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Rules of Operation - 1

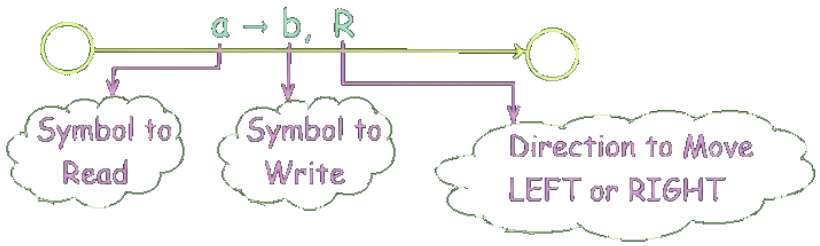
At each step of the computation:

-> Read the currect symbol

-> Update (i.e. write) the same cell

-> Move exactly one cell either LEFT or RIGHT

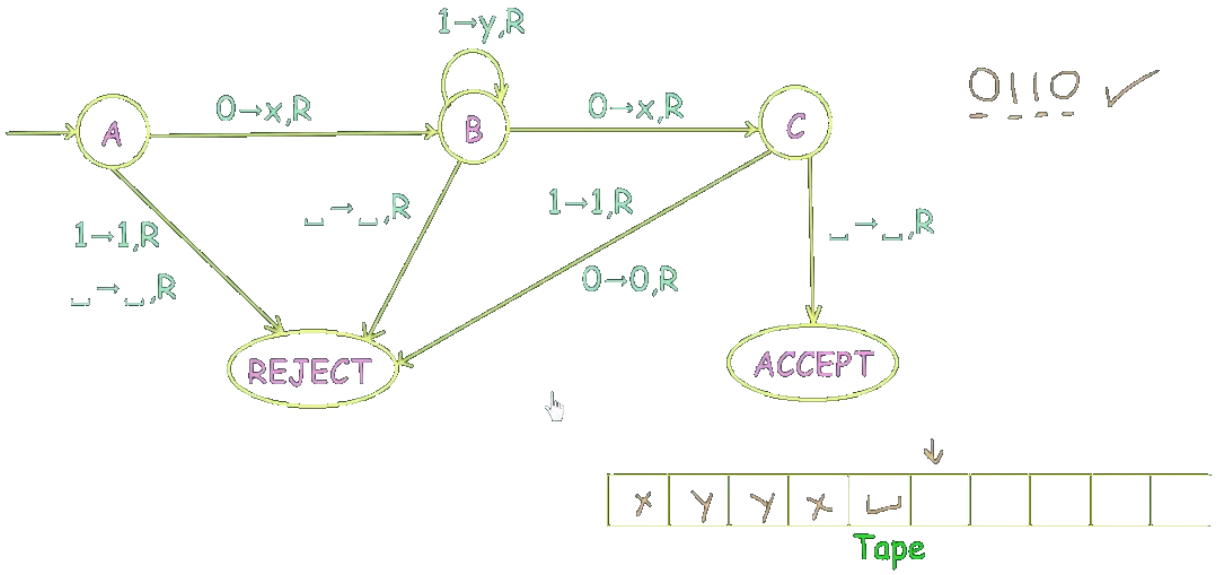
If we are at the left end of the tape, and trying to move LEFT, then do not move. Stay at the left end



If you dont want to update the cell, JUST WRITE THE SAME SYMBOL

Design a Turing Machine which recognizes the language

L = 01*0



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Design a Turing Machine which recognizes the language $L = 0^N 1^N$

0	0	0	0	1	1	1	1	␣	␣	...

Algorithm:

- Change "0" to "x"
- Move RIGHT to First "1"
  If None: REJECT
- Change "1" to "y"
- Move LEFT to Leftmost "0"
- Repeat the above steps until no more "0"s
- Make sure no more "1"s remain

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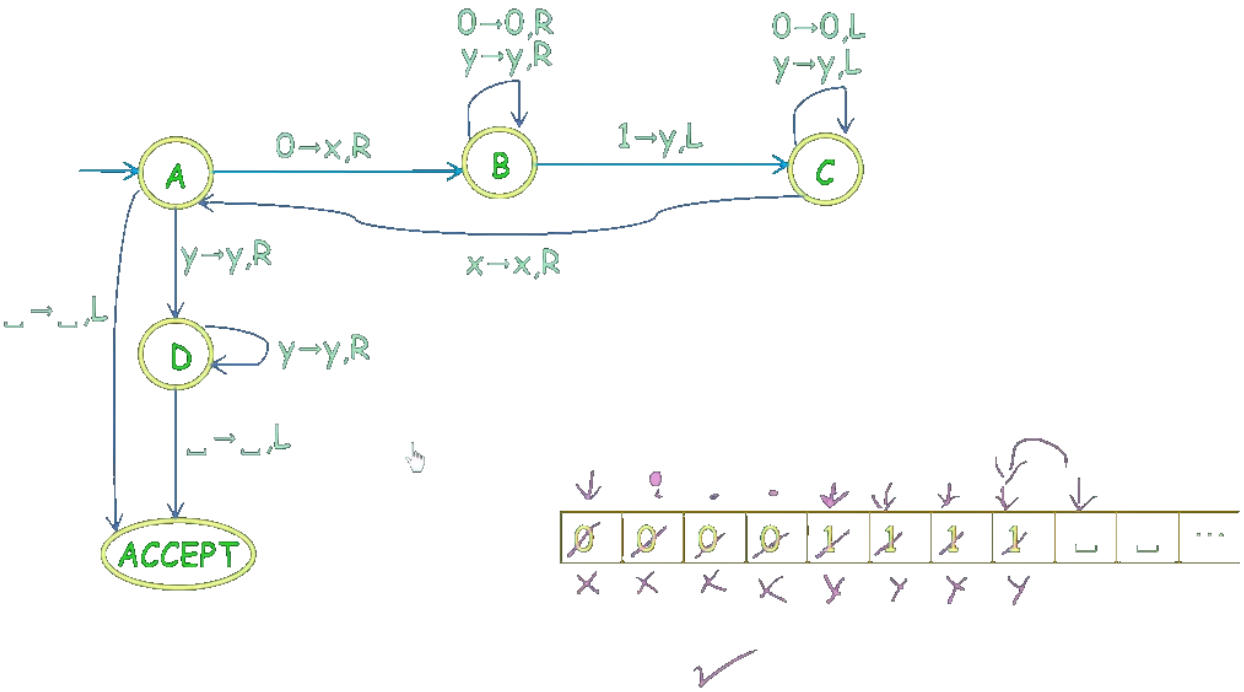
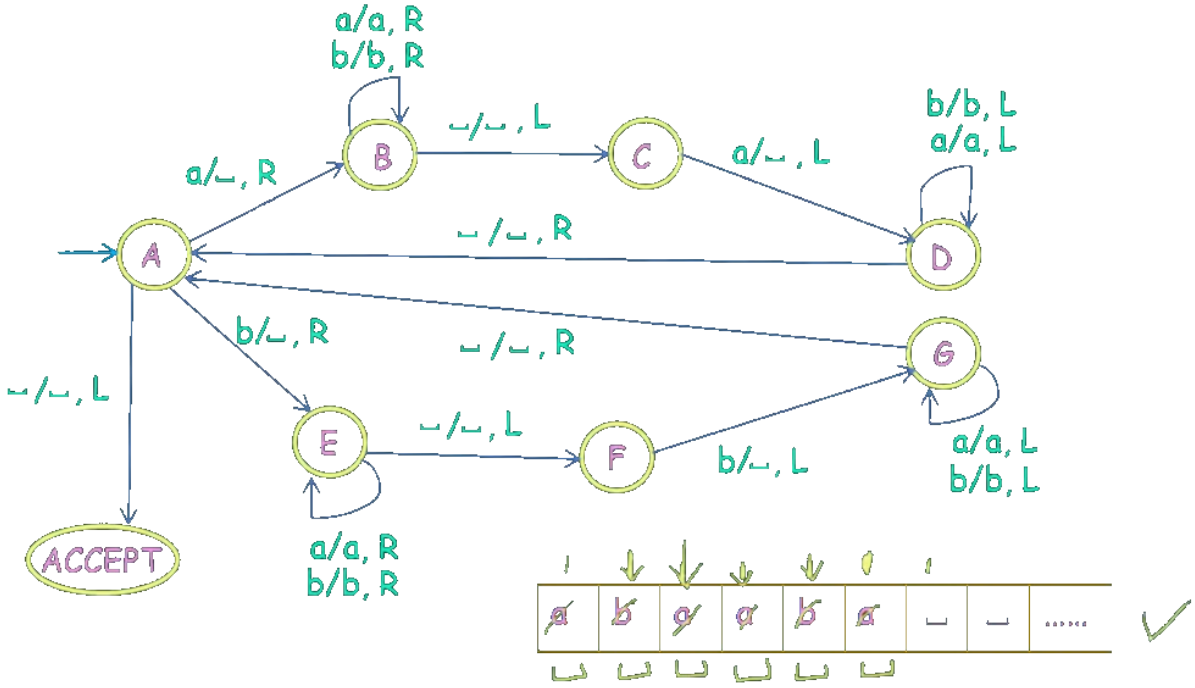


Macchina di Turing che accetta parole palindrome



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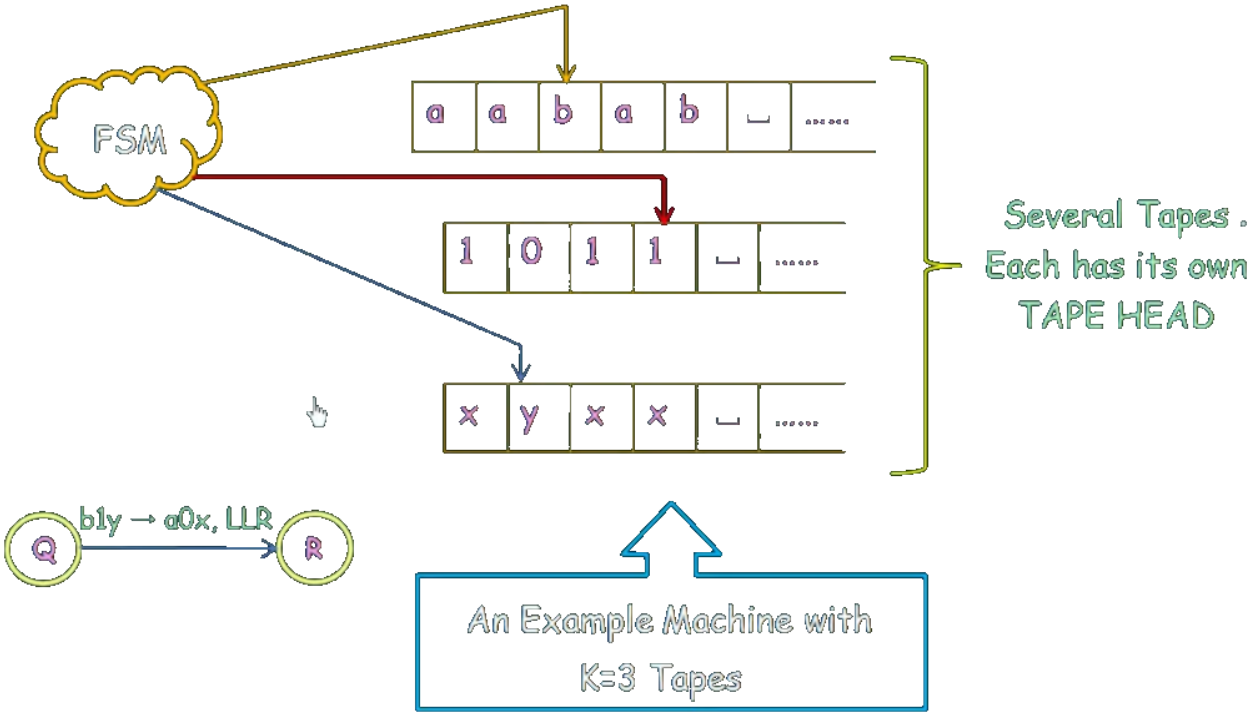
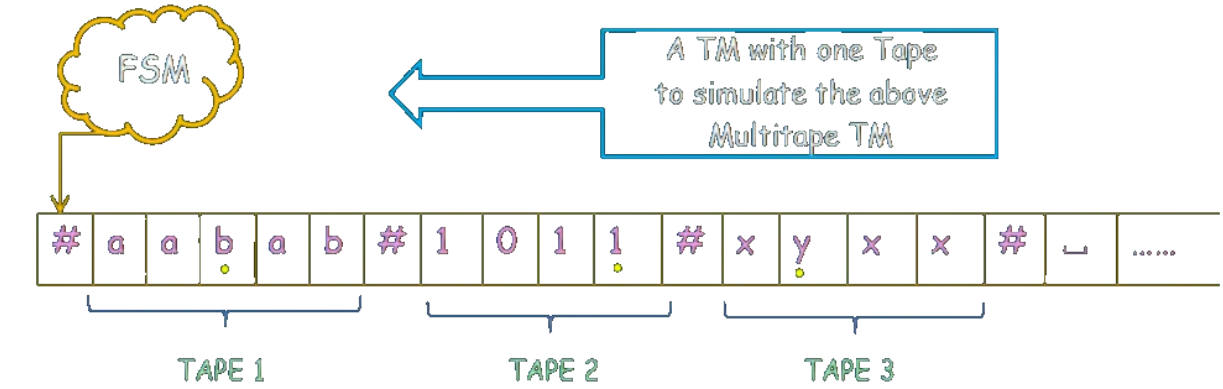
Multitape Turing Machine



Single Tape Turing Machine



- Add "dots" to show where Head "K" is
- To simulate a transition from state Q, we must scan our Tape to see which symbols are under the K Tape Heads
- Once we determine this and are ready to MAKE the transition, we must scan across the tape again to update the cells and move the dots
- Whenever one head moves off the right end, we must shift our tape so we can insert a ␣

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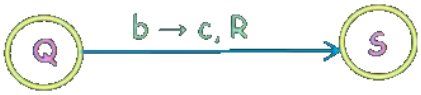
Nondeterminism in Turing Machine (Part-1)

Nondeterministic Turing Machines:

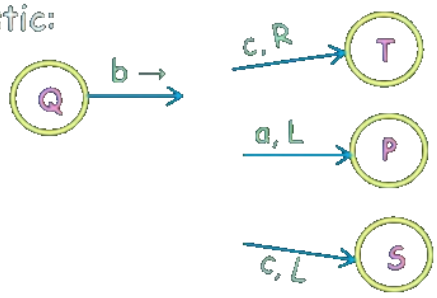
Transition Function:

δ : $Q \times \Sigma \rightarrow P\{\Gamma \times (R/L) \times Q\}$

Deterministic:

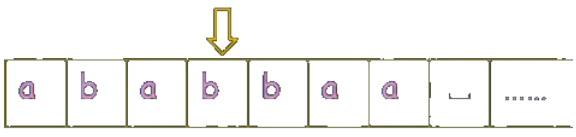


Nondeterministic:



CONFIGURATION

- A way to represent the entire state of a TM at a moment during computation
- A string which captures:
  - The current state
  - The current position of the Head
  - The entire Tape contents



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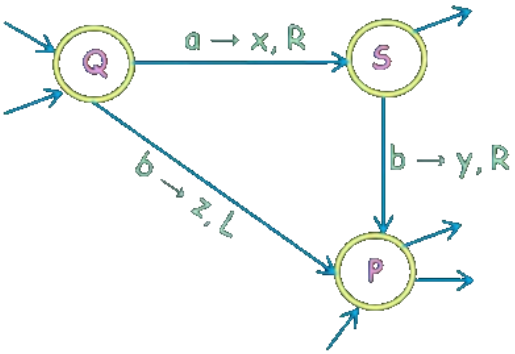
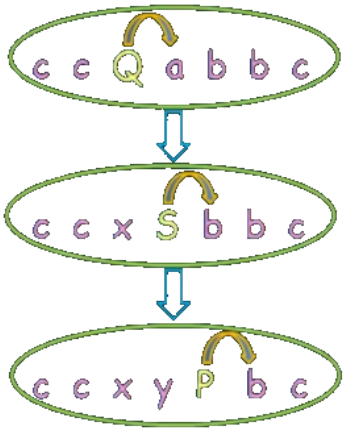
Deterministic TM:



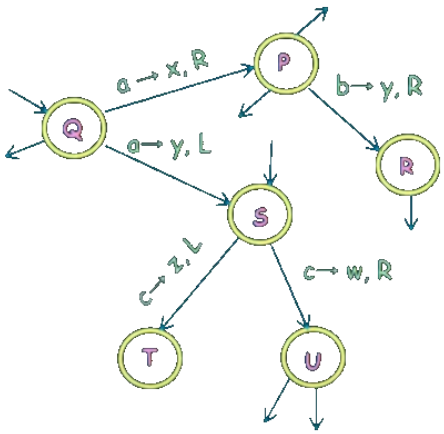
Computation History:



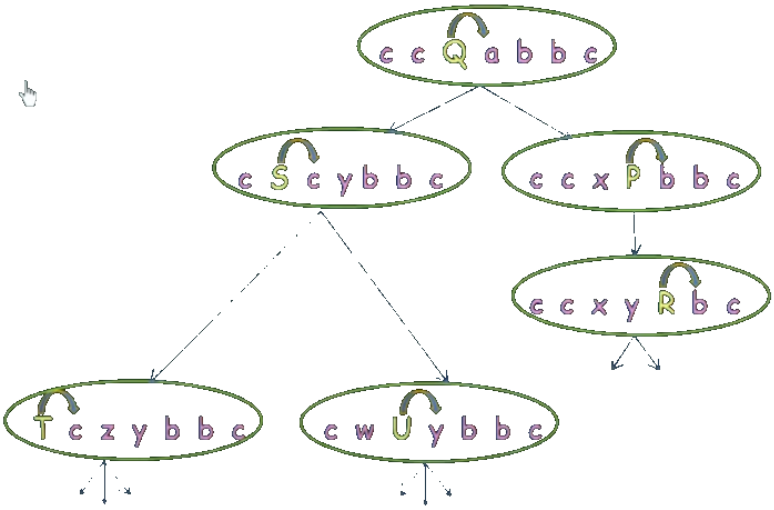
With Nondeterminism:

At each moment in the computation there can be more than one successor configuration

Nondeterministic TM:



Computation History:



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Outcomes of a Nondeterministic Computation:

ACCEPT If any branch of the computation accepts, then the nondeterministic TM will Accept.

REJECT If all branches of the computation HALT and REJECT (i.e. no branches accept, but all computations HALT) then the Nondeterministic TM Rejects.

LOOP Computation continues but ACCEPT is never encountered. Some branches in the computation history are infinite.