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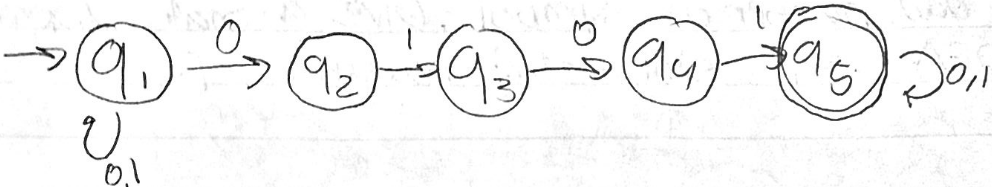
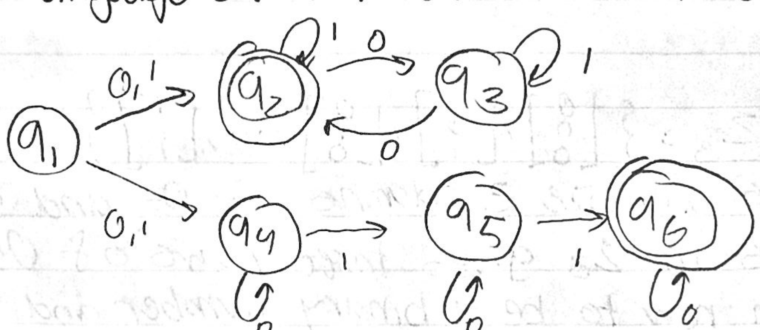
L 1

# Homework 3

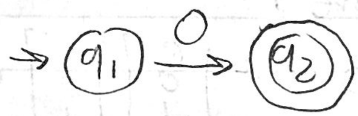
1.7 b) 5 states {w | w contains the substring 0101}



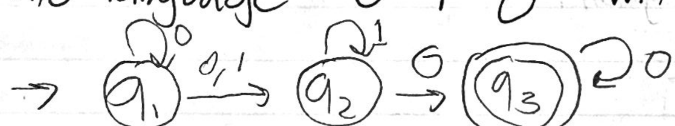

c) The language of exercise 1.6 l with six states



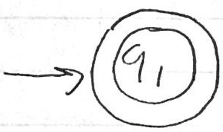

d) The language {0} with two states




e) The language $0^* 1^* 0^+$ with three states

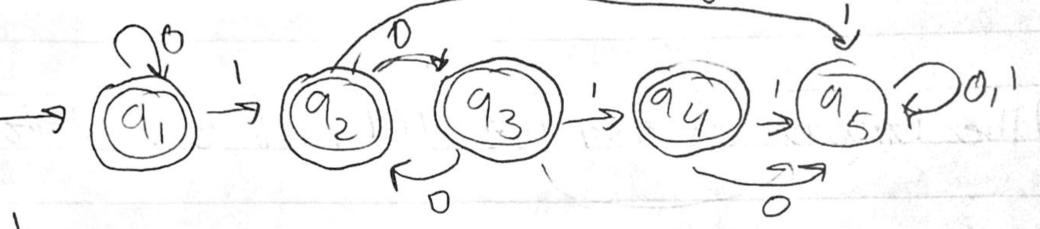



g) The language {ε} with one state




h) The languge $0^*$ with one state

1.13 Let F be the language of all strings over $\{0,1\}$ that do not contain a pair of 1s that are seperated by an odd number of symbols. Give a state diagram of a DFA with 5 states that recognize F.




1.32 Let

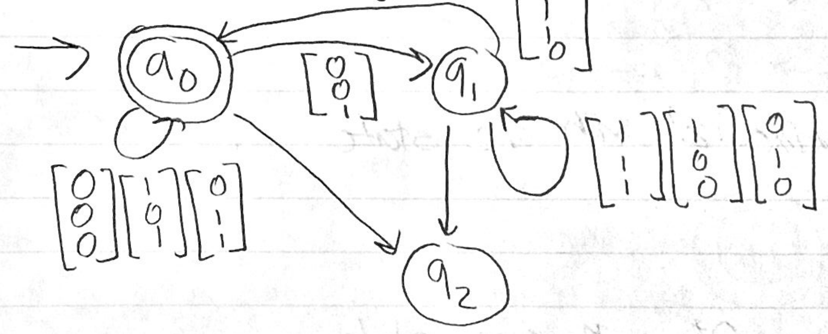
$$\Sigma_3 = \left\{ \begin{bmatrix}0\\0\\0\end{bmatrix}, \begin{bmatrix}0\\0\\1\end{bmatrix}, \begin{bmatrix}0\\1\\0\end{bmatrix}, \ldots, \begin{bmatrix}1\\1\\1\end{bmatrix} \right\}$$

$\Sigma_3$ contains all size 3 columns of 0s and 1s. A string of symbols in $\Sigma_3$ gives three rows of 0s and 1s. Consider each row to be a binary number and let

$B = \{ w \in \Sigma_3^* \mid$ the bottom row of $w$ is the sum of the top two rows $\}$

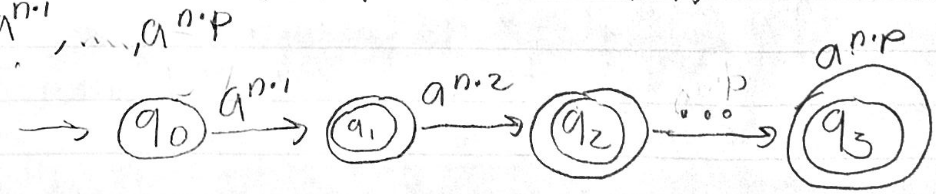
For example $\begin{bmatrix}0\\0\\1\end{bmatrix}\begin{bmatrix}1\\0\\0\end{bmatrix}\begin{bmatrix}1\\1\\0\end{bmatrix} \in B$ but $\begin{bmatrix}0\\0\\1\end{bmatrix}\begin{bmatrix}1\\0\\1\end{bmatrix} \notin B$

Show that B is regular.



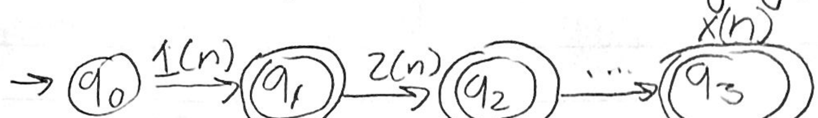

1.36 Let $B_n = \{a^k \mid k$ is a multiple of $n\}$. Show that for each $n \geq 1$ the language $B_n$ is regular.

Since k is a multiple of $n$ $\forall n \geq 1$, $a^k$ can be written as $a^{n \cdot 1}, \ldots, a^{n \cdot p}$



1.37 Let $C_n = \{x \mid x$ is a binary number that is a multiple of $n\}$

Show that for each $n \geq 1$, the languge $C_n$ is reguler




1.41 For Languages A and B let the perfect shuffle of A and B be the language

$\{w \mid w = a_1 b_1 \ldots a_k b_k$, where $a_1 \ldots a_k \in A$ and $b_1 \ldots b_k \in B$, each $a_i, b_i \in \Sigma\}$.

Show that the class or regular languages is closed under perfect shuffle.