CDMA

- Unlike TDMA, in CDMA all stations can transmit data simultaneously.
- CDMA allows each station to transmit over the entire frequency spectrum all the time.
- Multiple simultaneous transmissions are separated using coding theory.
- In CDMA, each user is given a unique code sequence.

Working of CDMA

- Let us assume that we have four stations: 1, 2, 3 and 4 that are connected to the same channel.
- The data from station 1 is d_1, from station 2 is d_2 and so on.
- The code assigned to station 1 is c_1, station 2 is c_2 and so on.
- These assigned codes have two properties:
  - If we multiply each code by another, we get 0.
  - If we multiply each code by itself, we get 4, (no. of stations).

Working of CDMA

- When these four stations send data on the same channel, then station 1 multiplies its data by its code i.e. $d_1.c_1$, station 2 multiplies its data by its code i.e. $d_2.c_2$ and so on.
- The data that goes on the channel is the sum of all these terms:

$$\mathbf{d_1.c_1 + d_2.c_2 + d_3.c_3 + d_4.c_4}$$

- Any station that wants to receive data from the channel multiplies the data on the channel by the code of the sender.

Working of CDMA

- For e.g.: suppose station 2 wants to receive data from station1.
- It multiplies the data on the channel by c_1, (code of station 1).
- Because $(c_1.c_1)$ is 4, but $(c_2.c_1)$, $(c_3.c_1)$ and $(c_4.c_1)$ are all 0s, station 2 divides the result by 4 to get the data from station 1.

$$\begin{aligned} \text{data} &= (d_1.c_1 + d_2.c_2 + d_3.c_3 + d_4.c_4).c1 \\ &= d_1.c_1.c_1 + d_2.c_2.c_1 + d_3.c_3.c_1 + d_4.c_4.c_1 \\ &= d_1.4 + 0 + 0 + 0 \\ &= (d_1.4) / 4 = d_1 \end{aligned}$$