Theory of Computation — Week one

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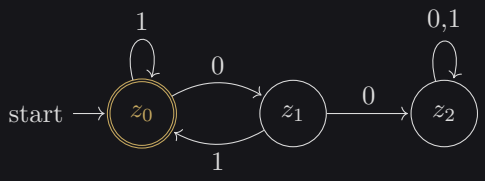
1. Find a deterministic finite automaton accepting all strings in $\{0,1\}^*$ such that every 0 has a 1 immediately to its right.

   Such automaton would look like this:



2. Since language is regularg if and only if it can be represented by a DFA, the complement can also be represented by just switching the accepting states for non-accepting and vice versa.

3. For a language consisting of a single string, building a regular expression is straight forward, just concatenate the symbols in the neccessary order. Unifying finite amount of regular expressions is similarly straight forward. So if a language has finite strings, building a regular expression is always possible, therefore every finite language is regular.

4. Assuming $A = \{1\}$ the DFA is:

5. For $M = (Z, A, \delta, z_s, Z_A)$ assuming that $A_1 = A_2$ for both languages

$$
\begin{aligned}
Z &= Z_1 \times Z_2 \\
A &= A_1 = A_2 \\
\delta((z_1, z_2), x) &= (\delta_1(z_1, x), \delta_2(z_2, x)) \\
z_s &= (z_{1_s}, z_{2_s}) \\
Z_A &= (Z_{1_A} \times Z_2) \cup (Z_1 \times Z_{2_A})
\end{aligned}
$$