# Exercises 3: "Cellular Principle"

**Exercise 3.1:** For a cellular mobile system a carrier to co-channel interference ratio C/I larger than 17dB is required.

a) Calculate the smallest possible cluster size and the corresponding reuse factor if a propagation coefficient of $\gamma = 3{,}522$ is assumed and omnidirectional cells are used.

b) How does C/I improve, if three sector cells per base station (directional antennas) are used?

**Exercise 3.2:** An area of 99km² should be covered by a mobile network and three sector cells per base station should be used. The maximum cell radius (given by the environment and the system parameters) is r=800m.

a) How many bases stations assuming a rhomboid cell layout are necessary to serve the area? Calculate the site-to-site distance d of neighboring base stations.

b) Calculate the required number of base stations and the site-to-site distance d, if a shamrock cell layout is used.

**Exercise 3.3:** A mobile network shall be installed in a urban area. For that a square cell layout should be used, i.e. all base stations are arranged in a rectangular grid with a constant distance to each other.

a) Calculate the reuse distance D of two base stations operating with the same frequencies, dependent on the cluster size N and the edge length a of the square cells?

b) The mobile operator installs cells with a edge length of 500m in the urban area. A maximum of 64 frequencies are available. The capacity of a frequency channel is sufficient to allow 8 voice calls in parallel (FDMA/TDMA principle). The network should be designed so that 128 simultaneous calls per square kilometer are possible. Calculate the reuse distance D of two base stations operating with the same set of frequency channels.