OUTLINE OF LECTURE 8

- Gate Question Related to UNIT I-II
- Discuss Tool and Language Used For Tomorrow Practical
  - Topic: Physical Layer Component Design using Hardware Description Language
  - Tool: Vivado 2018
  - Language: Verilog

GATE CS 2012 Question

1) Consider a source computer (S) transmitting a file of size 106 bits to a destination computer (D) over a network of two routers (R1 and R2) and three links (L1, L2 and L3). L1 connects S to R1;L2 connects R1 to R2; and L3 connects R2 to D. Let each link be of length 100km. Assume signals travel over each link at a speed of 10^8 meters per second. Assume that the link bandwidth on each link is 1Mbps. Let the file be broken down into 1000 packets each of size 1000 bits. Find the total sum of transmission and propagation delays in transmitting the file from S to D?

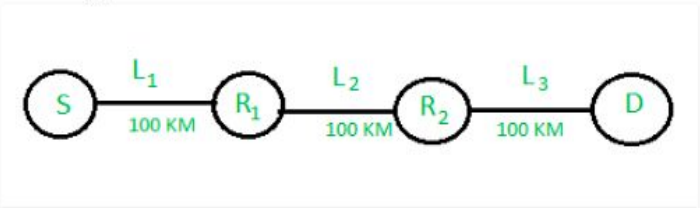
(A) 1005ms

(B) 1010ms

(C) 3000ms

(D) 3003ms

Answer (A)



Propagation delay to travel from S to R1 = (Distance) / (Link Speed) = 10^5/10^8 = 1ms

Total prorogation delay to travel from S to D = 3*1 ms = 3ms

Total Ttransmission delay for 1 packet = 3 * (Number of Bits) / Bandwidth = 3*(1000/10^6) = 3ms.

The first packet will take 6ms to reach D.

While first packet was reaching D, other packets must have been processing in parallel.

So D will receive remaining packets 1 packet per 1 ms from R2.

So remaining 999 packets will take 999 ms. And total time will be 999 + 6 = 1005 ms

GATE CS 2005 Exam

2) The address resolution protocol (ARP) is used for:

(a) Finding the IP address from the DNS

(b) Finding the IP address of the default gateway

(c) Finding the IP address that corresponds to a MAC address

(d) Finding the MAC address that corresponds to an IP address

Answer (d)

Address Resolution Protocol (ARP) is a request and reply protocol used to find MAC address from IP address.

GATE CS 2005 Exam

3) The maximum window size for data transmission using the selective reject protocol with n-bit frame sequence numbers is:

(a) 2^n

(b) 2^(n-1)

(c) 2^n – 1

(d) 2^(n-2)

Answer (b)

In Selective Reject (or Selective Repeat), maximum size of window must be half of the maximum sequence number.

GATE CS 2005 Exam

4) Suppose the round trip propagation delay for a 10 Mbps Ethernet having 48-bit jamming signal is 46.4 ms. The minimum frame size is:

(a) 94

(b) 416

(c) 464

(d) 512

Answer (c)

Transmission Speed = 10Mbps.

Round trip propagation delay = 46.4 ms

The minimum frame size = (Round Trip Propagation Delay) * (Transmission Speed) = 10*(10^6)*46.4*(10^-3) = 464 * 10^3 = 464 Kbit

GATE CS 2008 Exam

5) A computer on a 10Mbps network is regulated by a token bucket. The token bucket is filled at a rate of 2Mbps. It is initially filled to capacity with 16Megabits. What is the maximum duration for which the computer can transmit at the full 10Mbps?

(A) 1.6 seconds

(B) 2 seconds

(C) 5 seconds

(D) 8 seconds

Answer (B)

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New tokens are added at the rate of r bytes/sec which is
2Mbps in the given question.

Capacity of the token bucket (b) = 16 Mbits
Maximum possible transmission rate (M) = 10Mbps
  So the maximum burst time = b/(M-r) = 16/(10-2) = 2 seconds
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GATE CS 2007 Exam

6) 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 (A)

In Manchester encoding, the bitrate is half of the baud rate.

GATE CS 2007 Exam

7) There are n stations in a slotted LAN. Each station attempts to transmit with a probability p in each time slot. What is the probability that ONLY one station transmits in a given time slot?

(A) (1-p)^(n-1)

(B) np(1-p)^(n-1)

(C) p(1-p)^(n-1)

(D) 1-(1-p)^(n-1)

Answer (B)

The probability that a particular station transmits and no body else transmits = p*(1-p)^(n-1)

The probability that any station can transmit = n*(probability that a particular station transmits) = n*p*(1-p)^(n-1).

GATE CS 2007 Exam

8) In a token ring network the transmission speed is 10^7 bps and the propagation speed is 200 metres/micro second.

The 1-bit delay in this network is equivalent to:

(A) 500 metres of cable.

(B) 200 metres of cable.

(C) 20 metres of cable.

(D) 50 metres of cable.

Answer (C)

Transmission delay for 1 bit t = 1/(10^7) = 0.1 micro seconds.

200 meters can be traveled in 1 micro second. Therefore, in 0.1 micro seconds, 20 meters can be traveled.

GATE CS 2007 Exam

9) The message 11001001 is to be transmitted using the CRC polynomial x^3 + 1 to protect it from errors. The message that should be transmitted is:

(A) 11001001000
(B) 11001001011
(C) 11001010
(D) 110010010011

Answer (B)

The polynomial x^3+1 corresponds to divisor is 1001.

```
11001001 000  <--- input right padded by 3 bits
1001          <--- divisor
01011001 000  <---- XOR of the above 2
 1001         <--- divisor
00010001 000
   1001
00000011 000
      10 01
00000001 010
       1 001
00000000 011 <------- remainder (3 bits)
```

See this for division process.

After dividing the given message 11001001 by 1001, we get the remainder as 011 which is the CRC. The transmitted data is, message + CRC which is 11001001 011.

GATE CS 2007 Exam

3) The distance between two stations M and N is L kilometers. All frames are K bits long. The propagation delay per kilometer is t seconds. Let R bits/second be the channel capacity. Assuming that processing delay is negligible, the minimum number of bits for the sequence number field in a frame for maximum utilization, when the sliding window protocol is used, is:

(A) $\left\lceil \log_2 \frac{2LtR + 2K}{K} \right\rceil$

(B) $\left\lceil \log_2 \frac{2LtR}{K} \right\rceil$

(C) $\left\lceil \log_2 \frac{2LtR + K}{K} \right\rceil$

(D) $\left\lceil \log_2 \frac{2LtR + K}{2K} \right\rceil$

Answer (C)

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Distance between stations = L KM
Propogation delay per KM = t seconds
Total propagation delay = Lt seconds

Frame size = k bits
Channel capacity = R bits/second
Transmission Time = k/R

Let n be the window size.

Utilization = n/(1+2a) where a = Propagation time / transmission time
            = n/[1 + 2LtR/k]
            = nk/(2LtR+k)
For maximum utilization: nk = 2LtR + k
Therefore, n = (2LtR+k)/k
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GATE CS 2006 Exam

11) Station A uses 32 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 optimal window size that A should use?

(A) 20

(B) 40

(C) 160

(D) 320

Answer (B)

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Round Trip propagation delay = 80ms
Frame size = 32*8 bits
Bandwidth = 128kbps
Transmission Time = 32*8/(128) ms = 2 ms

Let n be the window size.

UtiliZation = n/(1+2a) where a = Propagation time / transmission time
            = n/(1+80/2)

For maximum utilization: n = 41 which is close to option (B)
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GATE CS 2006 Exam

12) Station A needs to send a message consisting of 9 packets to Station B using a sliding window (window size 3) and go-back-n error control strategy. All packets are ready and immediately available for transmission. If every 5th packet that A transmits gets lost (but no acks from B ever get lost), then what is the number of packets that A will transmit for sending the message to B?

(A) 12

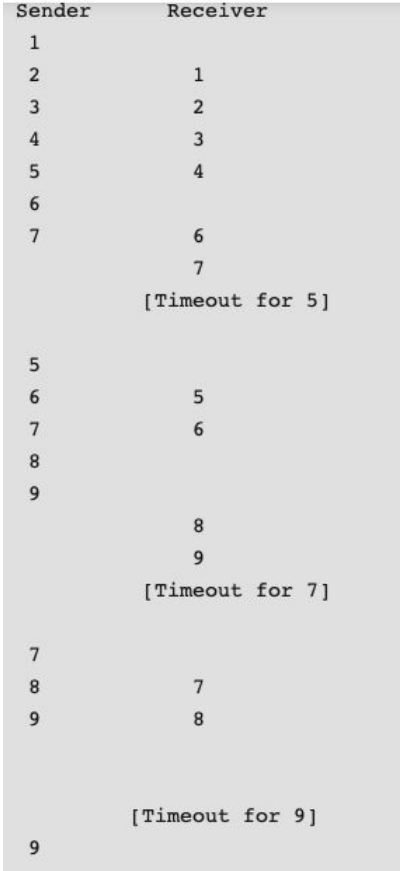
(B) 14

(C) 16

(D) 18

Answer (C)

Total 16 packets are sent. See table for sequence of events. Since go-back-n error control strategy is used, all packets after a lost packet are sent again.



GATE CS 2009 Exam

13) Let G(x) be the generator polynomial used for CRC checking. What is the condition that should be satisfied by G(x) to detect odd number of bits in error?

(A) G(x) contains more than two terms

(B) G(x) does not divide 1+x^k, for any k not exceeding the frame length

(C) 1+x is a factor of G(x)

(D) G(x) has an odd number of terms.

Answer (C)

Odd number of bit errors can be detected if G(x) contains (x+1) as a factor.

GATE CS 2009 Exam

14) Frames of 1000 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 (i) that will be required to represent the sequence numbers distinctly? Assume that no time gap needs to be given between transmission of two frames.

(A) i=2

(B) i=3

(C) i=4

(D) i=5

Answer (D)

Transmission delay for 1 frame = 1000/(10^6) = 1 ms

Propagation time = 25 ms

The sender can atmost transfer 25 frames before the first frame reaches the destination.

The number of bits needed for representing 25 different frames = 5

GATE CS 2009 Exam

15) Consider the data of previous question. Suppose that the sliding window protocol is used with the sender window size of 2^i where is the number of bits identified in the previous question and acknowledgments are always piggybacked. After sending 2^i frames, what is the minimum time the sender will have to wait before starting transmission of the next frame? (Identify the closest choice ignoring the frame processing time.)

(A) 16ms

(B) 18ms

(C) 20ms

(D) 22ms

Answer (B)

Size of sliding window = 2^5 = 32

Transmission time for a frame = 1ms

Total time taken for 32 frames = 32ms

The sender cannot receive acknoledgement before round trip time which is 50ms

After sending 32 frames, the minimum time the sender will have to wait before starting transmission of the next frame = 50 – 32 = 18

- Discuss Tool and Language Used For Tomorrow Practical
  - Topic: Physical Layer Component Design using Hardware Description Language
  - Tool: Vivado 2018
  - Language: Verilog

Vivado 2018.1

- **Vivado Design Suite** is a software suite produced by Xilinx for synthesis and analysis of HDL designs, superseding Xilinx ISE with additional features for system on a chip development and high-level synthesis.

VERILOG

- This language is similar to C.
- This language has also switch case, for loop, if else statement.
- We can design Parity Generator in only 10-line code.
- Similarly, CRC in a single page code.
- In one lecture, you will understand code of Parity Generator, CRC Module, UART Circuit, Key Generator and network processor in Verilog.
- **http://www.asic-world.com/examples/verilog/uart.html**

LECTURE 9: OUTLINE

- Practical: Physical Layer Component Design

- FIR Low Pass Filter
- UART Circuit,
- Key Generator: Fibonacci Generator
- Parity Generator,
- CRC Module