Homework, the 2nd series

Deadline: Monday 6 May, 2013, 23:59

Prove that the following problem is complete in the class P with respect to reductions computable in logarithmic space.

Given: a context-free grammar G.
Decide: if $L(G) \neq \emptyset$.

For concreteness, assume that context free grammars over arbitrary alphabets are encoded as binary words. Please specify the encoding used in your solution (you may follow the principle of encoding of Turing machines known from the course).

Reminder. A language $M \subseteq \Sigma^*$ is complete in a class $\mathcal{C}$ with respect to reductions in a class $\mathcal{D}$ if $M \in \mathcal{C}$ and, for any $\Gamma^* \supseteq L \in \mathcal{C}$, there is a function $f : \Gamma^* \to \Sigma^*$ in class $\mathcal{D}$, which reduces L to M, i.e.,

$$(\forall x \in \Gamma^*)\ x \in L \iff f(x) \in M.$$

Hence, in this exercise, you need to show that the language consisting of the encoding of those grammars G, which satisfy $L(G) \neq \emptyset$ has the required completeness property.