EECS 395-23 – Assignment 6

1. Define MAM and AMA. Show that both of these classes are contained in AM.

2. Show that every language in AM has a protocol where for x in L, the prover will be able to convince the verifier with probability one (instead of at least 2/3). Hint: Use the proof that BPP is in Σ_2^p.

3. Show that IP $\subseteq$ PSPACE. 1 point if you show the inclusion for public coins, 2 points for private coins (no fair citing Goldwasser-Sipser).

4. Show that every language with a PCP (exponential size with polynomial queries and random bits) is in NEXP.

5. Let $f(x,y)$ be a #P function, that is there is some NP Turing machine M such that $f(x,y)$ is the number of accepting paths of $M(x,y)$. Let $q(x)$ be a polynomial-time computable function such that $0 \leq q(x) \leq |x|^c$ for some c. Show that the following are also #P functions.

   (a) $g_1(x) = \sum_{y \in \Sigma^{q(x)}} f(x,y)$.

   (b) $g_2(x) = \prod_{0 \leq y \leq q(x)} f(x,y)$.

   (c) $g_3(x) = \binom{f(x,0)}{q(x)}$ (as in binomial coefficient)