Design ***nondeterministic*** finite-state automata that accept the following languages over the binary alphabet $\{0,1\}$. Briefly describe how your NFA works.

Your NFAs can have multiple start states and/or ε-transitions, but remember to write that down as part of your description. Either drawings or formal descriptions are acceptable, as long as the states Q, the start state s (or start states S), the accepting states A, and the transition function δ are all clear.

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0. $\emptyset$

1. Binary strings that end with the suffix 001.

2. Binary strings that contain at least one of the substrings 11, 101, and 1001.

3. $(01)^*(010)^*(10)^*$

4. $\left\{w \in \{0,1\}^* \;\middle|\; \min\{\#(0,w), \#(1,w)\} \le 3\right\}$

5. Binary strings that contain a substring of the form $1x1$, where $|x|$ is odd.

Problems to think about later:

6. Binary strings with length at least 7 whose 7th symbol from the end is 1.

7. Binary strings that contain at least one palindrome[1] substring of length 4. *[Hint: What are the palindromes of length 4?]*

8. Binary strings that contain both 01010 and 1001001 as substrings.

9. Binary strings that contain *at least two* of the substrings 11, 101, and 1001.

10. Binary strings of length at least 547 such that the 173d symbol from the beginning is equal to the 374th symbol from the end.

    [Hint: Use mathematical notation.]

[1] A *palindrome* is a string that is equal to its reversal, like A or POOP or STRESSED⋄DESSERTS or the empty string.