

b) All binary strings that contain at most one 1.

c) All binary strings that contain at least three 1's.

d) All strings over $\{0,1,2\}$ with the same number of 1s and 0s and exactly one 2.

Hint: Try modifying the grammar from lecture for binary strings with the same number of 1s and 0s. (You may need to introduce new variables in the process.)

Task 3 – FSM Design

Let $\Sigma = \{0, 1, 2, 3\}$. Construct FSMs to recognize each of the following languages.

For all states in your FSM, include “documentation” for them by describing, in English, the set of strings that *end* in that state.

a) All binary strings that end with two 1's.

b) All strings whose digits sum to an even number.

Let $\Sigma = \{0, 1\}$. Construct FSMs to recognize each of the following languages.

For all states in your FSM, include “documentation” for them by describing, in English, the set of strings that *end* in that state.

c) All strings that do not contain the substring 101.

d) All strings containing at least two 0's and at most one 1.

Task 4 – Good, Good, Good, Good Relations

For each of the relations below, determine whether or not it has each of the properties of reflexivity, symmetry, antisymmetry, and/or transitivity. If a relation has a property, simply say so without any further explanation. If a relation does not have a property, state a counterexample, but do not explain your counterexample further.

a) Let $R = \{(x, y) : x = y + 1\}$ on \mathbb{N} .

b) Let $R = \{(x, y) : x^2 = y^2\}$ on \mathbb{R} .

c) Let $R = \{(x, y) : \text{len}(xy) \text{ is even}\}$ on $\{0, 1\}^*$.