

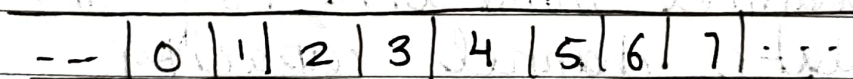
Topic:- Assignment on Numericals.

Q1] Two neighbouring nodes A and B using Selective Repeat ARQ with 3-bit sequence number. Assume A is transmitting and B is receiving. Show the position of window and frame flow for following

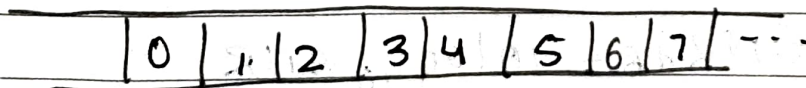
- Initial position at both A and B
- Frame 0,1 are sent.
- ACK 2 is received.

→ a) Initial position at both A and B

At A:-

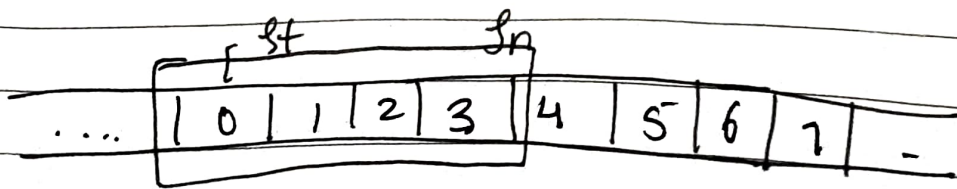


At B:-



b) Frame 0,1 are sent.

At A:

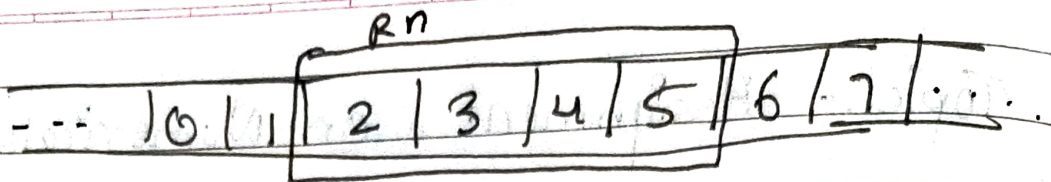


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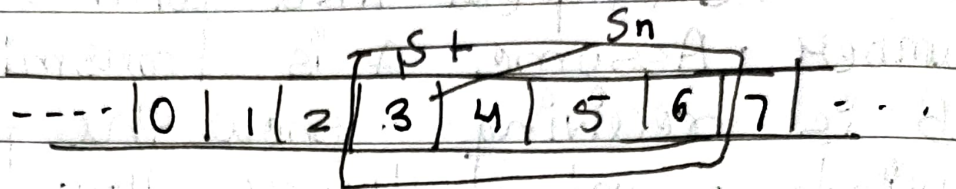
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A+B:

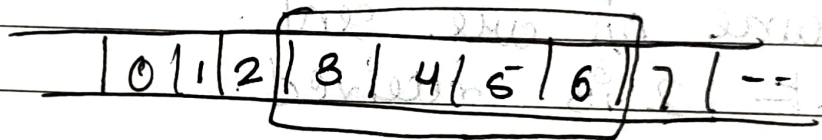


c) Atk 2 is received

At A:



At B:



Q2]

consider a noisy channel with  $SNR_{dB} = 36$  and channel bandwidth is  $2 \text{ MHz}$  calculate channel capacity.

→

given:  $SNR_{dB} = 36$ ,  $B = 2 \text{ MHz} = 2 \times 10^6 \text{ Hz}$

$$SNR_{dB} = 10 \log_{10} SNR$$

$$\therefore SNR = 10^{(SNR_{dB}/10)}$$

$$\therefore SNR = 10^{(36/10)} = 10^{3.6} = 3981$$

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$$C = B \log_2 (1 + \text{SNR})$$

$$= 2 \times 10^6 \times \log_2 (1 + 3981)$$

$$= 2 \times 10^6 \times \log_2 (3982)$$

$$C = 24 \text{ Mbrs}$$



Q3] The sender needs to send the four data items  $0x6543$ ,  $0xABCC$ ,  $0x02AC$ ,  $0xEFEE$

a) Find the checksum at sender site.

(i) Convert all data items to binary

$0x6543 \rightarrow 0110 \ 0101 \ 0100 \ 0011$   
 $0xABCC \rightarrow 1010 \ 1011 \ 1100 \ 1100$   
 $0x02AC \rightarrow 0000 \ 0010 \ 1010 \ 1100$   
 $0xEFEE \rightarrow 1110 \ 1111 \ 1110 \ 1111$

(ii) Then, find sum of all data items.

Frame 1:  $0110 \ 0101 \ 0100 \ 0011$

Frame 2:  $1010 \ 1011 \ 1100 \ 1100$

Partial sum

$10001 \ 0001 \ 0000 \ 1111$
$+ \quad 0001 \ 0001 \ 0001 \ 0000$
$\rightarrow 1$

Frame 3:  $0000 \ 0010 \ 1010 \ 1100$

Partial Sum

$0001 \ 0011 \ 1011 \ 1100$
$+ \quad 1110 \ 1111 \ 1110 \ 1111$
$+ \quad 0000 \ 0011 \ 1010 \ 1011$
$\rightarrow 1$

Sum

$0000 \ 0011 \ 1010 \ 1100$
$\rightarrow 1$

(ii) Taking one's complement of sum  $\rightarrow$

Sum : 0000 0011 1010 1100  
 checksum: 1111 1100 0101 0011  
 0x F C 5 3

So the checksum is (1111 1100 0101 0011)<sub>2</sub>  
 i.e. 0xFC53

(b) Find the checksum at the receiver side if there is no error.

Frame 1: 0110 0101 0100 0011

Frame 2: 1010 1011 1100 1100

Partial Sum: 10001 0001 0000 1111

0001 0001 0001 0000

Frame 3: 0000 0010 1010 1100

Partial sum: 0001 0010 1011 1100

Frame 4: 1110 1111 1110 1111

Partial sum: 10000 0011 1010 1011

0000 0011 1010 1100

sum:

checksum: +1111 1100 0101 0011

sum:

complement: 0000 0000 0000 0000

Thus there is no error and it will accept



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i) Find the checksum at the receiver side if the second data item is changed to 0x ABCF

ii) Convert all data items to binary -

0x 6543 → 0110 0101 0100 0011

0x ABCF → 1010 1011 1100 1110

0x 02AC → 0000 0010 1010 1100

0x EFEF → 1110 1111 1110 1111

iii) Sum of all data items.

Frame 1: 0110 0101 0100 0011

Frame 2: 1010 1011 1100 1110

Partial sum: 10001 0001 0001 0001

Frame 3: 0001 0001 0001 0010

Partial sum: 0000 0010 1010 1100  
 0001 0011 1011 1110  
 1110 1111 1110 1111  
 10000 0010 1010 1101

Sum: 0000 0011 1010 1110

checksum: 1111 1100 0101 0011  
 10000 0000 0000 0001

Sum: 0000 0000 0000 0010

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complement: 1111 1111 1111 1101  
 0x F F F D

Thus there is error and data is discarded.

d) Find the checksum at the receiver side if the second data item is changed to 0x ABCE and the third data item to 0x02BA

(i) Convert to binary

0x 6543 → 0110 0101 0100 0011  
 0x ABCE → 1010 1011 1100 1110  
 0x 02BA → 0000 0010 1011 1010  
 0x EFEF → 1110 1111 1110 1111

(ii) Addition

Frame 1: 0110 0101 0100 0011  
 Frame 2: 1010 1011 1100 1110  
 Partial sum: 1 0001 0001 0001 0001  
 + 1 → 1  
 0001 0001 0001 0010

Frame 3: 0000 0010 1011 1010  
 0001 0011 1100 1100

Frame 4: 1110 1111 1110 1111  
 1 0000 0011 1011 1011

Sum: 0000 0011 1011 1100

Checksum: + 1111 1100 0101 0011



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1 0000 0000 0000 1111  
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0000 0000 0001 0000

Complement  $\rightarrow$  111 111 110 111  
0X E F E F (Error)

Data is discarded as there are errors