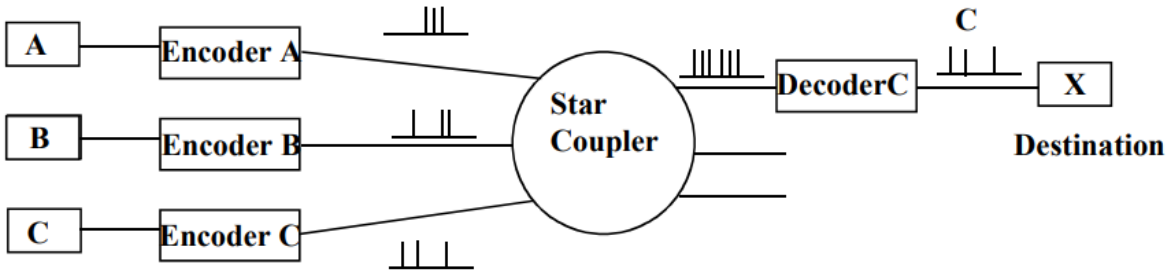
Experiment No. 2

Aim: To implement a basic function of Code Division Multiple Access (CDMA).

Theory:

In CDMA (**Code Division Multiple Access**), each group of users is given a shared code and individual conversations are encoded in a digital sequence. Data is available on the shared channel, but only those users associated with a particular code can access the data.

Each channel transmits its data bits as a coded channel specific sequence over available BW, wavelength, and time slots.



CDMA:

Example: Assume 4 stations S1, S2, S3, S4 use 4×4 Walsh Table to assign codes to them.

C1 = [+1 +1 +1 +1]

C2 = [+1 -1 +1 -1]

C3 = [+1 +1 -1 -1]

C4 = [+1 -1 -1 +1]

Let their data bits currently be:

D1 = -1

D2 = -1

D3 = 0 (Silent)

D4 = +1

Resultant channel sequence = C1.D1 + C2.D2 + C3.D3 + C4.D4

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

+ [+1 -1 -1 +1]

= [-1 -1 -3 +1]

Now suppose station 1 wants to listen to station 2.

Inner Product = [-1 -1 -3 +1] x C2

= -1 + 1 - 3 - 1 = -4

Data bit that was sent = -4/4 = -1.

Python Code:

```
import numpy as np
C1=[1,1,1,1]
C2=[1,-1,1,-1]
C3=[1,-1,1,-1]
C4=[1,-1,-1,1]
Rc=[]
print("Enter the data bits:")
D1=int(input("Enter the data D1:")
D2=int(input("Enter the data D2:")
D3=int(input("Enter the data D3:")
D4=int(input("Enter the data D4:")
R1=np.multiply(C1,D1)
R2=np.multiply(C2,D2)
R3=np.multiply(C3,D3)
R4=np.multiply(C4,D4)
Resultant_Channel=R1+R2+R3+R4;
```

```
print("Resultant Channel is:", Resultant_Channel)

Channel = int(input("Enter channel number who wants to listen to data: C1=1, C2=2, C3=3, C4=4"))

    if Channel == 1:

    Rc=C1

    elif Channel ==2:

    Rc=C2

    elif Channel ==3:

    Rc=C3

    elif Channel ==4:

    Rc=C4

Inner_product=np.multiply(Resultant_Channel,Rc)

print("Data visible to all channels is:", Inner_product)

Inner_product1=sum(Inner_product)

Data=Inner_product1/len(Inner_product)

print("Data bit which was sent is:",Data)
```

Output:

```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.19045.4170]
(c) Microsoft Corporation. All rights reserved.

C:\Users\kdbom\Desktop>python cdma.py
Enter the data bits:
Enter the data D1: -1
Enter the data D2: -1
Enter the data D3: 0
Enter the data D4: 1
Resultant Channel is:  [-1 -1 -3  1]
Enter channel number who wants to listen to data: C1=1, C2=2, C3=3, C4=4: 2
Data visible to all channels is: [-1  1 -3 -1]
Data bit which was sent is:  -1.0
```

Conclusion:

The implemented Python code demonstrates a basic simulation of Code Division Multiple Access (CDMA) communication. It utilizes Walsh codes to encode data bits for multiple stations. Through the inner product calculation, a specific station can extract the data intended for it from the resultant channel sequence. This experiment illustrates the fundamental principle of CDMA, where multiple users share the same channel by encoding their data with unique codes, enabling simultaneous communication with minimal interference.