Homework # 8: CDMA + Mobility Management

Rules: 1. Due by Friday, May 3, 2013
2. Solve all the problems below for 100 points - **independent work only.**
3. Show full solution to the problems - do not skip steps.

Problem number 1:
Derive a formula for the cost of mobility management using Dynamic Location Area for the one-dimensional case, similarly to the two-dimensional case treated in class. Assume that in the one-dimensional case the average number of terminals, *E[m],* leaving a square from each of its sides per unit time is: $E[m] = \rho l E[v] / \pi$, where ρ is terminal density per unit area, l is the square cell side length, and $E[v]$ is the average mobiles' velocity. Use the following labeling: λ_i is the call arrival rate, u_k is the update rate of location area of length *k* squares, C_p is the cost of a single page per cell, and C_u is the cost of location update. What is the optimal value of *k* ?

Problem number 2:
Calculate the maximum number of users in the following CDMA system:

- Required E_b/I_o of 12 [dB]
- Voice activity factor of 40%
- System bandwidth of 1.25 [MHz]
- Voice bit-rate statistics:
  - 10% of the time at 16 [Kbps]
  - 50% of the time at 8 [Kbps]
  - 40% of the time at 4 [Kbps]

Problem number 3:
Repeat problem number 2, when the power control is accurate within 2 [dB] (assume worst-case scenario).

Problem number 4:
In an omni-directional (single-cell, single-sector) CDMA cellular system, to achieve the required BER, minimum E_b/I_o of 20 dB is needed. The system should accommodate 100 users, transmitting at data rate of 13 [kbps]. Ignoring voice activity considerations, calculate the chip rate of the spreading sequence. Assume perfect power control and bit efficiency (μ) of 1.75 [bps/Hz].

Problem number 5:
Repeat problem 3 with voice activity factor of 40% and the following conditions:

1. single cell with omni-directional antenna
2. single cell with tri-sector antenna
3. multiple cells with tri-sector antenna.

Assume that frequency reuse efficiency is 0.455 and perfect power control.