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**Question :1) Complete the next table for the different protocols discussed in this chapter. Answer yes or no.**

|  |  |  |
| --- | --- | --- |
| **Characteristic** | **Token Passing** | **Chanalization** |
| **Multiple access** | no | yes |
| **Carrier Sense** | no | no |
| **Collision checking** | no | no |
| **Acknowledgment** | no | no |

**Question : 2)**  A network with one primary and four secondary stations uses polling. The size of a data frame is 1000 bytes. The size of the poll, ACK, NACK frames are 32 bytes. Each station has 5 frames to send how many total bytes are exchanged if each station can send only one frame in response to a poll.

Polling and data transfer:

Frame 1 for all four stations: 4 \* [ poll + frame + ACK]

Frame 2 for all four stations: 4 \* [ poll + frame + ACK]

Frame 3 for all four stations: 4 \* [ poll + frame + ACK]

Frame 4 for all four stations: 4 \* [ poll + frame + ACK]

Frame 5 for all four stations: 4 \* [ poll + frame + ACK]

Polling and sending NAKs

Station 1: [poll+ NAK]

Station 2: [poll+ NAK]

Station 3: [poll+ NAK]

Station 4: [poll+ NAK]

Total activity:

24 polls + 20 frames + 20 ACK s+ 4 NAKs = 21536 bytes.

3) Prove that the inner product of the two same sequences will give N , where N is the number of sequences (stations) for any two entries of your choice in W8.

[+1 -1 +1 -1 +1 -1 +1 -1]. [+1 -1 +1 -1 +1 -1 +1 -1]

=1+1+1+1+1+1+1+1=8 =N

 5) What is the number of sequences if we have 50 stations in our network?

The number of sequences needs to be 2m

We need to choose m = 6 and Number of sequences = 26 or 64.

We can then use 50 of the sequences as the chips.

6) Get the sequences (chips) for 6 stations. (6 is not power of 2 but 23=8 so we calculate W8 but consider only the first 6 rows as our stations)

1) W1=[1]

W8 = +1 +1 +1 +1 +1 +1 +1 +1 S1

+1 -1 +1 -1 +1 -1 +1 -1 S2

+1 +1 -1 -1 +1 +1 -1 -1 S3

+1 -1 -1 +1 +1 -1 -1 +1 S4

+1 +1 +1 +1-1 -1 -1 -1S5

+1 -1 +1 -1-1 +1 -1 +1S6

+1 +1 -1 -1-1 -1 +1 +1

+1 -1 -1 +1-1 +1 +1 -1

W2 = 1 1

1. -1

W4 = +1 +1 +1 +1

+1 -1 +1 -1

+1 +1 -1 -1

+1 -1 -1 +1

7) Four stations A,B,C and D share a link during 1-bit interval using CDMA channelization method. Assume that station B send a ***0*** bit ,stations A is ***silen***t and both of station C and D send a ***1*** bit and W1=[-1].

1. Determine the common data on the common channel.

* Sequence generation:

We have 4 stations N=4

W4 =  -1 -1 -1 -1

-1 +1 -1 +1

-1 -1 +1 +1

-1 +1 +1 -1

* Each station is assigned a sequence:

A = [-1 -1 -1 -1]

B = [-1 +1 -1 +1]

C = [-1 -1 +1 +1]

D = [-1 +1 +1 -1]

* Encoding:

A is silent 🡪 0

B send 0 bit 🡪-1

C send 1 bit 🡪 1

D send 1 bit 🡪 1

* In the multiplexer:

0\* [-1 -1 -1 -1] **+**-1 \* [-1 +1 -1 +1] + 1 \* [-1 -1 +1 +1] +1\*[-1 +1 +1 -1]

The encoded number is multiplied by each chip in the sequence=

[0 0 0 0] + [+1 -1 +1 -1] + [-1 -1 +1 +1] + [-1 +1 +1 -1]

All first chips are added, as are all second, third and forth= [-1 -1 +3 -1] the result is a new sequence, which is transmitted through the link.

1. Show how does station can detect the data sent by stations A and D

* Station A: [-1 -1 +3 -1] \* [-1 -1 -1 -1] = [+1 +1 -3 +1]

Then the chips in the sequence are added and divided by 4: 1+1-3+1=0/4 =0🡪 silence

* Station B: [-1 -1 +3 -1] \* [-1 +1 -1 +1] =[+1 -1 -3 -1] =-4/4= -1 🡪 bit 0
* Station C: [-1 -1 +3 -1] \* [-1 -1 +1 +1] = [+1 +1+3 -1] =4/4=1🡪bit 1
* Station D: [-1 -1 +3 -1] \* [-1 +1 +1 -1] = [+1 -1 +3 +1] = 4/4 =1🡪bit 1

**Question 3** Hamming code is a technique that is used to achieve forward error control. This allows a receiver to correct any single error, if any, in the received message. If the transmitted character is **01001010**, generate the Hamming codeword.

1. Calculate the number of redundant bits:

2r>= m + r + 1 we have 8 bit of data so,

2r>= 8 + r + 1

r=4

16 > 13

We have 4 redundant bits which gives us a total of 4+8=12 bit

1. Implementing the Hamming codeword:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 0 | 1 | 0 | 0 | **r8** | 1 | 0 | 1 | **r4** | 0 | **r2** | **r1** |

***r1:*** 1, 3, 5, 7, 9, 11

***r2:*** 2, 3, 6, 7, 10, 11

***r4:*** 4, 5, 6, 7,12

***r8:*** 8, 9, 10, 11,12

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 0 | 0 | **r8** | 1 | 0 | 1 | **r4** | 0 | **r2** | **r1** |
| 0 | 1 | 0 | 0 | **r8** | 1 | 0 | 1 | **r4** | 0 | **r2** | **1** |
| 0 | 1 | 0 | 0 | **r8** | 1 | 0 | 1 | **r4** | 0 | **0** | **1** |
| 0 | 1 | 0 | 0 | **r8** | 1 | 0 | 1 | **0** | 0 | **0** | **1** |
| 0 | 1 | 0 | 0 | **1** | 1 | 0 | 1 | **0** | 0 | **0** | **1** |

**Question 4)how does CSMA/CD protocol improve performance compared to CSMA protocol?**

**CSMA/CD has less Collision that's why CSMA/CD performs better than CSMA**