

CSE 311: Foundations of Computing I

Section : Regular Expressions, CFGs, Relations

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.