Homework I (due: 03/01/2010)
CIS 9590 Ad Hoc Networks

Name ——————————————- Student Number ——————————————-

1. (Wireless Communication: Nyquest's Theorem and Shannon's Theorem)
   - Given channel bandwidth $B = 10$ GHz and noise level $SNR = 40$. Determine the maximum data rate C using Shannon's theorem.
   - In order to theoretically reach the above rate, use Nyquist's theorem to determine the minimum number of discrete signal levels/voltage values used.
2. (Cellular Architecture: Location Management)
   - Discuss the difference and similarity between *location area* and *reporting center* approaches in cellular architecture.
   - In an $n \times n$ grid structured cellular network, can you come up an assignment of n reporting centers such that the average size of the vicinity of a reporting center (i.e., the size of reachable non-reporting cells from the center) is $o(n^2)$ (i.e. less than n^2)? Briefly justify your conclusions.
   - Same as above. Assume the number of reporting centers is $4n-4$. Provide an assignment such that the maximum size of vicinity is minimized. Determine the minimized value assuming $n = 3k + 2$.
3. (Channel Assignment: Clustering)
   - Assume each cell is an $R \times R$ square, discuss different ways of clustering.
   - Find out different N (cluster size) that can be used for clustering and show all possible clustering structures for $N = 1, 2, ..., 9$. (Note that cells are not necessarily aligned along rows and columns)
   - Determine the relationship(s) among R, N, and D (minimum distance between two cochannel cells).
4. (Channel Assignment: Graph Coloring)
   - Given a 7-cell graph with edge set $\{(A, B), (B, C), (B, F), (C, D), (D, E), (D, F), (F, G)\}$. If the channel reuse distance is $r = 2$, determine the minimum number of colors needed to color the given graph. Show the color assignment and briefly describe why the coloring scheme uses the minimum number of colors.
   - If the channel reuse distance is $r = 3$, transfer the given graph to another graph with $r = 2$, and then, repeat the above step. Show all work.
   - Repeat the above step for $r = 4$.