National University of Computer and Emerging Sciences, Lahore Campus

Quiz ……6 [BS(CS): Section C] Fall 2023

Computer Networks (Code: CS3001) **Quiz Date: Novemer 30, 2023**

Total Marks: 10 **Duration: 25 -Minutes**

Name ---------- Roll #---------- Section --------

Q6: Consider the Cyclic Redundancy Check (CRC) algorithm with a 5-bit generator, G = 10011, and suppose that D has the value 1010101010 (data to transmit). What is the value of R (CRC bits)? Write the value of total data transmitted by the sender? [4 Marks]

Answer: If we divide 10011 into 1010101010 0000, we get 1011011100 (quotient), with a remainder of R=0100.

Total data transmitted by the sender: 1010101010 0100

Q2: 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 node A succeeds for the first time in slot 4? What is the probability that some node (either A, B, C or D) succeeds in slot 5? Moreover, what is the efficiency of this four-node system given the transmission probability p=0.50? [6 Marks]

Answer:

probability that node A succeeds for the first time in slot 4

$p(\text{A succeeds for first time in slot 4}) = (1 - p(A))^3\, p(A) = (1 - p(1-p)^3)^3\, p(1-p)^3$

p(A) = probability that A succeeds in a slot

p(A) = p(A transmits and B does not and C does not and D does not)

p(A) = p(A transmits) p(B does not transmit) p(C does not transmit) p(D does not transmit)

p(A) = = p(1 – p) (1 – p)(1-p) = p(1 – p)3

Probability that some node succeeds in slot 5

p(A succeeds in slot 5) = p(1-p)3

p(B succeeds in slot 5) = p(1-p)3

p(C succeeds in slot 5) = p(1-p)3

p(D succeeds in slot 5) = p(1-p)3

p(either A or B or C or D succeeds in slot 5) = 4 $p(1-p)^3$

The maximum efficiency of Slotted Aloha with 4 nodes is calculated as follows:

For a given p = 0.50

Max efficiency = Np (1 - p)^(N - 1)

= 4 * 0.50 * (1 - 0.50)^(4 - 1)

= 2 * (0.50) ^3 = 0.25 or 25% efficiency

Efficiency = p(success in a slot) =4 $p(1-p)^3$ = 4 . 0.50 $(1-0.50)^3$ = 2 .$(0.50)^3$= 2 . 0.125 = 0.25or

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t is the probability that node A succeeds for the first time in slot 4?

t is the probability that some node (either A, B, C or D) succeeds in slot 5?

t is the probability that the first success occurs in slot 4?

t is the efficiency of this four-node system?

:

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:

p(A succeeds for first time in slot 4) = (1 – p(A))^3 p(A) = (1 – p(1 – p)3)3 p(1 – p)^3

p(A) = probability that A succeeds in a slot

p(A) = p(A transmits and B does not and C does not and D does not)

p(A) = p(A transmits) p(B does not transmit) p(C does not transmit) p(D does not transmit)

p(A) = = p(1 – p) (1 – p)(1-p) = p(1 – p)3

Probability that some node succeeds in slot 5

p(A succeeds in slot 5) = p(1-p)3

25% p(B succeeds in slot 5) = p(1-p)3