

ECE 537 - Foundations of Computing

Prof. Sen

**Homework #5**

**Optional practice homework**

1. Show that if you can solve the decision problem SAT in polynomial time, then you can find a satisfying assignment (if one exists) in polynomial time.
2. Consider a variant of 3-SAT called Majority-of-3-SAT in which each clause contains three literals where at least two of them must be true for it to be satisfied. Either show that this problem is in P by reducing it to 2-SAT or show that it is NP-Complete by reducing from 3-SAT to it.
3. Recall that the star operation on a language gives the concatenation of the language with itself zero or more times. Show that NP and P are closed under this operation, ie. that if  $L \in \text{NP}$ , then  $L^* \in \text{NP}$ , and the same for P. Hint: To show this for P, you need to deal with the fact that there are an exponential number of ways to write a word as a concatenation of words in  $L$ .
4. Point out the fallacy in the following “proof” that  $\text{P} \neq \text{NP}$ : “To see if a 3-SAT formula is satisfiable, you need to look at all  $2^n$  possible truth assignments. This takes exponential time, so 3-SAT is not in P. But it is in NP, so  $\text{P} \neq \text{NP}$ .”