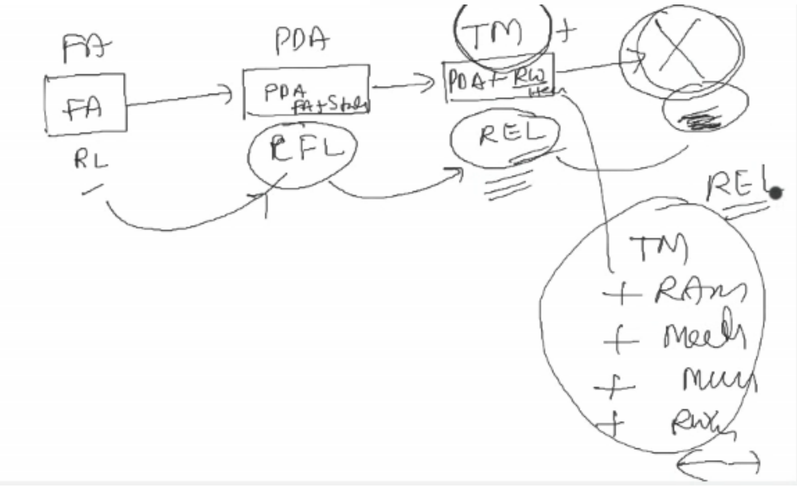
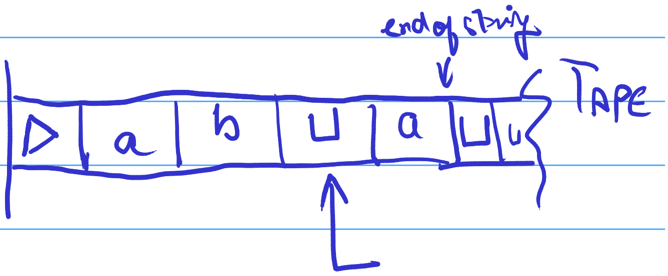
FA : $a^n b^n$

PDA : $a^n b^n c^n$

The formal definition of a TM and their operations are in the same mathematical style as those used for FA and PDA.
TM is not simply one more class of automata to be replaced by a more powerful type.
We see that as primitive as TM seem to be, attempts to strengthen them do not have any effect.





1. Put the Finite Control in a new state.
2. Either
(a)Write a symbol in the tape square currently scanned, i.e., replacing the one that is already there.
Or
(b)Move the head one tape square to the left or right.

Note: The tape has a left end but no right end (extends infinitely).
To prevent the machine moving its head off the left end, we assume that the left most end/cell of the tape is marked with a special symbol. ▷

- All the TMs are so designed that, when the head reads ► it immediately moves to the right.
- We use distinct symbols → , and ← to denote head movements. We also assume that the two symbols are not part of any alphabet.
- We give input to the TM by inscribing the string on the tape.
- The rest of the tape is initially contains blanks denoted by ⊔

Formal definition:

Formal definition:

A Turing Machine is a quintuple- (K, Σ , δ, s, H) → not final state

-K is a finite set of states

-Σ is an alphabet (containing blank symbol and left end marker but not → and ←.

-s∊K is the initial state H subset of K is the set of halting states

-δ is the transition function from-

$(K-H) \times \Sigma \rightarrow K \times (\Sigma \cup \{\rightarrow, \leftarrow\})$ ⇒ no transition on halt states

(a) $\forall q \in K - H$ if $\delta(q, \blacktriangleright) = (p, b)$ then $b = \rightarrow$

$\forall q \in K - H$ $a \in \Sigma$ if $\delta(q, a) = (p, b)$ then $b \neq \blacktriangleright$

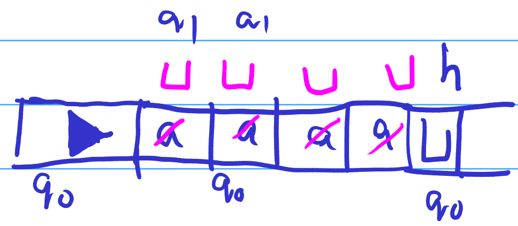
$M = (K, \Sigma, \delta, s, \{h\})$

$K = \{q_0, q_1, h\}$

$\Sigma = \{a, \sqcup, \blacktriangleright\}$

δ

q σ	$\delta(q, \sigma)$
(q_0, a)	$(q_1, \sqcup)$
$(q_0, \sqcup)$	$(h, \sqcup)$
$(q_0, \blacktriangleright)$	$(q_0, \rightarrow)$
(q_1, a)	(q_0, a)
q_1 $\sqcup$	q_0 $\rightarrow$
q_1 $\blacktriangleright$	q_1 $\rightarrow$



This is not a finite automata diagram

$\Sigma = \sqcup \triangleright a b$

q_0

(q_0, a)	(q_1, b)
(q_0, b)	(q_1, a)
$(q_0, \sqcup)$	$(h, \sqcup)$
$(q_0, \triangleright)$	$(q_0, \rightarrow)$
(q_1, a)	$(q_0, \rightarrow)$
(q_1, b)	$(q_0, \rightarrow)$
$(q_1, \sqcup)$	$(q_1, \sqcup)$ → to make it deterministic
$(q_1, \triangleright)$	$(q_1, \rightarrow)$