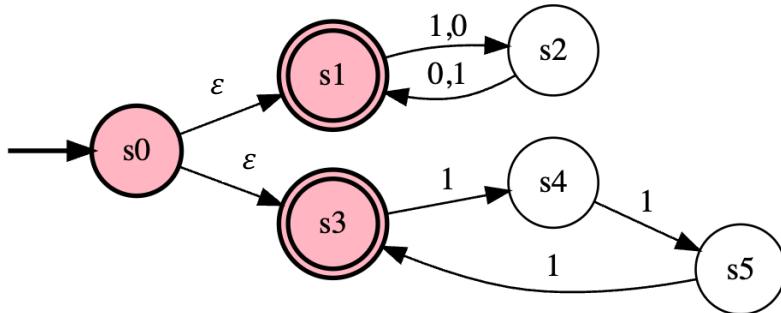


# Chapter 1.4 Practice Key

For each of the following languages over the alphabet  $\Sigma = \{0, 1\}$ , give a regular expression that describes that language.

1.  $\{w \mid w \text{ ends with } 001001\} \quad \Sigma^* 001001$
2.  $\{w \mid w \text{ contains substring } 001\} \quad \Sigma^* 001 \Sigma^*$
3.  $\{w \mid w \text{ is all strings except } 001\} \quad \varepsilon \cup 1\Sigma^* \cup 01\Sigma^* \cup 000\Sigma^* \cup 001\Sigma^+ \cup 0 \cup 00$
4.  $\{w \mid w \text{ is all strings containing two } 0\text{s followed by a } 1 \text{ (It does not have to be consecutive, just in that order.)}\} \quad \Sigma^* 0 \Sigma^* 0 \Sigma^* 1 \Sigma^*$
5.  $\{w \mid w \text{ has only two } 0\text{s and has at least one } 1\} \quad 1^* 01^* 01^+ \cup 1^* 01^+ 01^* \cup 1^+ 01^* 01^*$
6.  $\{w \mid w \text{ where every } 0 \text{ is followed by at least two } 1\text{s}\} \quad 1^* (011^*)^*$
7.  $\{w \mid w \text{ has an even length OR have length divisible by } 3 \text{ and consist of only } 1\text{s}\}$   
$$(\Sigma\Sigma)^* \cup (111)^*$$

Draw the state diagram for an NFA accepting the language in #7.



The shading is irrelevant.