## Homework 1

Due on Oct 29. Hand it in to me or TA.

1. Recall the definition of the “Greater Than” function: $GT\_{n}(x,y) = 1$ if $x\geq y$ and $GT\_{n}(x,y) = 0$ otherwise, where we view x and y as binary representation of two integers in [0, 2n-1]. Show that
 $D(GT\_{n})\geq n$, and $R(GT\_{n})=Θ(log n)$.
(Recall that D is the deterministic communication complexity, and R is the private-coin randomized communication complexity.)
2. Use discrepancy bound to prove that for all but an exponentially small fraction of Boolean functions $f:\left\{0,1\right\}^{n}\rightarrow \{0,1\}$, $R\left(f\right)=Ω(n)$.
3. Consider three players in the Number-on-the-Forehead model and the input contains three strings $x,y,z\in \left\{0,1\right\}^{n}$. So Player 1 sees (y,z), Player 2 sees (x,z), and Player 3 sees (x,y). The function is defined by $f\left(x,y,z\right)=⊕\_{i=1}^{n}Maj(x\_{i},y\_{i},z\_{i})$. What’s the most efficient communication protocol you can think of?