COMPUTER NETWORKS ASSIGNMENT

Name: Abhishek De
Roll no: 001710501027
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Section: A1
Assignment: 4

Problem statement:
In this assignment you have to implement CDMA for multiple access of a common channel by n stations. Each sender uses a unique code word, given by the Walsh set, to encode its data, send it across the channel, and then perfectly reconstruct the data at n stations.

Design
The program has 2 stages:
1. Multiplexing
2. Demultiplexing

We first take user input for the number of senders. Since Walsh code works for n stations, where n is a power of 2, we take the next greater power of 2 as the size of our Walsh matrix.

To calculate the Walsh matrix, we use the following formulae:

$$W_1 = = [+1]$$

$$W_{2N} = \begin{vmatrix} W_N & W_N \\ W_N & \overline{W_N} \end{vmatrix}$$

Each row of the matrix represents the Walsh code for a particular station.

Now, each station/sender can either transmit a bit(0 or 1) or be silent.
We define a matrix data such that:
data[i] = 1, when station i transmits a bit 1.
= -1, when station i transmits a bit 0.
= 0, when station i remains silent.

We multiply Walsh code for each station with its corresponding data value, and sum up the resultant row matrices, to receive data on the common channel.

For example, for a channel with 8 stations, the resultant codes will be:

	STATION CODE									DATA		RESULT CODE							
Station 1	[+1	+1	+1	+1	+1	+1	+1	+1]	x	+1	=	[+1	+1	+1	+1	+1	+1	+1	+1]
Station 2	[+1	-1	+1	-1	+1	-1	+1	-1]	x	+1	=	[+1	-1	+1	-1	+1	-1	+1	-1]
Station 3	[+1	+1	-1	-1	+1	+1	-1	-1]	x	+1	=	[+1	+1	-1	-1	+1	+1	-1	-1]
Station 4	[+1	-1	-1	+1	+1	-1	-1	+1]	x	0	=	[0	0	0	0	0	0	0	0]
Station 5	[+1	+1	+1	+1	-1	-1	-1	-1]	x	+1	=	[+1	+1	+1	+1	-1	-1	-1	-1]
Station 6	[+1	-1	+1	-1	-1	+1	-1	+1]	x	-1	=	[-1	+1	-1	+1	+1	-1	+1	-1]
Station 7	[+1	+1	-1	-1	-1	-1	+1	+1]	x	+1	=	[+1	+1	-1	-1	-1	-1	+1	+1]
Station 8	[+1	-1	-1	+1	-1	+1	+1	-1]	x	0	=	[0	0	0	0	0	0	0	0]

After multiplexing the data on the common channel will be
[4 4 0 0 2 -2 2 – 2]

To demultiplex the data, the data on the common channel is multipled with the sender's Walsh code and divided by the size of the row matrix.

For ex:

Station 1

[+1 +1 +1 +1 +1 +1 +1 +1] x [4 4 0 0 2 −2 2 −2] / 8
= [4 4 0 0 2 −2 2 −2] / 8
= (4 + 4 + 0 + 0 + 2 -2 +2 -2) / 8 = 8/8 = +1 which is bit 1

Results:

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Enter number of senders: 5

The walsh codes for the sender are:
Sender 0: [1 1 1 1 1 1 1 1 ]
Sender 1: [1 -1 1 -1 1 -1 1 -1 ]
Sender 2: [1 1 -1 -1 1 1 -1 -1 ]
Sender 3: [1 -1 -1 1 1 -1 -1 1 ]
Sender 4: [1 1 1 1 -1 -1 -1 -1 ]

Enter data bit(0 or 1) for each sender(-1 for no data)
Sender 0: 1
Sender 1: 1
Sender 2: -1
Sender 3: 0
Sender 4: -1

The resultant codes after multiplying with data are:
Sender 0: [1 1 1 1 1 1 1 1 ]
Sender 1: [1 -1 1 -1 1 -1 1 -1 ]
Sender 2: [0 0 0 0 0 0 0 0 ]
Sender 3: [-1 1 1 -1 -1 1 1 -1 ]
Sender 4: [0 0 0 0 0 0 0 0 ]

The resultant code after multiplexing: [1 1 3 -1 1 1 3 -1 ]

After demultiplexing.....
CHOICE
1.Sender
2.Exit
Enter choice:1
Enter sender number:2
Sender sent no data
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