Cellular Networks
Written Assignment I
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1. Consider a cellular network using power budget for handovers. Use path loss model from question 1. All parameters of both BTSs are identical. A UE is moving along the connecting lines of BTSs.
   a. If HO_MARGIN(cell1 -> cell2)=10db and distance between BTSs is 30Km, what is the minimum distance of the UE connected to BTS1 from BTS2 when it is handed over to BTS2.
   b. A UE is moving back and forth from the center of the connecting line of the BTSs with swing range of 10 km. What is minimum values of HO_MARGIN(cell1 -> cell2) and HO_MARGIN(cell2 -> cell1) such that no HO is performed.
   c. On the connecting line of BTSs and at distance 16 from BTS1 and 14 from BTS2, the received power from BTS1 deviates from its path loss value ∓ 6 db while the received power of BTS2 at this point deviates from its path loss ∓ 4 db. What is the minimum value of PBGT_hysteresis in order to prevent Ping-Pong effect (PBGT_hysteresis = HO_MARGIN(cell1 -> cell2) + HO_MARGIN(cell2 -> cell1)).

2. Consider two BTSs in distance 20 km of each other. Consider a path loss model with component $\alpha = 2$ between UE and BTS. path loss=$\alpha 10 \log_{10} d + C$, where d is the distance of the user (meter) and C is a constant. In this problem, consider C=10db. Assume that the HO is performed due to levels as

   RXLEV_DL < L_RXLEV_DL_H

   RXLEV_NCELL(BTS2) > RXLEV_MIN(BTS1)

   a. If the transmit power of both BTSs is 70db and L_RXLEV_DL_H(BTS1)= -25db and RXLEV_MIN(BTS2)= -20db, find the minimum distance a UE can have from BTS2 when it hands over from BTS1 to BTS2?
   b. Repeat part a for the case that RXLEV_MIN(BTS2)= -5db.
   c. Find suitable ranges for L_RXLEV_DL_H(BTS1) and RXLEV_MIN(BTS2) based on the transmit power P(BTS1) and P(BTS2) such that for a user moving along the line connecting BTS1 and BTS2, the HO is carried out at distance 16km of BTS1. Assume BTS1 and BTS2 have similar transmit powers of 70.
   d. What is the level hysteresis of BTS1 such that the swing area is 5km on the connecting line and the Ping-Pong effect does not occur? (assume $6 < d_1 < 15$).
   e. Assume that we have no control over RXLEV_MIN(BTS1) and RXLEV_MIN(BTS2) but we want to have swing area without Ping-Pong effect as in Part d. Can we provide similar conditions using L_RXLEV_DL_H(BTS1) and L_RXLEV_DL_H(BTS2)?

3. Consider two BTSs in distance 30 km of each other. Consider a path loss model with component $\alpha = 2$ between UE and BTS (path loss=$\alpha 10 \log_{10} d + C$, where d is the distance (meter) and C=10db). Assume that the HO is performed due to level. A UE is moving back and forth in 10 km range at the center of the connecting line. The received power from BTS1 deviates from its path loss value ∓ 5 db due to fading.
    a. What is the minimum level hysteresis of BTS1 such that no HO occurs for this user?
    b. What is the minimum value of "level hysteresis(BTS1) + level hysteresis(BTS2)" to prevent Ping Pong effect?