Remember that the class $P = \bigcup_k \text{DTIME}(n^k)$, $NP = \bigcup_k \text{NTIME}(n^k)$ and 
$L = \text{DSPACE} \left( \log n \right)$. 

1. For your favorite programming language, write a program that outputs its own code.

2. Let $A$ be the language of properly nested parentheses. For example 
   $(()$ and $()(())()$ are in $A$ but $)$ is not. Show that $A$ is in $L$.

3. Show that $NP$ is closed under union, intersection and the $*$-operation. 
   Show the same for $P$.

4. Show that $NP$ consists of exactly the set of languages $L$ such that there is an $A$ in $P$ and a constant $k$ such that 
   
   \[ x \in L \iff \exists y, |y| = |x|^k \text{ and } (x, y) \in A. \]

   Does the same result hold for some $A$ in $L$?