1. Consider a communication link between a workstation on Earth and a satellite that acts as a server. The distance between the earth and the satellite is 4 * 10^4 km. What is the best-case delay in response to a request?

A. 133.33 m sec
B. 266.67 m sec
C. 400.00 m sec
D. 533.33 m sec

Answer: Option D

Explanation:

The request must go up and down (request and acknowledgement), and the response must go up and down (response and acknowledgement).
The total distance d traversed is thus 16 * 10^4 km.
The speed is equal to the speed of light in space. So, speed v is 300,000 km/sec.
Therefore, the propagation delay is d/v = 160,000/300,000 sec or about 533 msec.

2. One hundred stations on a pure ALOHA network share a 1-Mbps channel. If frames are 1000 bits long, find the throughput if each station sends 10 frames per second.
(e= 2.72)

A. **13.53** B. 12.12 C. 10.12 D. 14.12

Answer: Option A
Explanation:

We can first calculate Tt (transmission time for a frame) and G, and then the throughput.

Tt(Transmission time) = (1000 bits) / 1 Mbps = 1 ms

G = no. of stations × no. of frames per station × Tt = 100 × 10 × 1 ms = 1

For pure ALOHA → Throughput = $G \times e^{-2G}$ ≈ 13.53 percent

3. The data rate of 10Base5 is 10 Mbps. How long does it take to create the smallest frame

A. 512 μs B. 512 s C. 5.12 μs **D. 51.2 μs**

Answer: Option D
Explanation:

The smallest frame is 64 bytes or 512 bits. With a data rate of 10 Mbps, we have
Tt = (512 bits) / (10 Mbps) = 51.2 μs
This means the time required to send the smallest frame is the same as the maximum time required to detect the collision.

4. Consider a link with a transmission rate of R. Assume N packets are reached to link simultaneously. What is the average queuing delay for N packets if each packet is of size L? Currently, no packet is transmitted or queued.

A. (N-1)(L-1)/(2R) B. (N)L/(2R)
C. (N-1)L/(4R) **D. (N-1)L/(2R)**

Answer: Option D
Explanation:
The queuing delay is 0 for the first transmitted packet, L/R for the second transmitted packet, and generally, (N-1)L/R for the nth transmitted packet. Thus, the average delay for the N packets is
(L/R + 2L/R + ... + (N-1)L/R)/N
= L/(RN) * (1 + 2 + ... + (N-1))
= L/(RN) * N(N-1)/2
= LN(N-1)/(2RN)
= (N-1)L/(2R)

5. Ten thousand airline reservation stations are competing for the use of a single-slotted ALOHA channel. The average station makes 18 requests/hour. A slot is 125 µsec. What is the approximate total channel load?

A. 0.672 B. 0.241 **C. 0.00625** D. 0.0254

Answer: Option C

Explanation:
Total channel load = average requests / average slots number
Average requests for 10000 stations = 10000 x 18 / (60 x 60) = 50 requests/sec.
Average slots number = $1 / (125 \times 10^{-6}) = 8000$ slots/sec.
Total channel load = 50 / 8000 = 0.00625 request/slot.

6. Suppose four active nodes - nodes A, B, C, and D are competing for access to a channel using slotted ALOHA. Assume each node has an infinite number of packets to send. Each node attempts to transmit in each slot with probability p. The first slot is numbered Slot 1, the second slot is numbered Slot 2, and so on. What is the probability that the first success occurs in slot 3?

A. $(1 - p(1-p)^3)\ 4\ p(1-p)^3$ **B. $(1 - 4\ p(1-p)^3)^2 * 4\ p(1-p)^3$**
C. $(1 – p(1-p)3)^2 * 4\ p(1-p)^3$ D. $(1 - 4\ p(1-p)^3) * 4\ p(1-p)$

Answer: Option B

Explanation:
p(any node succeeds in a slot) = $[P(A)+P(\cancel{B})+P(\cancel{C})+P(\cancel{D})] + [P(\cancel{A})+P(B)+P(\cancel{C})+P(\cancel{D})] + [P(\cancel{A})+P(\cancel{B})+P(C)+P(\cancel{D})] + [P(\cancel{A})+P(\cancel{B})+P(\cancel{C})+P(D)]$
$= p(1-p)^3 + p(1-p)^3 + p(1-p)^3 + p(1-p)^3$
$= 4\ p(1-p)^3$
p(no node succeeds in a slot) = $1 - 4\ p(1-p)^3$
Hence, p(first success occurs in slot 3) = p(no node succeeds in first 2 slots) * p(any node succeeds in 3rd slot) = $(1 - 4\ p(1-p)^3)^2 * 4\ p(1-p)^3$

7. Suppose users share a 3 Mbps link. Also, each user requires 150 kbps when transmitting, but each user transmits only 10 percent of the time. When a circuit switching is used, how many users can be supported?

A. **20** B. 10 C. 50 D. 15

Answer: Option A

Explanation:

Given that BW=3 Mbps
each user requires 150 Kbps
Number of users supported = 3 Mbps / 150 Kbps = 20

8. In Ethernet, when Manchester encoding is used, the bit rate is:

(A) Half the baud rate. (B) Twice the baud rate.
(C) Same as the baud rate. (D) none of the above

Answer: Option A
Explanation:

The bit rate is half the baud rate in Manchester encoding, as bits are transferred only during a positive transition of the clock.

9. If the k-bit maximum frame sequence numbers field is available. What is the maximum window size for data transmission using the selective repeat protocol and Go Back N protocol?

(A) 2^k+1, K+1 **(B) $2^{(k-1)}$, 2^k-1** (C) $2^k - 1$, $2^{(k-1)}$ (D) $2^{(k-2)}$, $2^{(k-1)}$

Answer: Option B

Explanation

Selective Reject (or Selective Repeat) protocol is one of the automatic repeat-request (ARQ) techniques used for communications.
In SR protocol, the window size of the receiver and sender must be (N+1)/2, where N is the maximum sequence number.
If N is the maximum available sequence number, then the window size of both sender and receiver must be N/2.

If n is the number of bits in the frame sequence field, then the window size of both sender and receiver must be 2^(n-1).

10. if 10 packets are sent from sender to receiver using stop & wait ARQ. If every fourth packet is lost, then what is the total number of transmissions required?

(A) 12 (B) 15 **(C) 13** (D) 16

Answer: Option C
Explanation:

Total number of transmissions: 1 2 3 **4** 4 5 6 **7** 7 8 9 **10** 10 = 13