Ain Shams University
Faculty of Engineering
Electronics and Communications Department
Undergraduate, Electrical Engineering
Spring 2024

ECE353: Wireless Communication Networks - Course Project

(A) It is required to design using MATLAB, a simple planning tool for a service provider that owns 340 channels in the 900 MHz band. Your code should ask for the GOS, city area, user density, SIR_{min} and sectorization method. Assume blocked calls are cleared in this system. Then, it should produce the following design parameters:

1) Cluster Size.
2) Number of cells.
3) Cell radius.
4) Traffic intensity per cell, and traffic intensity per sector.
5) Base station transmitted power.
6) A plot for the MS received power in dBm versus the receiver distance from the BS.

In your design, use the Hata model and assume urban-medium city (You can check outdoor propagation models). Let the effective heights of BS and MS equal 20 and 1.5 meters, respectively. Assume MS sensitivity equals $-95\ dBm$, the traffic intensity per user equals 0.025 Erlang and the path loss exponent equals 4.

(B) To validate your planning tool and understand the trade-offs between different design parameters it is required for a city area equal to $100\ km^2$ to deliver the following figures **with reasonable comments**. Each figure should contain three curves for omni-directional, 120° sectorization and 60° sectorization designs.

1) Plot the cluster size versus SIR_{min} with range from $1dB\ to\ 30\ dB$.

2) For $SIR_{min} = 19dB$ & user density= 1400 $users/km^2$,
   (i) Plot the number of cells versus GOS (1% to 30%).
   (ii) Plot the traffic intensity per cell versus GOS (1%to 30%).

3) At $SIR_{min} = 14dB$ & user density= 1400 $users/km^2$,
   (i) Plot the number of cells versus GOS (1% to 30%).
   (ii) Plot the traffic intensity per cell versus GOS (1% to 30%).

4) At $SIR_{min} = 14dB$ & GOS= 2%,
   (i) Plot the number of cells versus user density (100 to 2000 $users/km^2$).
   (ii) Plot the cell radius versus user density (100 to 2000 $users/km^2$).

5) At $SIR_{min} = 19dB$ & GOS= 2%,

      (i) Plot the number of cells versus user density (100 to 2000 $users/km^2$).

      (ii) Plot the cell radius versus user density (100 to 2000 $users/km^2$).

Deliverables:

Please submit a *soft-copy* of the following items:

- All MATLAB codes that produce (**A**) and (**B**). These codes have to be clear enough to be understood by the reader (for example, you have to use indicative variable names and use comments if required)
- A short report explaining the procedure you used along with the mathematical equations. The report should also include all the figures generated by your code and your comments on each figure.

Project rules:

- **4 students** per project.
- Project deadline is on ***Tuesday 14/5/ 2024 at 11:59 PM***.
- Late projects will be refused, and repeated reports will be canceled ***with a penalty***.
- The project will be **submitted on LMS**.

Helpful note:

The MATLAB command `[fzero]` could be helpful to relate between the GOS, traffic intensity and number of channels.