- If 20 MHz of total spectrum is allocated for a duplex wireless cellular system and each simplex channel has 25 kHz RF bandwidth. Find
  - The number of duplex channels
  - The total number of channels per cell size if N=4 reuse is used.

$$\frac{20M}{25K \times 2} = 400 \text{ channels}$$

$$400/4 = 100 \text{ channels per cell}$$

We consider a cellular system in which total available voice channels to handle the traffic are 960. The area of each cell is 6km^2 and the total coverage is 2000km^2

- The system capacity if the cluster size is N=4.
- The system capacity if the cluster size is N=7.

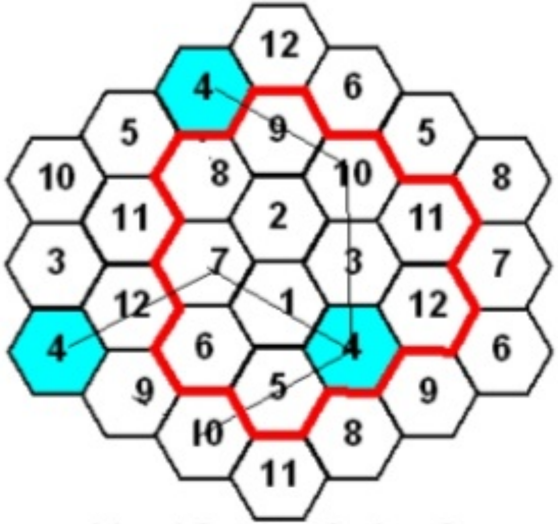
	Area of a cluster	**# of clusters**	**# of channels /cell**	**System capacity**
N=4	4*6=24 km^2	2000/24≅84	960/4=240	84*960=80640
N=7	7*6=42 km^2	2000/42≅48	960/7=137	48*960=46080

Comments:

N from 7 to 4, the capacity ↑ [from 46080 to 80640]

No free lunch… what would be the cost?

N = 3: $i = 1, j = 1$

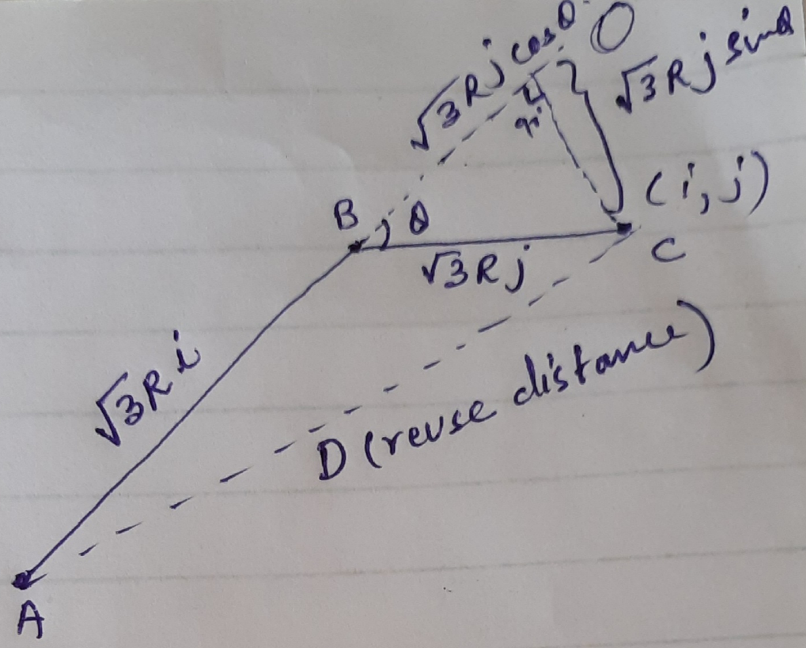


N= 12: $i = 2, j = 2$

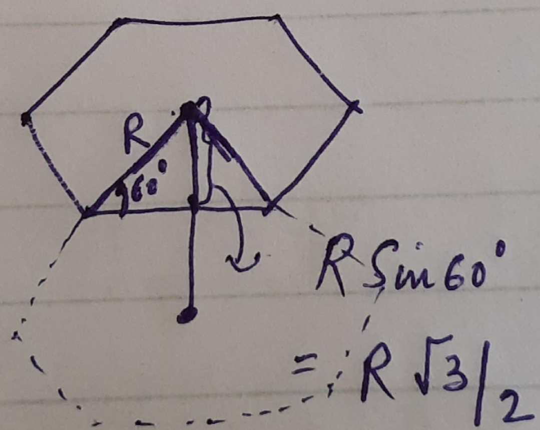
1) Move i cells along any chain
2) Turn 60 degrees <u>counter-clock</u> wise and move j cells

$$\boxed{N = i^2 + ij + j^2}$$

①



A → center of cell A



distance between two adjacents cells (centers) $= 2 \times R\sqrt{3}/2$

$= \sqrt{3}R$

(2)

if i unit then distance $= \sqrt{3}Ri$
in ΔAOC

$$D^2 = (\sqrt{3}Rj\sin\theta)^2 + (\sqrt{3}Ri + \sqrt{3}Rj\cos\theta)^2$$

$$= 3R^2j^2\sin^2\theta + 3R^2i^2 + 3R^2j^2\cos^2\theta + 2\times 3R^2 ij\cos\theta$$

$$= 3R^2(j^2\sin^2\theta + i^2 + j^2\cos^2\theta + 2ij\cos\theta)$$

$$= 3R^2(i^2 + j^2 + 2ij\times\cos 60^\circ)$$

$$D^2 = 3R^2(i^2 + j^2 + ij)$$

$$\boxed{\frac{D}{R} = \sqrt{3N}}$$
$\parallel$
Q

$$N = i^2 + ij + j^2$$

$$D^2 = 3R^2N$$

$$\boxed{D = R\sqrt{3N}} \Rightarrow \boxed{N = \frac{D^2}{3R^2}}$$

Reuse factor