

Describe a deterministic finite-state automata (DFA) that accept each of the following languages over the alphabet $\Sigma = \{0, 1\}$. Describe briefly what each state in your DFAs *means*.

- 1** All strings containing the substring **000**.
- 2** All strings *not* containing the substring **000**.
- 3** All strings in which every run of **0**s has length at least 3.
- 4** All strings in which no substring **000** appears before a **1**.
(Equivalently: All strings in which every substring **000** appears after every **1**.)
- 5** All strings containing at least three **0**s.
- 6** Every string except **000**. (**Hint**: Don't try to be clever.)

Work on these later:

- 7** All strings w such that *in every prefix of w* , the number of **0**s and **1**s differ by at most 1.
- 8** All strings containing at least two **0**s and at least one **1**.
- 9** All strings w such that *in every prefix of w* , the number of **0**s and **1**s differ by at most 2.
- 10** (Hard.) All strings in which the substring **000** appears an even number of times.
(For example, **0001000** and **0000** are in this language, but **00000** is not.)