Problem 1:
Prove that the set of all binary strings with more 0’s than 1’s is not recognized by any DFA.

Problem 2:
Use the method given in class to design a linear-time algorithm to determine all occurrences of the string 010101010101 in strings over the alphabet \{0, 1\}.

Problem 3:
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 4:
Let \( T = \{(i, j, k) \mid i, j, k \in \mathbb{N}\} \). Show that \( T \) is countable.

Problem 5:
[This problem will not be graded.] 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 \( x \).