Problem 1:
Use the method given in class to design a linear-time algorithm to determine all occurrences of the string 01011010101 in strings over the alphabet \{0, 1\}.

Problem 2:
Let \(B\) be the set of all infinite binary sequences. Show that \(B\) is uncountable using a proof by diagonalization. (Note that infinite binary sequences are not strings since any string has finite length.)

Problem 3:
Let \(T = \{(i, j, k) \mid i, j, k \in \mathbb{N}\}\). Show that \(T\) is countable.

Problem 4:
Show that the following problem is undecidable using the fact that the halting problem is undecidable: Given the code \(\langle P \rangle\) of a Java program \(P\) and an input \(x\) to \(P\), determine whether or not \(P\) ever prints out a 1 on input \(x\).