

Describe deterministic finite-state automata that accept each of the following languages over the alphabet $\Sigma = \{0, 1\}$. Describe briefly what each state in your DFAs *means*. Yes, these are exactly the same languages that you saw last Friday.

Either drawings or formal descriptions are acceptable, as long as the states Q , the start state s , the accept states A , and the transition function δ are all be clear. Try not to use too many states, but *don't* try to use as few states as possible.

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 all the 1 s appear before any substring 000 .
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. 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.)