**Question 1.**

A base station transmits at a power level such that a receiver at a distance of 1 metre from the transmitter receives a 1 mW signal. In order to mitigate cochannel interference effects, it is required that the signal received at any base station receiver from another base station transmitter which operates with the same channel must be below -100 dBm. Assume that the propagation environment can be adequately modelled by a distance-based path loss, with path loss exponent $\gamma = 3.52$.

Determine the major radius of each cell if a 7-cell reuse pattern is used. What is the major radius if a 4-cell reuse pattern is used?

*Note on dBm:* 

dBm expresses the power level of a signal, with respect to a reference level of 1 milliWatt. A signal of power level $P$ mW, expressed in dBm, is $10 \log_{10} \left( \frac{P \text{ (mW)}}{1 \text{ (mW)}} \right)$, so, e.g. 10 mW is 10 dBm, 1 mW is 0 dBm, 100 $\mu$W is $-10$ dBm, 10 $\mu$W is $-20$ dBm, 1 $\mu$W is $-30$ dBm.

**Question 2.**

For a worst case mobile station carrier-to-interference ratio $C/I$ of 17dB, and a path loss parameter of 3.52, find the permissible cluster size for both omnidirectional and 120° sectored cells.

*Useful equations from lecture slides:*

Cluster size: 

$$K = \frac{1}{3} \left( \frac{D}{r} \right)^2 = q^2 / 3$$

Omnidirectional cells: 

$$C = \frac{1}{2(q-1)^{-\gamma} + 2q^{-\gamma} + 2(q+1)^{-\gamma}}$$

For 120 degree sectorised cells: 

$$C = \frac{1}{(q+0.7)^{-\gamma} + q^{-\gamma}}$$

**Question 3.** (Rappaport, worked example 3.2)

If a signal-to-interference ratio of 15dB is required for satisfactory forward channel performance of a cellular system, what is the frequency reuse factor and cluster size that should be used for maximum capacity if the path loss exponent is (a) $\gamma = 4$, (b) $\gamma = 3$? Assume that there are six co-channel cells in the first tier, and all of them are at the same distance from the mobile.