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Suppose a network using CSMA/CD has the bandwidth of 20 Mbps and the maximum propagation is 20microsec. What will be the minimum frame size?

In a CSMA/CD (Carrier Sense Multiple Access with Collision Detection) network, the minimum frame size is determined by the time it takes for a signal to propagate across the network and the network's bandwidth. The minimum frame size is necessary to ensure that the sender is still transmitting data while it listens for collisions.

The formula to calculate the minimum frame size in a CSMA/CD network is as follows:

Minimum Frame Size (in bits) = 2 * Propagation Time * Bandwidth

In your case:

Propagation Time = 20 microseconds (20 μ s) Bandwidth = 20 Mbps (20,000,000 bits per second)

Now, plug these values into the formula:

Minimum Frame Size (in bits) = 2 * 20 μ s * 20,000,000 bits per second

Minimum Frame Size (in bits) = 2 * 20 * 10⁻⁶ seconds * 20,000,000 bits per second
Minimum Frame Size (in bits) = 400,000 bits

So, the minimum frame size for this CSMA/CD network with a bandwidth of 20 Mbps and a maximum propagation time of 20 microseconds is 400,000 bits, or 400 kilobits.

Regenerate



2	<p data-bbox="352 78 1477 145">A bit string, 01111011111111110, needs to be transmitted at the data link layer. What is the actual string transmitted after bit stuffing?</p> <div data-bbox="352 181 1477 349"> <p data-bbox="352 181 1477 349">Bit stuffing is a technique used in data link layer protocols to ensure that a specific bit sequence, often a control sequence or special characters, does not occur unintentionally within the data being transmitted. One common example is in Ethernet frames where the control sequence is 101010...</p> </div> <div data-bbox="352 394 1477 439"> <p data-bbox="352 394 1477 439">In this case, you have the bit string: 01111011111111110.</p> </div> <div data-bbox="352 477 1477 562"> <p data-bbox="352 477 1477 562">To perform bit stuffing, you need to insert an extra "0" bit after every five consecutive "1" bits. So, your data string would be transformed as follows:</p> </div> <div data-bbox="352 600 1477 645"> <p data-bbox="352 600 1477 645">Original: 01111011111111110 Stuffed: 011110011111011111110</p> </div> <div data-bbox="352 683 1477 768"> <p data-bbox="352 683 1477 768">The stuffed string ensures that there is never a sequence of six consecutive "1"s in a row, which is the control sequence for bit stuffing.</p> </div> <div data-bbox="352 806 1477 891"> <p data-bbox="352 806 1477 891">When the data is received, the receiver can perform destuffing by removing the extra "0" bits to recover the original data.</p> </div>
3	<p data-bbox="352 929 1477 996">In a fully-connected mesh network with 40 computers, calculate the total numbers of cables are required for each device.</p> <div data-bbox="352 1064 1477 1198"> <p data-bbox="352 1064 1477 1198">In a fully-connected mesh network, the formula to calculate the total number of cables needed is indeed $(n * (n - 1)) / 2$, where 'n' is the number of devices (computers in this case).</p> </div> <div data-bbox="352 1236 1477 1281"> <p data-bbox="352 1236 1477 1281">For a network with 40 computers:</p> </div> <div data-bbox="352 1319 1477 1364"> <p data-bbox="352 1319 1477 1364">Total cables = $(40 * (40 - 1)) / 2 = (40 * 39) / 2 = 780$ cables</p> </div> <div data-bbox="352 1402 1477 1487"> <p data-bbox="352 1402 1477 1487">So, the correct total number of cables required for a fully-connected mesh network with 40 computers is 780 cables.</p> </div>

4	<p>Assume that, in a stop-and-wait ARQ system, the bandwidth of the line is 1 Mbps, and 1 bit takes 20 ms to make a round trip. What is the bandwidth-delay product? If the system data Frames are 1000 bits in length; what is the utilisation percentage of the link?</p> <p>The bandwidth-delay product (BDP) is a measure of the amount of data that can be "in flight" in a network, which is important for understanding network performance and optimizing data transmission. It is calculated by multiplying the bandwidth of the line by the round-trip delay.</p> <p>In your case:</p> <ol style="list-style-type: none"> 1. Bandwidth (B) = 1 Mbps (1,000,000 bits per second) 2. Round trip time (RTT) = 20 ms (0.02 seconds) <p>$BDP = \text{Bandwidth (B)} * \text{Round Trip Time (RTT)}$ $BDP = 1,000,000 \text{ bps} * 0.02 \text{ seconds} = 20,000 \text{ bits}$</p> <p>So, the bandwidth-delay product is 20,000 bits.</p> <p>Now, let's calculate the utilization percentage of the link. To do this, you need to consider the size of the data frame and the time it takes for the frame to travel from the sender to the receiver and back (round-trip time).</p> <ol style="list-style-type: none"> 1. Data Frame Size (D) = 1000 bits 2. Round Trip Time (RTT) = 20 ms (0.02 seconds) <p>To calculate the utilization percentage, you can use the formula:</p> <p>$\text{Utilization Percentage} = (\text{Data Frame Size}) / (\text{BDP}) * 100$</p> <p>$\text{Utilization Percentage} = (1000 \text{ bits}) / (20,000 \text{ bits}) * 100$ $\text{Utilization Percentage} = (1/20) * 100$ $\text{Utilization Percentage} = 5\%$</p> <p>So, the utilization percentage of the link is 5%. This means that only 5% of the link's capacity is being used for data transmission, and the rest of the capacity is idle or used for other purposes like protocol overhead.</p>
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If efficiency is 50% and bandwidth is 2Mbps, calculate the throughput in stop and wait protocol.

The throughput of a communication protocol is the rate at which data is successfully transmitted over the network. In the context of a stop-and-wait protocol, the efficiency is related to the protocol's ability to utilize the available bandwidth effectively.

You mentioned that the efficiency is 50% and the bandwidth is 2 Mbps (2,000,000 bits per second). Efficiency can be defined as the ratio of useful data transmission to the total capacity. In the case of stop-and-wait, the efficiency can be calculated as follows:

$$\text{Efficiency} = (\text{Data Rate} / (\text{Data Rate} + \text{Protocol Overhead})) * 100$$

Where:

- Data Rate is the actual data transmission rate (throughput).
- Protocol Overhead is the extra data sent due to the protocol (acknowledgments, control messages, etc.).

You mentioned that the efficiency is 50%, so we can set up the equation as follows:

$$50 = (\text{Data Rate} / (\text{Data Rate} + \text{Protocol Overhead})) * 100$$

Now, we need to solve for Data Rate. Let "x" represent the Data Rate:

$$50 = (x / (x + \text{Protocol Overhead})) * 100$$

Divide both sides by 100:

$$0.5 = x / (x + \text{Protocol Overhead})$$

Now, let's solve for Protocol Overhead:

$$0.5 * (x + \text{Protocol Overhead}) = x$$

$$0.5x + 0.5 * \text{Protocol Overhead} = x$$

$$0.5 * \text{Protocol Overhead} = x - 0.5x$$

$$0.5 * \text{Protocol Overhead} = 0.5x$$

Now, divide both sides by 0.5:

	<p>Protocol Overhead = x</p> <p>So, the protocol overhead is equal to the data rate (throughput).</p> <p>Now, you can calculate the throughput: Throughput = Data Rate = Protocol Overhead</p> <p>Throughput = 50% of the bandwidth</p> <p>Throughput = $0.5 * 2,000,000$ bits per second = 1,000,000 bits per second</p> <p>The throughput in the stop-and-wait protocol, given an efficiency of 50% and a bandwidth of 2 Mbps, is 1,000,000 bits per second or 1 Mbps.</p>
6	<p>If the bandwidth of the line is 15 Mbps, RTT is 45ms and packet size is 1 KB, then find the link utilization in Stop and Wait Protocol</p> <p>To find the link utilization in the Stop-and-Wait Protocol, you need to consider the given bandwidth, round-trip time (RTT), and packet size.</p> <p>Here's the information you have:</p> <ol style="list-style-type: none"> 1. Bandwidth (B) = 15 Mbps (15,000,000 bits per second) 2. Round Trip Time (RTT) = 45 ms (0.045 seconds) 3. Packet size (P) = 1 KB (1,024 bytes = 8,192 bits) <p>The link utilization in the Stop-and-Wait Protocol can be calculated using the following formula:</p> <p>Link Utilization = $(\text{Packet Size} / (B * \text{RTT})) * 100$</p> <p>Let's plug in the values:</p> <p>Link Utilization = $(8,192 \text{ bits} / (15,000,000 \text{ bits/s} * 0.045 \text{ s})) * 100$</p> <p>Link Utilization = $(8,192 / (675,000)) * 100$</p> <p>Link Utilization $\approx 1.21\%$</p> <p>So, the link utilization in the Stop-and-Wait Protocol, given the provided bandwidth, round-trip time, and packet size, is approximately 1.21%. This means that only about 1.21% of the available bandwidth is effectively used for data transmission due to the protocol's stop-and-wait nature and the given RTT.</p>

7	<p>Suppose a binary data 1001101 is to be transmitted. Calculate the number of redundancy bits required using hamming code.</p> <div>1. You have 7 data bits ($m = 7$).</div> <div>2. Calculate the number of parity bits (r) required using the equation:</div> <div> $2^r \geq m + r + 1$ <p>For your case:</p> $2^r \geq 7 + r + 1$ <p>Now, find the smallest "r" that satisfies the condition:</p> $2^0 < 7 + 0 + 1 \text{ (r = 0)} \quad 2^1 < 7 + 1 + 1 \text{ (r = 1)} \quad 2^2 < 7 + 2 + 1 \text{ (r = 2)} \quad 2^3 < 7 + 3 + 1 \text{ (r = 3)} \quad 2^4 \geq 7 + 4 + 1 \text{ (r = 4)}$ <div>So, you need 4 parity bits to cover your 7 data bits.</div> </div>
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8	<p>Suppose that a message 1011 1000 1011 0111 is transmitted using Internet Checksum (4-bit word). What is the value of the checksum?</p> <p>Given message: 1011 1000 1011 0111</p> <p>Group these 4-bit words:</p> <ol style="list-style-type: none"> 1. 1011 2. 1000 3. 1011 4. 0111 <p>Calculate the binary sum without converting to decimal:</p> <p>1011</p> <ul style="list-style-type: none"> • 1000 • 1011 • 0111 <p>11011 (in binary)</p> <p>Now, we have the 5-bit binary sum. To create the 16-bit checksum, pad it with zeros on the left:</p> <p>0000000000011011</p> <p>Now, take the one's complement (complement all the bits) to calculate the checksum:</p> <p>1111111111100100</p> <p>So, the Internet Checksum value for the message "1011 1000 1011 0111" is 1111111111100100 in binary.</p>
9	<p>A bit stream of 1001000 is transmitted from source to destination.</p> <p>Apply the CRC error detection method using the polynomial number $X^3 + 1$ as a divisor.</p> <ol style="list-style-type: none"> 1. What is the actual bit stream transmitted after applying CRC? <p>Apply the same divisor and detect errors at the destination end.</p>

10	<p data-bbox="352 78 1362 143">Suppose a network using CSMA/CD has the bandwidth of 10 Mbps. If the maximum propagation is 40microsec. What will be the minimum frame size?</p> <div data-bbox="352 235 1461 470"> <p data-bbox="352 235 1461 470">In a CSMA/CD (Carrier Sense Multiple Access with Collision Detection) network, the minimum frame size is determined by the time it takes for a signal to propagate across the network and the network's bandwidth. The minimum frame size is necessary to ensure that the sender is still transmitting data while it listens for collisions.</p> </div> <p data-bbox="352 517 1370 600">The formula to calculate the minimum frame size in a CSMA/CD network is as follows:</p> <div data-bbox="352 651 1407 694"> <p data-bbox="352 651 1407 694">Minimum Frame Size (in bits) = 2 * Propagation Time * Bandwidth</p> </div> <p data-bbox="352 741 555 784">In your case:</p> <div data-bbox="403 831 1264 918"> <ol data-bbox="403 831 1264 918" style="list-style-type: none"> <li data-bbox="403 831 1165 873">1. Propagation Time = 40 microseconds (40 μs) <li data-bbox="403 875 1264 918">2. Bandwidth = 10 Mbps (10,000,000 bits per second) </div> <p data-bbox="352 965 1000 1008">Now, plug these values into the formula:</p> <p data-bbox="352 1055 1461 1095">Minimum Frame Size (in bits) = 2 * 40 μs * 10,000,000 bits per second</p> <p data-bbox="352 1099 1436 1187">Minimum Frame Size (in bits) = 2 * 40 * 10⁻⁶ seconds * 10,000,000 bits per second Minimum Frame Size (in bits) = 800 bits</p> <p data-bbox="352 1234 1362 1366">So, the minimum frame size for this CSMA/CD network with a bandwidth of 10 Mbps and a maximum propagation time of 40 microseconds is 800 bits.</p>
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11	<p>Consider a 10 Mbps Ethernet LAN that has stations attached to a 2.5km long coaxial cable. Given that the transmission speed is 2.3×10^8 m/sec, the packet size is 128 bytes out of which 30 bytes are overhead, find the effective transmission rate and maximum rate/throughput at which the network can send data.</p> <p>To find the effective transmission rate and maximum throughput of the Ethernet LAN, we need to consider factors like the data rate, cable length, packet size, and overhead.</p> <p>Given data:</p> <ul style="list-style-type: none"> • Transmission speed (speed of light in the cable), $v = 2.3 \times 10^8$ m/s • Cable length, $L = 2.5$ km (2.5×10^3 m) • Data rate (bandwidth), $B = 10$ Mbps (10^6 bits per second) • Packet size, $P = 128$ bytes • Overhead, $O = 30$ bytes <p>We'll calculate these values step by step:</p> <ol style="list-style-type: none"> 1. Calculate the propagation delay: Propagation delay (t_p) is the time it takes for a signal to travel from one end of the cable to the other. $t_p = \text{Cable length} / \text{Transmission speed} = (2.5 \times 10^3 \text{ m}) / (2.3 \times 10^8 \text{ m/s}) \approx 0.0108696 \text{ seconds}$ 2. Calculate the data transmission time for one packet: The packet size includes both data and overhead, so we need to calculate the time it takes to transmit this packet. $\text{Data transmission time} = \text{Packet size} / \text{Data rate}$ $\text{Data transmission time} = (128 \text{ bytes} + 30 \text{ bytes}) * 8 \text{ bits/byte} / 10^6 \text{ bits per second}$ $\text{Data transmission time} = 1152 \text{ bits} / 10^6 \text{ bits per second} = 0.001152 \text{ seconds}$ 3. Calculate the effective transmission rate: The effective transmission rate (throughput) is the rate at which useful data is transmitted, taking into account the time spent on overhead and propagation delay. $\text{Effective transmission rate} = \text{Packet size} / (\text{Packet size} + \text{Overhead} + 2 * \text{Propagation delay})$ $\text{Effective transmission rate} = (128 \text{ bytes} * 8 \text{ bits/byte}) / (128 \text{ bytes} * 8 \text{ bits/byte} + 30 \text{ bytes} * 8 \text{ bits/byte} + 2 * 0.0108696 \text{ seconds} * 10^6 \text{ bits per second})$ $\text{Effective transmission rate} = 1024 \text{ bits} / (1024 \text{ bits} + 240 \text{ bits} + 21.7392 \text{ bits})$ $\text{Effective transmission rate} = 1024 \text{ bits} / 1285.7392 \text{ bits} \approx 0.7968 \text{ (approximately)}$ <p>So, the effective transmission rate is approximately 0.7968 or 79.68%.</p> <ol style="list-style-type: none"> 4. Calculate the maximum rate or maximum throughput: The maximum rate or maximum throughput is the maximum rate at which data can be sent on the network without considering propagation delay or overhead. $\text{Maximum rate/throughput} = B / (1 + 2 * (\text{Propagation delay} / \text{Data transmission time}))$ $\text{Maximum rate/throughput} = 10^6 \text{ bits per second} / (1 + 2 * (0.0108696 \text{ seconds} / 0.001152 \text{ seconds}))$ $\text{Maximum rate/throughput} = 10^6 \text{ bits per second} / (1 + 2 * 9.4528)$ $\text{Maximum rate/throughput} = 10^6 \text{ bits per second} / 19.9056$ $\text{Maximum rate/throughput} \approx 50,232.06 \text{ bits per second}$
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	<p>So, the maximum rate/throughput at which the network can send data is approximately 50,232.06 bits per second or 50.23 kbps.</p>
12	<p>In Go-Back-N ARQ, if the sequence number is represented by 4bits, what is the window size of sender and receiver</p> <p>In Go-Back-N ARQ (Automatic Repeat reQuest), the window size of the sender and receiver depends on the number of sequence numbers available, which is determined by the number of bits used to represent the sequence numbers.</p> <p>If the sequence numbers are represented by 4 bits, it means that there are 2^4 (16) possible sequence numbers, ranging from 0 to 15.</p> <p>In Go-Back-N ARQ, the sender maintains a sending window, and the receiver maintains a receiving window. The window size for the sender is typically larger than the receiver's window to allow for pipelining of packets.</p> <p>The window size for the sender (N) is determined by the number of available sequence numbers, so in this case, $N = 16$.</p> <p>The window size for the receiver depends on the maximum number of out-of-order packets the receiver can handle and correctly buffer for eventual delivery. The receiver's window size (R) can be smaller than N. The exact value for the receiver's window size depends on the specific network configuration and requirements.</p> <p>So, in your case, with 4-bit sequence numbers, the sender's window size is 16, and the receiver's window size can be smaller, depending on the specific requirements of the network.</p>

13	<p>In a CSMA / CD network running at 1 Gbps over 10 km cable with no repeaters, the signal speed in the cable is 200000 km/sec. What is minimum frame size?</p> <p>In a CSMA/CD (Carrier Sense Multiple Access with Collision Detection) network, the minimum frame size is determined by the time it takes for a signal to propagate across the network and the network's bandwidth. The minimum frame size is necessary to ensure that the sender is still transmitting data while it listens for collisions.</p> <p>The formula to calculate the minimum frame size in a CSMA/CD network is as follows:</p> <p>Minimum Frame Size (in bits) = 2 * Propagation Time * Bandwidth</p> <p>In your case:</p> <ol style="list-style-type: none"> 1. Signal Speed in the cable (v) = 200,000 km/s (200,000,000 meters/s) 2. Cable Length (L) = 10 km (10,000 meters) 3. Bandwidth (B) = 1 Gbps (1,000,000,000 bits per second) <p>Now, plug these values into the formula:</p> <p>Minimum Frame Size (in bits) = 2 * (Cable Length / Signal Speed) * Bandwidth</p> <p>Minimum Frame Size (in bits) = 2 * (10,000 meters / 200,000,000 meters/s) * 1,000,000,000 bits per second</p> <p>Minimum Frame Size (in bits) = 2 * 0.00005 seconds * 1,000,000,000 bits per second</p> <p>Minimum Frame Size (in bits) = 100,000 bits</p> <p>So, the minimum frame size for this CSMA/CD network with a bandwidth of 1 Gbps, a cable length of 10 km, and a signal speed in the cable of 200,000 km/s is 100,000 bits.</p>
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14	<p>In a CSMA/CD network running at 1 Gbps over a 1 km cable with no repeaters, the signal speed on the cable is 200000 km/sec. What is the minimum frame size?</p> <p>In a CSMA/CD (Carrier Sense Multiple Access with Collision Detection) network, the minimum frame size is determined by the time it takes for a signal to propagate across the network and the network's bandwidth. The minimum frame size is necessary to ensure that the sender is still transmitting data while it listens for collisions.</p> <p>The formula to calculate the minimum frame size in a CSMA/CD network is as follows:</p> <p>Minimum Frame Size (in bits) = 2 * Propagation Time * Bandwidth</p> <p>In your case:</p> <ol style="list-style-type: none"> 1. Signal Speed in the cable (v) = 200,000 km/s (200,000,000 meters/s) 2. Cable Length (L) = 1 km (1,000 meters) 3. Bandwidth (B) = 1 Gbps (1,000,000,000 bits per second) <p>Now, plug these values into the formula:</p> <p>Minimum Frame Size (in bits) = 2 * (Cable Length / Signal Speed) * Bandwidth</p> <p>Minimum Frame Size (in bits) = 2 * (1,000 meters / 200,000,000 meters/s) * 1,000,000,000 bits per second</p> <p>Minimum Frame Size (in bits) = 2 * 0.000005 seconds * 1,000,000,000 bits per second</p> <p>Minimum Frame Size (in bits) = 10,000 bits</p> <p>So, the minimum frame size for this CSMA/CD network with a bandwidth of 1 Gbps, a cable length of 1 km, and a signal speed in the cable of 200,000 km/s is 10,000 bits.</p>
15	<p>In CRC checksum method, assume that given frame for transmission is 100110011011 and the generator polynomial is $G(x) = x^4 + x + 1$. After implementing CRC encoder, calculate the encoded word sent from sender side and check for errors at the receiver side.</p>
16	<p>A bit stream 1100011101 is transmitted using the standard CRC method the generator polynomial is $x^3 + x^2 + 1$.</p> <ol style="list-style-type: none"> a. What is the actual bit string transmitted? b. Suppose the sixth bit from the left is inverted during transmission. how will receiver detect this error?

17	<p>Frames of 100 bits are sent over a 10^6 bps duplex link between two hosts. The propagation time is 25ms. Frames are to be transmitted into this link to maximally pack them in transit (within the link). What is the minimum number of bits that will be required to represent the sequence numbers distinctly?</p> <p>To calculate the minimum number of bits required to represent sequence numbers distinctly in this scenario, we can use the following information:</p> <ol style="list-style-type: none"> 1. Frame size (F) = 100 bits 2. Link bandwidth (B) = 10^6 bps (1 Mbps) 3. Propagation time (T_{prop}) = 25 ms (0.025 seconds) <p>We want to maximize the number of frames in transit within the link. This means that the sender can continuously send frames without waiting for acknowledgment, and the receiver will buffer and process them. To do this, we need to ensure that we have enough sequence numbers to distinguish between the frames in transit.</p> <p>The sender can transmit frames during the propagation time without worrying about receiving acknowledgments during this period. To maximize the number of frames in transit, we want to ensure that the sender does not reuse sequence numbers before the acknowledgment for a previously sent frame is received.</p> <p>We can calculate the number of frames that can be in transit within the link by dividing the propagation time by the time it takes to transmit one frame:</p> <p>Number of Frames in Transit = $T_{prop} / (\text{Frame Transmission Time})$</p> <p>Frame Transmission Time = $\text{Frame size} / \text{Link bandwidth}$</p> <p>Frame Transmission Time = $100 \text{ bits} / 1 \text{ Mbps} = 100 \text{ microseconds}$</p> <p>Now, calculate the number of frames in transit:</p> <p>Number of Frames in Transit = $0.025 \text{ seconds} / 100 \text{ microseconds} = 250 \text{ frames}$</p>
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	<p>To represent these 250 frames distinctly, we need enough sequence numbers. We can find the minimum number of bits required to represent 250 different values:</p> <p>Number of Bits = $\log_2(\text{Number of Distinct Values})$</p> <p>Number of Bits = $\log_2(250)$</p> <p>Number of Bits ≈ 8</p> <p>So, the minimum number of bits required to represent the sequence numbers distinctly is approximately 8 bits.</p> <p>Regenerate</p> <hr/>
18	<p>Apply the hamming code error correction method for the data 1101010.</p> <ol style="list-style-type: none"> 1. How many redundant bits are required? 2. What bits are transmitted from source after applying Hamming code error correction method. <p>Alter fourth bit and detect the error at the destination end.</p>

A and B are the only two stations on an Ethernet. Each has a steady queue of frames to send. Both A and B attempt to transmit a frame, collide, and A wins the first backoff race. At the end of this successful transmission by A, both A and B attempt to transmit and collide. What is the probability that A wins the second backoff race. Justify your answer

In Ethernet, when multiple stations attempt to transmit at the same time and collide, they both go through a process of binary exponential backoff to determine when they can reattempt transmission. The stations select a random backoff value and wait for that amount of time before trying to transmit again. The backoff time is based on a contention window, which can vary in size.

In this scenario, A and B have collided once. A won the first backoff race, which means A successfully transmitted its frame. Now, both A and B want to transmit again. Since A won the first backoff race, A's contention window is reset to the minimum size, while B's contention window may still be larger, depending on the specific Ethernet protocol being used.

Let's assume that the contention window sizes are as follows:

- A's contention window (after winning the first backoff race) is at its minimum size, say 1 slot.
- B's contention window is at a larger size, say 4 slots.

To calculate the probability that A wins the second backoff race, we need to consider the number of backoff slots available to both A and B and the likelihood of A choosing a backoff value that results in a successful transmission before B.

- A has 1 slot.
- B has 4 slots.

For A to win, A must choose a backoff value between 1 and 4 (inclusive), and B must choose a backoff value greater than 4.

The probability of A choosing a backoff value between 1 and 4 is $4/16$ (since there are 4 possible values out of 16 in this range), and the probability of B choosing a backoff value greater than 4 is $12/16$ (since there are 12 possible values greater than 4 out of 16).

To find the probability that A wins the second backoff race, we multiply these probabilities together:

$$\text{Probability(A wins)} = (4/16) * (12/16) = 48/256 = 3/16$$

	So, the probability that A wins the second backoff race is 3/16. This is based on the assumption of specific contention window sizes for A and B and the random backoff selection process in Ethernet.																								
20	<p>Assume that a 12-bit Hamming codeword consisting of 8-bit data and 4 check bits is d8d7d6d5c8d4d4dd2c4d1c2c1, where the data bits and the check bits are given in the following tables:</p> <table><tr><td>d8</td><td>d7</td><td>d6</td><td>d5</td><td>d4</td><td>d</td><td>d2</td><td>d1</td></tr><tr><td>1</td><td>1</td><td>0</td><td>x</td><td>0</td><td>1</td><td>0</td><td>1</td></tr></table> <table><tr><td>c8</td><td>c4</td><td>c2</td><td>c1</td></tr><tr><td>y</td><td>0</td><td>1</td><td>0</td></tr></table> <p>Check bits</p> <p>Find out the correct values of x,y?</p> <p>Consider a 128 x 103 bits/sec satellite communication link with one way propagation delay of 150 msec. Selective Retransmission (repeat) protocol is used on this link to send data with a frame size of 1 KB. Neglect the transmission time of acknowledgement. Calculate minimum number of bits required for the sequence number field to achieve 100% utilization</p>	d8	d7	d6	d5	d4	d	d2	d1	1	1	0	x	0	1	0	1	c8	c4	c2	c1	y	0	1	0
d8	d7	d6	d5	d4	d	d2	d1																		
1	1	0	x	0	1	0	1																		
c8	c4	c2	c1																						
y	0	1	0																						

21	<p>A. A slotted ALOHA network transmits 200-bit frames on a shared channel of 100 kbps. What is the throughput if the system (all stations together) produces.</p> <p>a)9000 frames per second b)5000 frames per second c)200 frames per second.</p>
22	<p>In a slotted ALOHA network, the throughput can be calculated based on the offered load and the protocol's efficiency. The efficiency of slotted ALOHA is approximately 36.8%.</p> <p>The efficiency (η) of slotted ALOHA is given by:</p> $\eta = G * e^{(-G)}$ <p>Where G is the offered load, which is the average number of frames generated per slot time.</p> <p>In this case, we have three different offered loads to consider:</p> <p>a) If the system produces 9000 frames per second, then the average number of frames generated per slot time (G) is 9000 frames/second.</p> <p>b) If the system produces 5000 frames per second, then G is 5000 frames/second.</p> <p>c) If the system produces 200 frames per second, then G is 200 frames/second.</p> <p>Let's calculate the throughput for each case:</p> <p>a) $G = 9000$ frames/second $\eta = 9000 * e^{(-9000)}$</p> <p>b) $G = 5000$ frames/second $\eta = 5000 * e^{(-5000)}$</p> <p>c) $G = 200$ frames/second $\eta = 200 * e^{(-200)}$</p> <p>Now, calculate the throughput for each case:</p> <p>Throughput (T) = Efficiency (η) * Channel Bandwidth</p> <p>For all cases, the channel bandwidth is 100 kbps (100,000 bps).</p> <p>a) $T = \eta * 100,000$ bps b) $T = \eta * 100,000$ bps c) $T = \eta * 100,000$ bps</p> <p>You can calculate the throughput for each case using the corresponding value of η calculated above.</p>

	Keep in mind that slotted ALOHA assumes that the number of slots per frame time is the same as the number of slots per frame. If this is not the case, you may need to adjust the calculations accordingly.
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B. Consider a CSMA/CD network that transmits data at a rate of 100 Mbps (108 bits second) over a 1 km(kilometer) cable with no repeaters. If the minimum frame size required for this network is 1250 bytes, find what is the signal speed (km/sec) in the cable?

To find the signal speed (in km/sec) in the cable, you can use the following formula, which relates the network's data rate, cable length, and minimum frame size:

$$\text{Data Rate} = \frac{\text{Minimum Frame Size}}{(\text{Propagation Time} + \text{Transmission Time})}$$

In this equation:

- Data Rate is the network's data rate, which is 100 Mbps (100,000,000 bits per second).
- Minimum Frame Size is the minimum frame size required, which is 1250 bytes.
- Propagation Time is the time it takes for a signal to propagate across the 1 km cable, which is what we're trying to find.
- Transmission Time is the time it takes to transmit the 1250-byte frame.

Let's first calculate the Transmission Time:

$$\text{Transmission Time} = \frac{\text{Minimum Frame Size}}{\text{Data Rate}}$$

$$\text{Transmission Time} = \frac{1250 \text{ bytes} \times 8 \text{ bits/byte}}{100,000,000 \text{ bits/second}}$$

$$\text{Transmission Time} = \frac{10,000 \text{ bits}}{100,000,000 \text{ bits/second}}$$

$$\text{Transmission Time} = 0.0001 \text{ seconds}$$

Now, we can use the formula to calculate the Propagation Time:

$$100,000,000 \text{ bits/second} = \frac{1250 \text{ bytes} \times 8 \text{ bits/byte}}{(\text{Propagation Time} + 0.0001 \text{ seconds})}$$

Solving for Propagation Time:

$$\text{Propagation Time} + 0.0001 \text{ seconds} = \frac{1250 \text{ bytes} \times 8 \text{ bits/byte}}{100,000,000 \text{ bits/second}}$$

Propagation Time =

$$\frac{1250 \text{ bytes} \times 8 \text{ bits/byte}}{100,000,000 \text{ bits/second}} = 0.0001 \text{ seconds}$$

$$\text{Propagation Time} = 0.001 - 0.0001 \text{ seconds}$$

$$\text{Propagation Time} = 0.0009 \text{ seconds}$$

Since the cable length is 1 km, the signal speed can be calculated as:

$$\text{Signal Speed} = \frac{\text{Cable Length}}{\text{Propagation Time}}$$

$$\text{Signal Speed} = \frac{1 \text{ km}}{0.0009 \text{ seconds}}$$

$$\text{Signal Speed} \approx 1111.11 \text{ km/sec}$$

So, the signal speed in the cable is approximately 1111.11 km/sec.