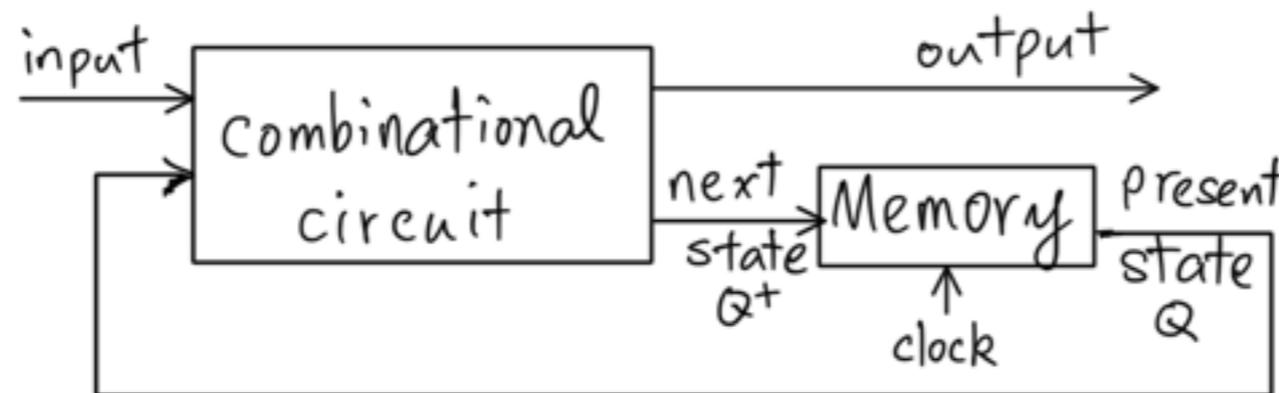


Digital Logic and Computer Organization

Sequential Logic — Latches

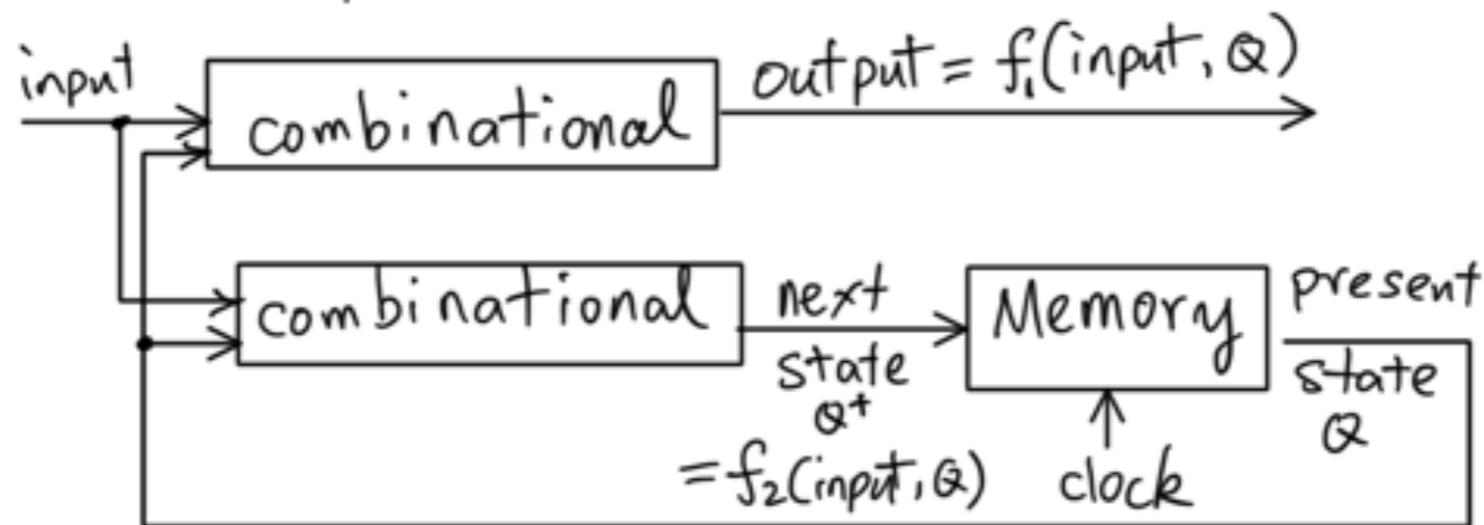
Sequential Logic

- a logic circuit whose output depends on the present value of its input signals and on the sequence of past inputs.
- Brutally simplified view: a logic circuit that has memory elements.

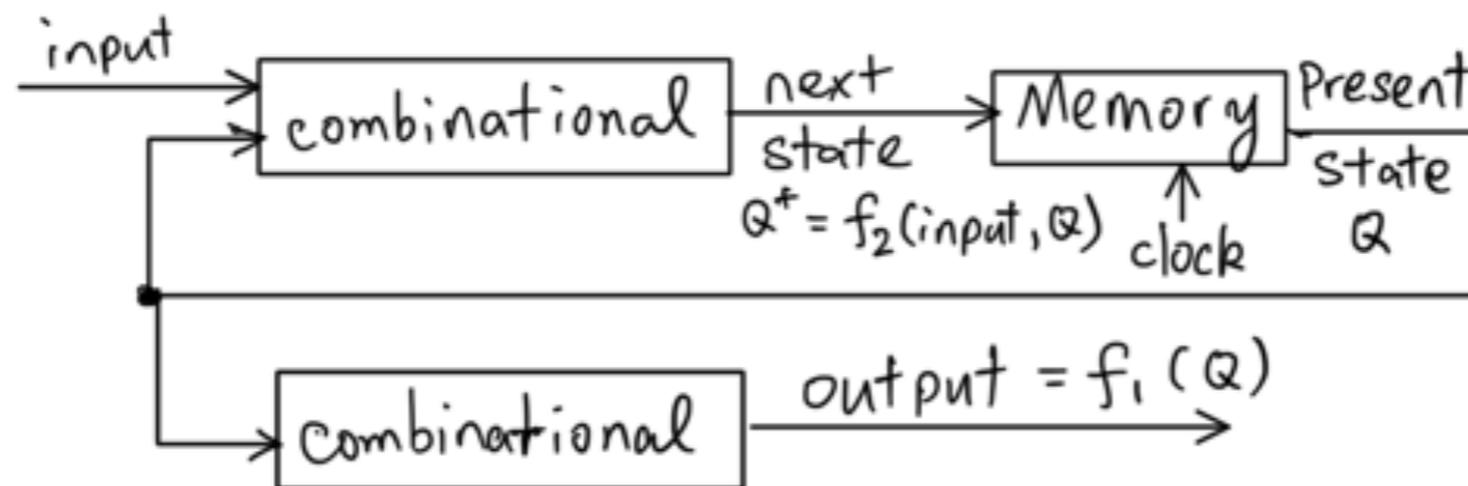


Mealy vs Moore Machine

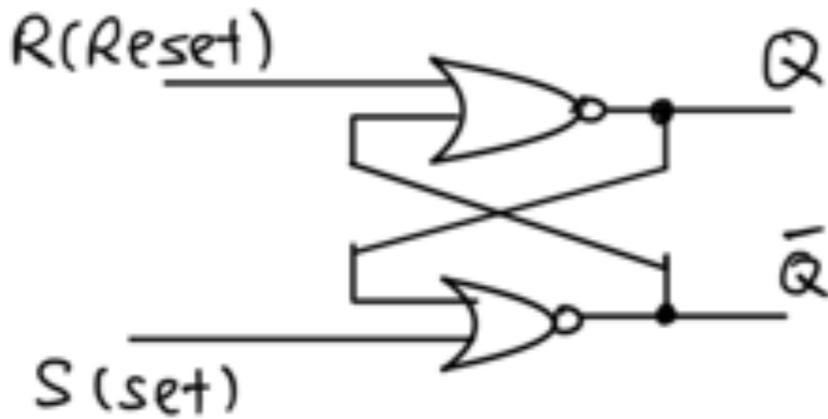
Mealy Machine



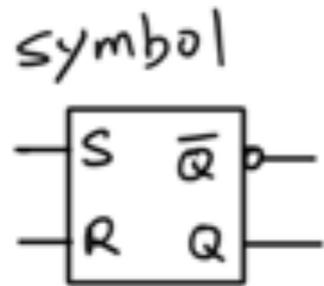
Moore Machine



SR Latch with NOR



S	R	Q^+	\bar{Q}^+
1	0	1	0
0	1	0	1
0	0	Q	\bar{Q}
1	1	undefined	



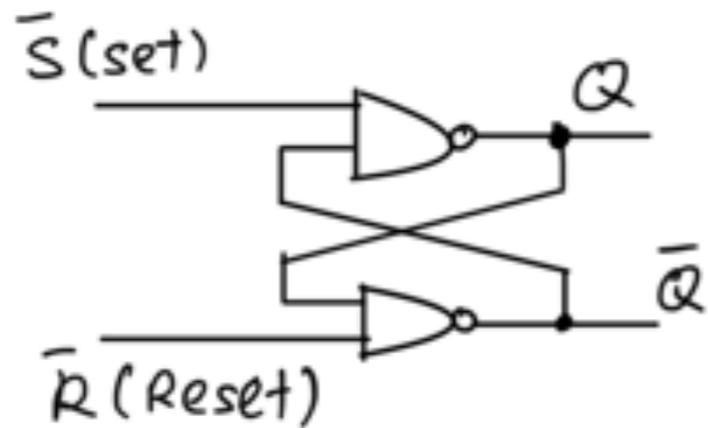
characteristic table

S	R	Q^+
0	0	Q unchanged
0	1	0 reset
1	0	1 set
1	1	X invalid

Excitation table

Q	Q^+	S	R
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0

SR Latch with NAND

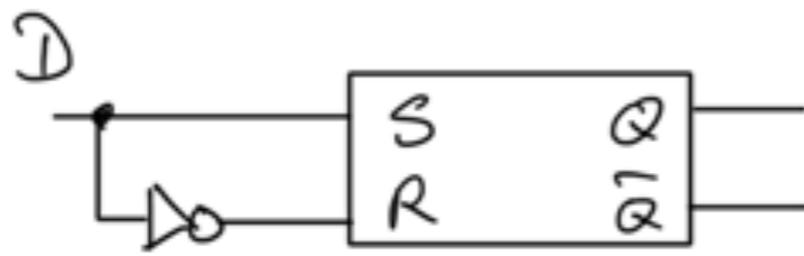


\bar{S}	\bar{R}	Q^+	\bar{Q}^+
0	1	1	0
1	0	0	1
1	1	Q	\bar{Q}
0	0	undefined	

symbol



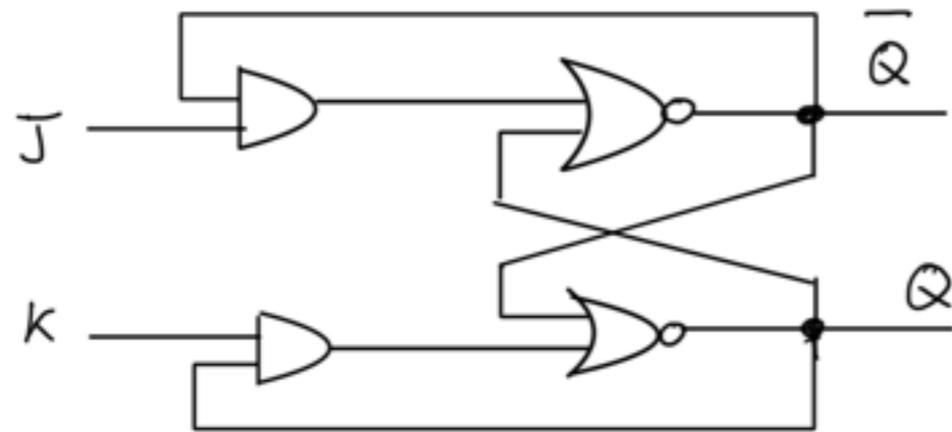
D Latch



D	Q ⁺
0	0
1	1

$$Q^+ = D$$

JK Latch

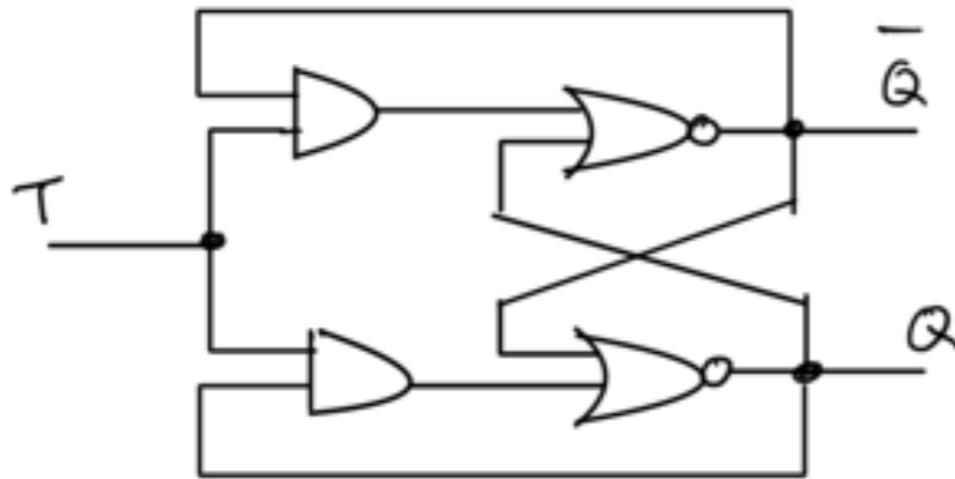


J	K	Q^+
0	0	Q
0	1	0
1	0	1
1	1	\bar{Q}

when JK = 11
output
oscillates

$$Q^+ = J\bar{Q} + \bar{K}Q$$

T Latch



T	Q^+
0	Q
1	\bar{Q}

when $T = 1$
output oscillates

$$\begin{aligned} Q^+ &= T\bar{Q} + \bar{T}Q \\ &= T \oplus Q \end{aligned}$$