

Assignment #6

*Due: Thursday, December 11**Sanjeev Arora**(Contains 5 questions)*

1. Show that $\text{SPACE}(n) \neq \text{NP}$.

(Hint: Use padding, which we defined in the last problem set. Also keep in mind that it is not known if $\text{SPACE}(n) \subseteq \text{NP}$ or $\text{NP} \subseteq \text{SPACE}(n)$, so your argument should somehow just prove that they are unequal).

2. Show that $\Sigma_2\text{SAT}$ is complete for Σ_2^p .

3. Show that if 3-SAT is poly-time reducible to its complement then $\mathbf{PH} = \text{NP}$.

4. Show that for every $k > 0$, $\mathbf{PH}$ contains languages whose circuit complexity is $\Omega(n^k)$.

(Hint: Recall the proof of existence of functions with high circuit complexity – the counting argument).

5. Show that $\Sigma_2^p = \text{NP}^{\text{SAT}}$.