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*.

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  $\delta$  are all clear. Try to keep the number of states small.

- 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 **1** does not appear after a substring **000**.
- 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. 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.)