Describe deterministic finite-state automata that accept each of the following languages over the alphabet $\Sigma = \{0, 1\}$. Give the states of your DFAs mnemonic names, and describe briefly *in English* the meaning or purpose of each state.

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 not to use too many states, but *don't* try to use as few states as possible. Clarity is more important than brevity.

Yes, these are exactly the same languages that you saw last Friday.

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0. All strings.
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 the last `1` (if any) appears before the first substring `000` (if any).
5. All strings containing at least three `0`s.
6. Every string except `000`. *[Hint: Don't try to be clever.]*

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**More difficult problems to think about 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 every run has odd length. (For example, `0001` and `100000111` and the empty string $\varepsilon$ are in this language, but `000000` and `001000` are not.)

*11. All strings in which the substring `000` appears an even number of times. (For example, `01100` and `000000` and the empty string $\varepsilon$ are in this language, but `00000` and `001000` are not.)