1. [10 marks] Is the following grammar LR(0)? Justify your answer.

\[
S \rightarrow E# \\
E \rightarrow E + T \mid T \\
T \rightarrow a \mid (E)
\]

2. [10 marks] Use the incompressibility method to prove that the language

\[L = \{x#y : x, y \in \{0, 1\}^* \text{ and } x \text{ is a subsequence of } y\}\]

is not regular. Here # is a new symbol.
(Recall: x is a subsequence of y if we can delete 0 or more letters from y to get x.)

3. [10 marks] Show that if a binary string x of length 2n contains exactly n 0’s, then it is not Kolmogorov-random, for all n sufficiently large.
(Recall: x is Kolmogorov random if \(C(x) \geq |x|\).)