CN Revision Q's

- TA said its important

1. Consider message '1001011' what are the resulting Parity bits after applying Hamming with even Parity

$m = 7 \rightarrow$  $2^r - r$ thus $r = 4$

P_1	P_2	m_3	P_4	m_5	m_6	m_7	P_8	m_9	m_{10}	m_{11}
		1		0	0	1		0	1	1
		011		101	110	111		1001	1010	1011

$P_1 = m_3 \oplus m_5 \oplus m_7 \oplus m_9 \oplus m_{11} = 3\%2 = 1$

$P_2 = m_3 \oplus m_6 \oplus m_7 \oplus m_{10} \oplus m_{11} = 4\%2 = 0$

$P_4 = m_5 \oplus m_6 \oplus m_7 = 1$

$P_8 = m_9 \oplus m_{10} \oplus m_{11} = 0$

- Asked for $P_3 P_2 P_1 P_0 = 0101$
  (P_8 P_4 P_2 P_1)

2. Consider bitstream 1101 0111 11

→ As the receiver detect if there are any errors using CRC where the generator polynomial is $x^3 + 1$

- Which part of the bitstream is message / CRC?

- Generator is x^3+1 → CRC is 3 last bits

Message = 1101011 , CRC = 111

- To detect error

→ Divide bitStream Polynomial by Generator in GF(2)
  - Should yield zero remainder

bitStream: $x^9+x^8+x^6+x^4+x^3+x^2+x+1$

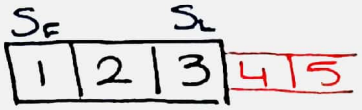
Generator: x^3+1

$$
\begin{array}{r|l}
x^3+1 & x^6+x^5+x^2+x+1 \\
\hline
 & x^9+x^8+x^6+x^4+x^3+x^2+x+1 \\
- & x^9+x^6 \\
\hline
 & x^8+x^5+x^4+x^3+x^2+x+1 \\
 & x^8+x^5 \\
\hline
 & x^5+x^4+x^3+x^2+x+1 \\
 & x^5+x^2 \\
\hline
 & x^4+x^3+x+1 \\
 & x^4+x \\
\hline
 & x^3+1 \\
 & x^3+1 \\
\hline
 & 0
\end{array}
$$

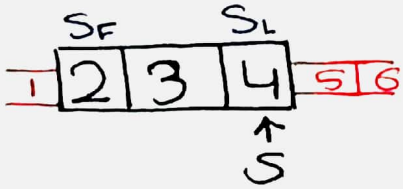
→ Remainder is 0; no error detected

3. Go-back-N where $W_S = 3$

- Frames 1, 2, 3 have been sent



- Sender received ack for frame 1



- Frames 4, 5, 6, 7, 8. are waiting to be sent
  → assume frame 2 is lost. what frames would the sender need to retransmit?
  Send twice

- In the worst case, by the time the sender times out it has sent 4 as well
  → So once it times out, it will need to send 2, 3, 4 ($S = S_F \rightarrow S = S$)

4. Is Selective Repeat commonly used with noisy channels?
Yes, although it requires a receiver with a larger buffer & that's more complex compared to Go-back it results in much fewer retransmissions for noisy channels

5. In, SR what is the maximum sender & receiver window size. (max no. of outstanding frames)
- Perhaps, receiver should be fixed

→ Consider m bits for seq. nr
→ Then it's 2^{m-1} (i.e. (MAXSEQ+1)/2)

6. In Go-back-N there's only one timer which is ack timer.
   → Go-back-N has no ack timer
   → only sets timer each time it sends frame

7. Consider a Sliding Window Protocol where
   $T_t = 3$ ms
   Roundtrip delay = 30 ms ($2T_p$)
   • What window size W_S guarantees 100% Channel Utilization

$$W_S = \frac{T_t + 2T_p}{T_t} = \frac{3+30}{3} = 11$$

which further means we need to use atleast

$$m = \lceil \log_2 W_S \rceil = 4 \text{ bits for the seq. nrs}$$

8. Station A uses 32B Packets to transmit messages to Station B using Sliding Window Protocol.

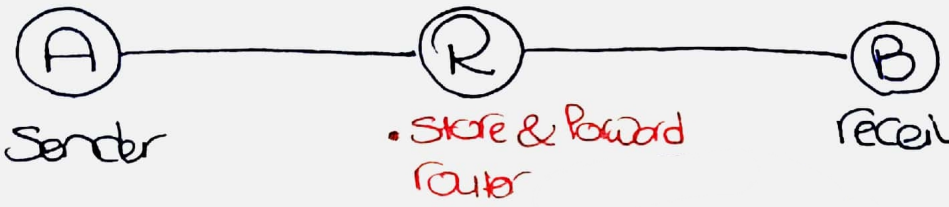
   • Roundtrip delay ($2T_p$) is 80 ms
   • Bottleneck BW is 128 KBPS

   • What is the optimal window size W_S that A should use

$$W_S = \frac{T_t + 2T_p}{T_t} = \frac{2+80}{2} = 41$$

• need T_t
• $T_t = \frac{L}{B} = \frac{32 \times 8}{128 \times 10^3} = 2$ ms

9. Consider the network topology

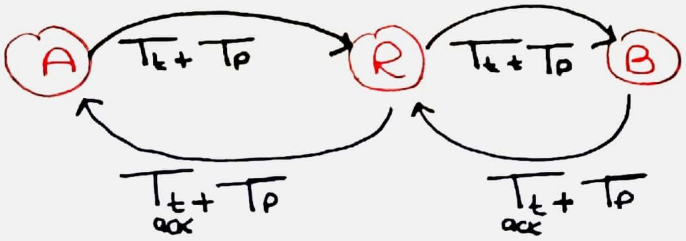


- T_t (data) = 1000 Ms
  T_t (ACK) = 10 Ms
- T_p = 1 Ms
- File Size = 10 Kbit
  Packet Size = 1000 bit

//assume between each 2 nodes

» How much time to transmit whole file?

- File can be clearly sent over 10 Packets (frames)
- To send 1 frame using Stop & wait



} will need to get ack before sending next frame.

- Clearly, $T_{frame} = 2(1000+1) + 2(10+1)$

$= 2024$ Ms $= 2.024$ ms

- For the whole file

$T = 10\, T_{frame} = 20.24$ ms

10. Which Protocol has the functionality of selecting the best Path for data transmission

- IP (IP routing finds the Path given a Packet)

→ Note that TCP doesn't find the specific Path (but ensures it will be equivalent to a reliable (ordered and error-checked Packets)
one

- UDP doesn't even ensure that and ethernet is irrelevant

11. Consider the character sequence

"H I ESC U FLAG"

→ each encoded in 8 bits

H	I	ESC	U	FLAG
01101101	11100111	11100000	10101111	01111110
	↑ 0	↑ 0		↑ 0

- Stuffed message: $8 \times 5 + 3$ bits

Flags: 8×2 bits

→ Hence 59 bits will need to be transmitted