

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 0s 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 0s.
- 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 0s and 1s differ by at most 1.
- 8** All strings containing at least two 0s and at least one 1.
- 9** All strings w such that *in every prefix of w* , the number of 0s and 1s 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.)