CNT 5106

Spring 2023

Homework Assignment 6

1. Suppose the information content of a packet is the bit pattern 1110 0110 1001 1101 and an even parity scheme is being used. What would the value of the field containing the parity bits be for the case of a two-dimensional parity scheme? Your answer should be such that a minimum-length checksum field is used.

The minimum length checksum field should be 4*4 matrix. For our data, two-dimensional (even) parity:

1	1	1	0	1
0	1	1	0	0
1	0	0	1	0
1	1	0	1	1
1	1	0	0	0

2. Consider the 7-bit generator, G=10011, and suppose that D has the value 1010101010. What is the value of R?

The polynomial expression of G is 1*x^4+0*x^3+0*x^2+1*x^1+1*x^0=x^4+x+1

So, the degree is 4.

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              101101110
10011 ) 10101010100000
        10011
         1100
         0000
         11001
         10011
          10100
          10011
           1111
           0000
           11110
           10011
            11010
            10011
             10010
             10011
                010
                000
                0100
```

The value of R is 0100.

3. 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.

a. What is the probability that node A succeeds for the first time in slot 5?

We set event N is the probability that node A succeeds for the first time in slot 5, so P(N)=P(A)*(1-P(A))^4.
Also, P(A)=p*(1-p)^3
P(N)= p(1 - p)^3[1 - p(1 - p)^3]^4

b. What is the probability that some node (either A, B, C or D) succeeds in slot 4?

We set event Y is the probability that any node (either A, B, C or D) succeeds in slot 4.
P(Y) = p(1 - p)^3

We set event X is the probability that some node (either A, B, C or D) succeeds in slot 4.
P(X)=4*P(Y)=4p(1-p)^3

c. What is the probability that the first success occurs in slot 3?

We set event D is the probability that the first success occurs in slot 3.
P(D)=P(X)(1-P(X))^2
P(D)= 4p(1 - p)^3*[1 - 4p(1 - p)^3]^2

d. What is the efficiency of this four-node system?

The efficiency is P(X)=4p(1-p)^3

4. Recall that with the CSMA/CD protocol, the adapter waits K * 512 bit times after a collision, where K is drawn randomly. For K= 100, how long does the adapter wait until returning to Step 2 for a 10 Mbps broadcast channel? For a 100 Mbps broadcast channel?

The one bit time for 10Mbps is 1/10000000 s = 0.0001 ms
The one bit time for 100Mbps is 1/100000000 s = 0.00001 ms

Waiting time for a 10Mbps broadcast channel is K*512*0.0001= 5.12 ms

Waiting time for a 100Mbps broadcast channel is K*512*0.00001= 0.512ms

5. Let's consider the operation of a learning switch in the context of a network in which 6 nodes labeled A through F are star connected into an Ethernet switch. Suppose that (i) B sends a frame to E, (ii) E replies with a frame to B, (iii) A sends a frame to B, (iv) B replies with a frame to A. The switch table is initially empty. Show the state of the switch table before and after each of these events. For each of these events, identify the link(s) on which the transmitted frame will be forwarded, and briefly justify your answers.

Before any events have occurred, the switch table is empty i. B sends a frame to E: The switch learns that B is connected to its interface 1 and adds an entry to the table. The switch does not have an entry for E, so it floods the frame to all interfaces except the incoming interface (interface 1).

ii. E replies with a frame to B: The switch learns that E is connected to its interface 2 and adds an entry to the table The switch looks up the MAC address of B in its table and forwards the frame to interface 1.

iii. A sends a frame to B: The switch does not have an entry for A, so it floods the frame to all interfaces except the incoming interface (interface 3). The switch looks up the MAC address of B in its table and forwards the frame to interface 1.

iv. B replies with a frame to A: The switch already has an entry for B in its table, so it forwards the frame to interface 3.

The final state of the switch table after all events have occurred is:

MAC address	Interface
B	1
E	2
A	3