Homework I (due: 02/04/2015)
**CIS 5636   Ad Hoc Networks**

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

1. (Wireless Communication: Nyquest's Theorem and Shannon's Theorem)

   - Given channel bandwidth $B = 10GHz$ 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. (Channel Reuse: Cluster and Cochannel Reuse Ratio)

   - Show that cluster size N have to satisfy $I^2 + IJ + J^2$ for integers $I$ and $J$.
   - Verify cochannel reuse ratio for $N = 9$ and $N = 12$. You are required to show the topology of the cluster and the layout structure of clusters.

3. (Channel Renew in a Geographical Area: Hexagon Cells)

   - Assume a system of 32 hexagon cells with a cell radius of $1.6km$, a total of 32 cells, a total frequency bandwidth that supports 336 traffic channels, and a reuse factor of $N = 7$. If there are 32 total cells, what geographic area is covered, how many channels are there per cell, and what is the total number of concurrent cells that can be handled? Repeat for a cell radius of $0.8km$ and 128 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 $r = 4$.