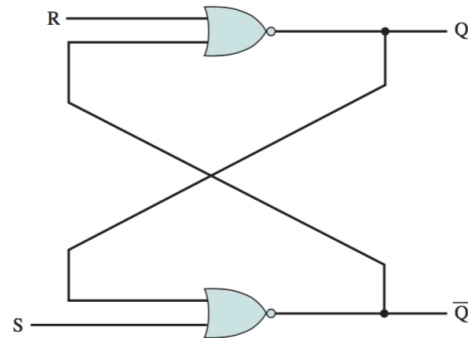


## Sequential Circuits (II)

### S-R Latch (S-R flip-flop)

- The **simplest** form of sequential circuit is **flip-flop**.
- A most simple type of flip-flop is S-R latch.
- A S-R latch looks like below.



- It has two inputs: S (set), R (reset), and two outputs: Q and Q'.
- The truth table for S-R latch is

| $S$ | $R$ | $Q_n$ (current state) | $Q_{n+1}$ (next state) |
|-----|-----|-----------------------|------------------------|
| 0   | 1   | 1                     | 0                      |
| 0   | 1   | 0                     | 0                      |
| 1   | 0   | 1                     | 1                      |
| 1   | 0   | 0                     | 1                      |
| 0   | 0   | 0                     | 1                      |
| 0   | 0   | 0                     | 0                      |
| 1   | 1   | 1                     | —                      |

- From the table, we can observe that when  $R = 1$  (reset), Q's value will become 0 no matter what is the current value of Q.
- When  $S = 1$  (set), Q's value will become 1 regardless the current value of Q.
- When  $S = R = 0$ , Q's value remains the same.
- When  $S = R = 1$ , the outputs of the S-R latch is meaningless, as both Q and Q' become 0.
- Therefore, **as long as S and R stay 0**, the S-R latch is **bistable**.
- This bistable feature enables S-R latch being used as a **1-bit memory**.