ECE455: **Wireless and Mobile Communications**
Faculty of Engineering
Ain Shams University
4th Year ECE
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ECE455 – WIRELESS AND MOBILE COMMUNICATIONS

PROJECT REPORT

(4C)

Section 2

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Calculation:

For A(traffic)=1 Erlang/20 subscribers , GOS=2% , #C=333 (including 21 controls) & N=7

For one subscriber: Au=1/20 Erlang.

Used C= 333-21=312 channels in one cluster @ GOS=2%

#C/cell=Used C/N=312/7=44.57 --->(44)

From Erlang-B table:

@ GOS=2% & #C=44 channels --->A(cell)=34.68

#Users/cell=A(cell)/Au=34.68*20=693 user.

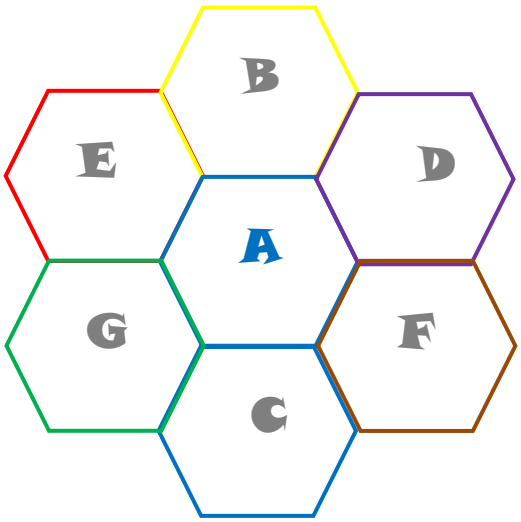
Design flow:

- Design the unit cell based on the most populated adjacent squares.
- Manipulating in (R) of the cell unit till # of users <670 (<693 for safety).
- Start in distributing the cells with this R to cover all Squares in the region.
- Specify a frequency plan for each 7 cells to form a cluster.
- Choose the plan depending on:
  - the position of cluster in the region (in the middle or at the borders)
  - Co-interference and adjacent interference.
  - How to use the smallest number of antennas with high efficiency.
- Check the result system.

Design Description:

The design consists of (11 Clusters):

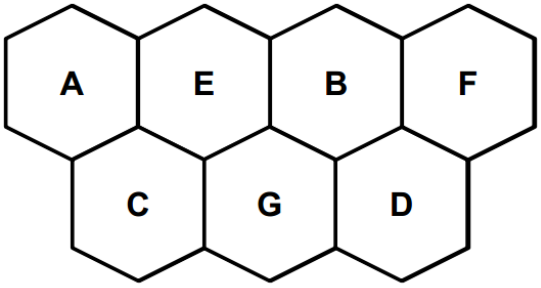
- cellular clusters (8 clusters)



  - Refers to it with: A,B,…
  - Covers the middle of region.

- Trapezoidal frequency plan (2 clusters):

  - for the remaining horizontal squares
  - The cellular doesn't fit it and will consume more BS to cover it effectively
  - Covers the last 2 row of cells at upper border.
  - Almost Distributed depending on the interference of (Co-channel &adjacent).
  - Refers to it with: (At…. Gt),



- Vertically frequency plan (1 cluster) :

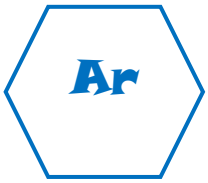
  - Covers the remaining cells at right border.
  - Distribution doesn't depend on the interference of (Co-channel &adjacent).
  - Refers to it with: Av…. Gv.

- Residue cell:

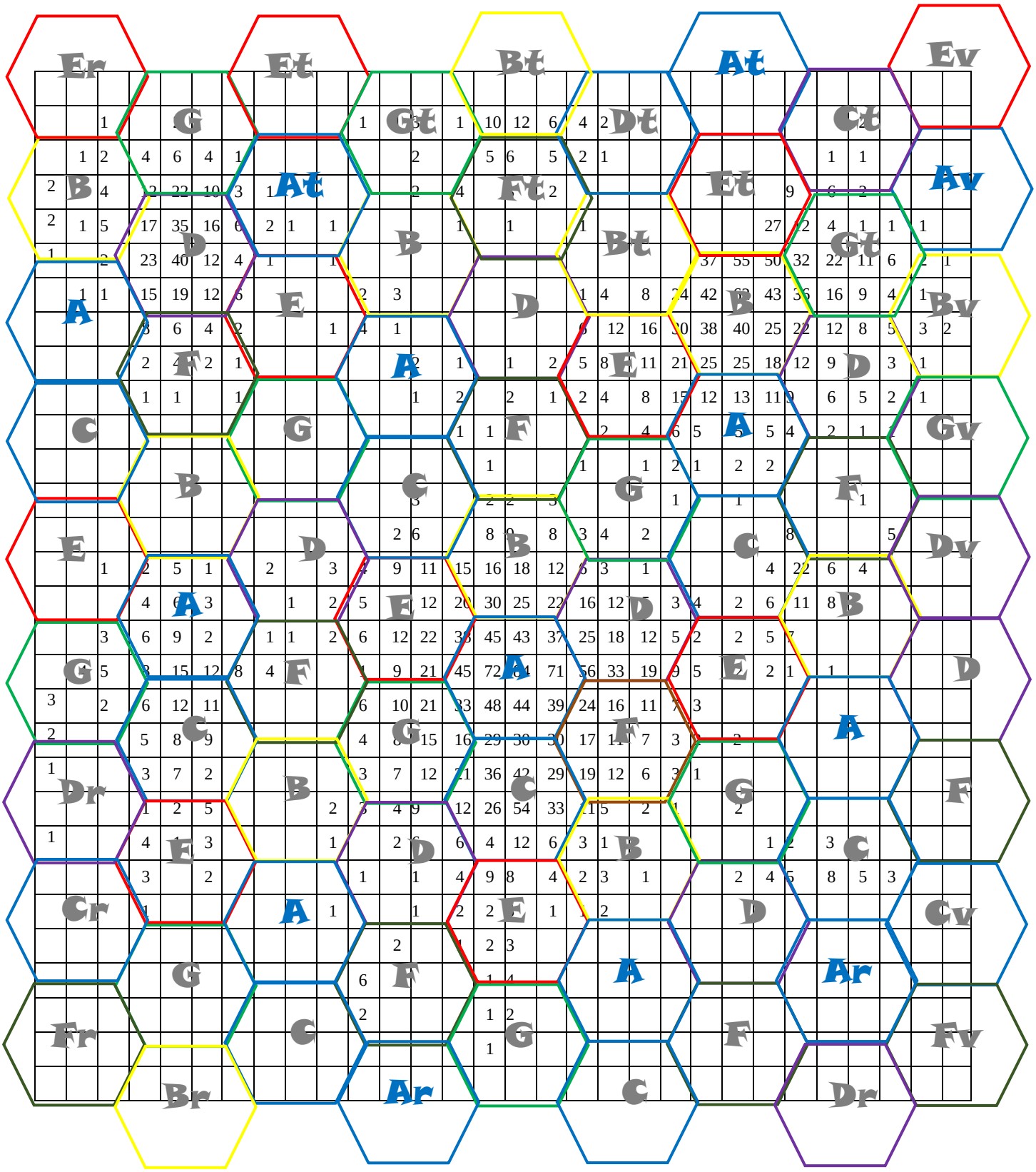
  - Takes the extra cells of the cellular and trapezoidal plans (that covers the out range) and separates it from its plan and distributes it again for uncovered squares at borders.

  - Generally, Its distribution doesn't depend on interference but it takes in consideration the adjacent interference as possible as.

  - Refers to it with : Ar, Br,….. Gr.



The Design:



The required calculation:

- Calculate the trunking efficiency for this system.

  Eff=(1-GOS)*A(cell)/#C(cell)*100=

  98*34.68/44= 77.24%

- Calculate the base station transmitted power, if the mobile sensitivity equals -100 dBm.

  [the square unit area = 0.5Km2] → L=$\sqrt{0.5}\ Km$

  For L_scaled of square=0.58 cm → (the width of cell of the region table in word)

  Scale factor= L/L_scaled= 121914.96

  Width of cell of cluster=2*R=2.61 cm (the width in word scale)

  → ***R=1.305cm***

  Distance btn BS and Ms (R)=1.305* 121914.96=159099.02cm =1591m=1.591km

  For Gsm system: f=900Mhz→ ***lmda=c/f=300/900=1/3***

  Gt =Gr =1 → for isotropic antenna & pr= -100 dbm

  From:

  ➢ The received power in dBm can be written as

  $$P_R(dBm) = P_T(dBm) + G_T(dBi) + G_R(dBi) - 20\log\frac{4\pi d}{\lambda}$$

  PT= -4.44 dBm=0.998 watt