11. A Sliding window protocol of a 4 Mbps point-to-point link has a propagation delay of 0.5 sec. Assume that each frame carries 2KB of data. What is the minimum no. of bits used for the sequence number field?

(A) 10 (B) 9

(C) 12 **(D) 8**

Answer: Option D

Explanation:

Propagation delay 1-way latency = 0.5 sec

RTT (2-way latency) = 2Tprop = 2*0.5 = 1-sec

Bandwidth (B) = 4Mbps

Length (L) = 2KB of data

Ttrans = L/B = 2* 1024* 8 bits / 4* 10^6 bits/sec = 4.096*10^{-3} sec

RTT = 1 sec = 1000 * 10^{-3} sec

Window size = Ttrans + 2* Tprop / Ttrans

= (4.096* 10^{-3}) + (1000* 10^{-3}) / 4.096* 10^{-3} = 245.14

Therefore, no. of sequence bits = ceil ($\log_2$ Ws) = ceil ($\log_2$ 245.14) = 8

12. A system that uses the Sliding window Protocol has a bandwidth of 10Mbps with a window size of 100. What is the size of data if the distance between the sender and receiver is 72000 km and the propagation speed is 3 x 10^8 m/sec? Given utilisation is 0.5

(A 2048 bytes **(B) 3015 bytes**

(C) 4096 bytes (D) 3072 bytes

Answer: Option B

Explanation:

Given Bandwidth B = 10Mbps = 10*10^6 bits/sec

Distance between sender and receiver d = 72000 km = 72 * 10^6 m

Speed of signal V = 3 * 10^8 m/sec

Window size = 100

Utilization or efficiency = $\frac{W}{1+2a}$

Where a = Tprop / Ttrans

Therefore, utilization = $\frac{W * Trans}{Ttrans+2Tprop}$

$$=> 1/2 = \frac{W.Ttrans}{Ttrans + 2Tprop}$$

=> Ttrans + 2*Tprop = 2 * W*Ttrans
=> Ttrans (2W – 1) = 2*Tprop
=> L/B = 2*Tprop / (2W – 1)
=> L = 2*B*Tprop / (2W – 1)

Tprop = d / V = (72 * 10^6 m) / 3 * 10^8 Sec) = 24 * 10^{-2} sec = 0.24 Sec
Therefore, L = 2*(10*10^6 bits/sec)*(0.24 sec) / (2*100 - 1)
= 0.48 * 10^7 bits / 199
= 24120.60302 bits
= 3015.075 bytes
= 3015 bytes (approx)

13. A broadcast channel has ten nodes and a total capacity of 16Mbps. It uses polling for medium access. Once a node finishes transmission, there is a polling delay of 100 µseconds to poll the next node. Whenever a node is polled, it is allowed to transmit a maximum of 1500 Bytes. The maximum throughput of the broadcast channel is:

(A) 8 Mbps
(B) 14 Mbps
(C) 100/11Mbps
(D) 750/85 Mbps

Answer: Option (B)
Explanation:

B = 16 Mbps
Tpoll = 100µsec
L = 1500 bytes = 12000 bits

$$T_{trans} = \frac{L}{B} = \frac{12000\,bits}{16 \times 10^6\,b/sec} = \frac{3}{4} \times 10^{-3}\,Sec = 0.75 - 750\,\mu sec$$

Cycle time = $T_{trans} + T_{poll} = 750 + 100 = 850\,\mu sec$

$$Utilization = \frac{750}{850} = 0.8823$$

Throughput = 0.8823 × 16 Mbps = 14.1176 Mbps

14. Station A needs to send a message consisting of 15 packets to station 'B' using a sliding window (window size 4) and go-back-N error control strategy. All packets are ready and immediately available for transmission. If every 6th packet that 'A' transmits gets lost (but no Acks from 'B' ever gets lost), then what is the number of packets that 'A' will transmit for sending the message to 'B'?

(A) 29
(B) 33
(C) 27
(D) 25

Solution: Option (B)

Explanation:

Every sixth packet is lost and the window size is 4.

1 2 3 4 5 **6(Lost)** 7 8 9 6 7 **8(Lost)** 9 10 11 8 9 **10(Lost)** 11 12 13 10 11 **12(Lost)** 13 14 15 12 13 **14(Lost)** 15 14 15 = #33

15. Suppose a CSMA/CD network is operating at 1 Gbps, and suppose there are no repeaters and the length of cable is 1 km. Determine the minimum frame size if the signal propagation speed is 200 Km/ms.

A. **10000 bits**
B. 20000 bits
C. 1000 bits
D. 2000 bits

Solution: 10000 bits
Explanation:
1 msec -------- 200 km
1 sec -------------?
V= 200 km / 1 msec =200×10^3 km/sec

Tx=2*Tp
L / B = 2*   /   ⇒L= 2×1 km$\times1\times10^9$ bps / 200×10^3 km/s =10^4 bits => L = 10000 bits

16. Station 'A' uses 64 Byte packets to transmit messages to station 'B' using a sliding window protocol. The round trip delay between A and B is 80 milliseconds, and the bottleneck bandwidth on the path between 'A' and 'B' is 128 Kbps. What is the sender window size for maximum efficiency?------------------------

Solution: 21
Explanation:

Tt = L / B = 64 Bytes / 128 Kbitps = 64*8 bits / $128*10^3$ bitps = $4*10^{-3}$ sec = 4 msec

Round trip delay = 80 msec
2Tp = 80 msec
Tp = 40 msec

Optimal window size = 1 +2*a (where a= Tp/Tt)
= 1+ 2*40/4 => 21

17. In a sliding window ARQ scheme, the transmitter's window size is 'N', and the receiver's window size is 'M'. The minimum number of sequence numbers (distinct) required to ensure correct operation of the ARQ scheme is:

(A) Min (M, N)
(B) Max (M, N)
(C) M + N
(D) M * N

Solution: Option (C)
Explanation:

Ws+Wr ≤ Sequence numbers (as the maximum number of unacknowledged packets at sender will be Ws and at the receiver, it will be Wr. similar to the sequence numbering in Selective Repeat)

Where Ws is the size of the sender window and Wr is the receiver window size.

18. A 25 Kbps satellite link has a propagation delay of 400 ms. The transmitter employs a "Selective Repeat" scheme with N set to 8. Assume each frame is 100 Bytes long; what is the maximum bandwidth utilization? (where N is window size)

(A) 5 KBps | **(B) 7.7 Kbps**
(C) 15 Kbps | (D) 10 Kbps

Solution: Option (B)
Explanation:

Transmission delay Tt = L / B = 100*8 bits / 25 Kbps =32 ms
Propagation delay Tp = 400 ms,
a = Tp / Tt = 400 / 32 = 12.5
Efficiency of GBN = w/(1+2a), where w = window size = 8
= 8/(1+25) = 8/26
BW utilisation or throughput or max data rate = efficiency * BW
= (8/26) * 25 = 7.69 Kbps

19. A channel has a bit rate of 4 Kbps and a one-way propagation delay of 20 ms. The channel uses the stop-&-wait protocol. The transmission time of the acknowledgement frame is negligible. To get a channel efficiency of at least 75%, the minimum frame size should be:

(A) 480 Bytes | (B) 480 bits
(C) 160 Bytes | (D) 160 bits

Solution: Option (B)
Explanation:

Efficiency of Stop & Wait protocol = $1 / 1 + 2a$
$0.75 = 1 / 1 + 2a$
$3 / 4 = 1 / 1 + 2a$
$3(1 + 2a) = 4$
$6a = 1$

$a = 1/6$
$T_p / T_t = 1 / 6$
$T_t = 6T_p$
$L / B = 6T_p$
$L = 6T_p \cdot B \Rightarrow 6 \cdot 4 \text{ kbps} \cdot 20 \text{ ms} = 480 \text{ bits}$

20. In the Go-Back-N protocol, if the maximum window size is 127, what is the range of the sequence number?

(a) 0 to 127
(b) 0 to 128
(c) 1 to 127
(d) 1 to 128

Solution: Option (a)
Explanation:

Sender window size is 127 (i.e. a sender window will have numbers from 0 to 126). Now,

the sequence number required >= Sender window size(127) + receiver window size(1) >= 128.
Therefore, the range of sequence numbers is 0 to 127.