor: 11011









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P8. In below Figure,

1) assume Link 2 is broken. How can Alice communicate with Bob? They cannot communicate.

2) show the specifically process of frame change in routers R1 and R2. L2 L1 N1 N8 Data changes to N5 L4 N1 N8 Data