Homework 6
due October 27th in class

1. Show that if a TM decides a language using $S(n)$ space (where $S(n) \geq \log n$), then it decides the language in $2^{O(S(n))}$ time.

2. Let $\Sigma = \{0, 1, \#\}$. Consider the language $L \subseteq \Sigma^*$ consisting of the words

$$\begin{array}{l} 0\#1\# \\ 00\#01\#10\#11\# \\ 000\#001\#010\#011\#100\#101\#110\#111\# \\ \vdots \end{array}$$

   (If the pattern is not clear, please don't hesitate to ask.) Show that (i) this language can be decided using $O(\log \log n)$ space; (ii) the language is not regular.

   Fun fact (which you do not need to prove): If a language can be decided using $o(\log \log n)$ space,[1] then it must be regular.

[1] Little-o notation: `https://en.wikipedia.org/wiki/Big_O_notation#Little-o_notation`