Tuple

DFA / NFA

A finite automaton can be defined as a tuple:

{ Q, Σ, q, F, δ }, where:

- Q: Finite set of states
- Σ: Set of input symbols
- q: Initial state
- F: Set of final states
- δ: Transition function

Grammar

- V - It is the collection of variables or non-terminal symbols.
- T - It is a set of terminals.
- P - It is the production rules that consist of both terminals and non-terminals.
- S - It is the starting symbol.
- G -> (V∪T)*, where G ∈ V

Pushdown Automata

- Q is the set of states
- ∑is the set of input symbols
- Γ is the set of pushdown symbols (which can be pushed and popped from the stack)
- q0 is the initial state
- Z is the initial pushdown symbol (which is initially present in the stack)
- F is the set of final states

- δ is a transition function that maps Q x {Σ ∪ ∈} x Γ into Q x Γ*. In a given state, the PDA will read the input symbol and stack symbol (top of the stack) move to a new state, and change the symbol of the stack.

Turing Machine

A TM is expressed as a 7-tuple (Q, T, B, ∑, δ, q0, F) where:

- Q is a finite set of states
- T is the tape alphabet (symbols which can be written on Tape)
- B is blank symbol (every cell is filled with B except input alphabet initially)
- ∑ is the input alphabet (symbols which are part of input alphabet)
- δ is a transition function which maps Q × T → Q × T × {L,R}. Depending on its present state and present tape alphabet (pointed by head pointer), it will move to new state, change the tape symbol (may or may not) and move head pointer to either left or right.
- q0 is the initial state
- F is the set of final states. If any state of F is reached, input string is accepted.