CS 6505 - Homework 12

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Let c be the branching factor of our nondeterministic turing machine which verifies whether $x \in L$. Namely, the branching factor is the maximum number of transition options ever available at some configuration of the turing machine. Now, to deterministically decide whether $x \in L$ in O($2^{p|x|}$) time we do the following:

- Explore the tree of configurations breadth first starting from the start configuration.

- Say that $p(x)$ is the number of steps it takes us to reach an accept or reject state non-deterministically on input x (when we verified which we could since this problem is in NP).

- Once we have explored breadth first say $p(x) + 5$ levels from the starting configuration with input x, we can say the following. We know that either $x \in L$ or $x \notin L$. We know that the TM accepts on x if and only if $x \in L$. Thus, we know that once we reach the $p(x)th$ level then the TM will accept if and only if $x \in L$. Likewise it will reject if and only if $x \in L$. Thus, if it accepts, we know $x \in L$. Otherwise, we know that $x \notin L$.

Note: there is definitely a finer point here. Namely, my argument is using the fact that