AIM: To implement a basic function of Code Division Multiple Access[CDMA].

Theory:

Code Division Multiple Access (CDMA) is a sort of multiplexing that facilitates various signals to occupy a single transmission channel. It optimizes the use of available bandwidth. The technology is commonly used in ultra-high-frequency (UHF) cellular telephone systems, bands ranging between the 800-MHz and 1.9-GHz.

CDMA Overview:

Code Division Multiple Access system is very different from time and frequency multiplexing. In this system, a user has access to the whole bandwidth for the entire duration. The basic principle is that different CDMA codes are used to distinguish among the different users.

Techniques generally used are direct sequence spread spectrum modulation (DS-CDMA), frequency hopping or mixed CDMA detection (JDCDMA). Here, a signal is generated which extends over a wide bandwidth. A code called spreading code is used to perform this action. Using a group of codes, which are orthogonal to each other, it is possible to select a signal with a given code in the presence of many other signals with different orthogonal codes.

Advantages of CDMA

CDMA has a soft capacity. The greater the number of codes, the more the number of users. It has the following advantages −

CDMA requires a tight power control, as it suffers from near-far effect. In other words, a user near the base station transmitting with the same power will drown the signal latter. All signals must have more or less equal power at the receiver

Rake receivers can be used to improve signal reception. Delayed versions of time (a chip or later) of the signal (multipath signals) can be collected and used to make decisions at the bit level.

Flexible transfer may be used. Mobile base stations can switch without changing operator. Two base stations receive mobile signal and the mobile receives signals from the two base stations.

Transmission Burst − reduces interference.

Disadvantages of CDMA

The disadvantages of using CDMA are as follows −

The code length must be carefully selected. A large code length can induce delay or may cause interference.

Time synchronization is required.

Gradual transfer increases the use of radio resources and may reduce capacity.

As the sum of the power received and transmitted from a base station needs constant tight power control. This can result in several handovers.

CODE:

```
from functools import reduce


class User:
     def __init__(self, code):
          # code is a list of 1 and -1.
          # All the users has same number of bits in the code.
          # with length equal to number of users.
          self.code = code
     def __mul__(self, num):
          return [num * bit for bit in self.code]
     def __add__(self, oth):
          return [a + b for a, b in zip(self.code, oth)]
     def __repr__(self):
          return self.code.__str__()
     __rmul__ = __mul__


def algo():
     avail_codes = [
          [1] * 4,
          [1, -1, 1, -1],
          [1, 1, -1, -1],
          [1, -1, -1, 1]
     ]
     users = [User(code) for code in avail_codes]
     data = tuple(map(int, input("Enter the data of the four stations:
").split()))
     garbled = [num * user for num, user in zip(data, users)]
     final_code = User([sum(codes) for codes in zip(*garbled)])
     which_channel = int(input('Enter the channel you want to listen to[0-4]: '))
     decoded = sum([num * user for num, user in zip(final_code.code,
users[which_channel].code)]) >> 2
     print(decoded, 'is the data.')

if __name__ == '__main__':
     algo()
```

OUTPUT:

```
Enter the data of the four stations: 48 17 50 87
Enter the channel you want to listen to[0-4]: 3
87 is the data.
```