1. In a cellular system it is desirable to allocate channel sets to a hexagonal lattice in such a way that there is a minimum distance between cells using the same channel set and the total number of channel sets is as small as possible. Do a channel set assignment for systems with 3, 7, 12, and 19 channel sets. In each case give the co-channel re-use ratio. In each case of the above show a few clusters.

2. In assigning actual channels to cells we would like to minimize adjacent channel, co-channel, and forward-link/reverse-link interference. Assume that a particular cellular system contains 130 one-way channels and that to minimize interference it is desirable to implement a system with 13-cell clusters. How many voice circuits per cell will the system have? Do a channel allocation for such a system (show a few clusters).

3. To achieve higher spectral efficiency it is desirable to use directional antennae at each cell-site with 120 degree beams. In such a system it is found that a cellular plan with 7-cell clusters is sufficient. Let the number of one-way channels in such a system be 126. How many voice circuits will there be per cell? How many will there be on each antenna? Devise a frequency plan that minimizes co-channel, adjacent channel, forward-link/reverse-link, and beam side-lobe interference.

4. In determining the cluster size for a frequency plan co-channel interference is the main consideration. It is very difficult to obtain analytic expressions for the interference on the reverse-link channel without a probabilistic characterization of vehicle positions. Since the cell-site positions are fixed, one may obtain estimates of the co-channel interference on the forward-link channel. For a system with a cluster size of 7 obtain an approximate value for the signal to interference power ratio assuming that co-channel interference is the only type of interference, and that signals attenuate as $\frac{1}{R^4}$ and that the terrain is perfectly flat.

5. An IS-95 CDMA system is utilized in an environment where the propagation follows an attenuation inverse 3-rth power law. Determine the capacity of the system in terms of the number of voice circuits per cell if a total bandwidth of 10 MHz (base transmit) and another 10 MHz (mobile transmit band) is available and the required SNR for satisfactory speech quality is 10 dB. The system utilizes antennas with 3 sectors per cell.