1. Regular Expressions
   (a) Write a regular expression that matches base 10 numbers (e.g., there should be no leading zeroes).
   (b) Write a regular expression that matches all base-3 numbers that are divisible by 3.
   (c) Write a regular expression that matches all binary strings that contain the substring "111", but not the substring "000".

2. CFGs
   Construct CFGs for the following languages:
   (a) All binary strings that end in 00.
   (b) All binary strings that contain at least three 1’s.
   (c) All binary strings with an equal number of 1’s and 0’s.

3. Relations
   (a) Draw the transitive-reflexive closure of \( \{(1, 2), (2, 3), (3, 4)\} \).
   (b) Suppose that \( R \) is reflexive. Prove that \( R \subseteq R^2 \).
   (c) Consider the relation \( R = \{(x, y) : x = y + 1\} \) on \( \mathbb{N} \). Is \( R \) reflexive? Transitive? Symmetric? Anti-symmetric?
   (d) Consider the relation \( S = \{(x, y) : x^2 = y^2\} \) on \( \mathbb{R} \). Prove that \( S \) is reflexive, transitive, and symmetric.