

Homework 8 - Problems 8-10

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CS517

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- a) It is possible to construct a linear bounded automaton that accepts this language, so it is definitely a CSL. This is because squaring a number can be done in space linear in the length of the number.
- b) This language is not context-free (and therefore not regular also), by the pumping lemma for context free languages. Whether the two pumped substrings are all a 's, or they are all b 's, or one of them has some a 's and some b 's, the pumped string cannot maintain the property that the number of b 's is the square of the number of a 's. This is because the number of b 's required for a string to be in the language is not linear in the number of a 's in such a string.

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- a) It is not known whether $NLIN - SPACE = LIN - SPACE$, but if it is not then $NLIN - SPACE$ is in $PSPACE$, by Savitch's Theorem.
- b) Compilers must perform the task of deciding whether strings belong to a given language defined by a given grammar. Since the worst problems in $LIN - SPACE$ are not known to be solvable in polynomial time, defining languages as CSLs would make compilers impractically slow.

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- a)