Homework 4
Due: 4/6/2026

1) A cellular operator must cover a city of area 900 km² using hexagonal cells of radius 1.8 km. The system has 420 total voice channels and uses a reuse factor of 7. Assume a blocking probability of 2%.
   a) Estimate the number of cells required to cover the city.
   b) If each user offers 0.04 Erlangs of traffic, estimate the number of users supported per cell.
   c) Estimate the total number of users supported in the city.

2) A system has 336 total channels and hexagonal cells of radius 2 km. Compare two designs: reuse factor 7 and reuse factor 4. Assume each cell can support traffic at 1% blocking rate.
   a) Determine the number of channels per cell.
   b) Determine the supported Erlang load per cell.
   c) Compute the user capacity per cell if each user offers 0.03 Erlangs.
   d) Compute the user density in users/km² for both cases.
   e) State which reuse plan gives higher density and why.

3) A hexagonal cellular system has 6 first-tier co-channel interferers and path-loss exponent $n = 4$. Compare reuse factors $N = 3, 4, 7$.
   a) Compute D/R for each reuse factor using $D/R = \sqrt{3N}$.
   b) Compute the linear SIR for each reuse factor using $S/I = (D/R)^n/6$.
   c) Convert each SIR into dB.
   d) If the minimum acceptable SIR is 18 dB, which reuse factors are acceptable?
   e) Which reuse factor would you recommend if the goal is to maximize capacity while meeting the SIR constraint?

4) A mmWave system operates at 28 GHz. Path loss is:
$$PL = 32.4 + 20\log_{10}(f) + 20\log_{10}(d)$$
   a) Compute path loss at 100 m
   b) Compute path loss at 300 m
   c) How much additional loss occurs?
   d) Why does this make mmWave suitable for small cells?