# Formal languages and automata

## Regular Grammars

https://t.me/fla_uog

mh.olyaee@gmail.com

# Grammar

- Definition:
  - Each grammar describes its relating language exactly.
  - A grammar is defined as a five-tuple G(V,T,S,P)

- V: set of variables
- T: set of terminals
- S: start variable
- P: set of production rules
  - Each rule is based on the below template:
  - $x \rightarrow y$
  - In the above rule, we have:
    - $x \in \{V \cup T\}^+$ and $y \in \{V \cup T\}^*$

- Example:
  - Let T={a,b}, V={S,A,B}
  - $S \rightarrow aA$
  - $A \rightarrow aA|bB$
  - $B \rightarrow bB|\lambda$

- Example:
  - Let T={a,b}, V={S,A,B}
  - $S \rightarrow aA$
  - $A \rightarrow aA|bB$
  - $B \rightarrow bB|\lambda$

  - $S \rightarrow aA \rightarrow aaA \rightarrow aaaA \rightarrow aaabB \rightarrow aaabbB \rightarrow aaabb$
  - $S \rightarrow aA \rightarrow aaA \rightarrow aabB \rightarrow aab$

# Derivation

- Suppose $W \in L(G)$, Next we have:
  - $S \rightarrow W_1 \rightarrow W_2 \rightarrow \cdots \rightarrow W_n \rightarrow W$
- The above path which is named as a derivation for W.

# Example

- $S \rightarrow aSb|\varepsilon$
- Test it!

# Example

- $S \rightarrow Ab$
- $A \rightarrow aAb$
- $A \rightarrow \varepsilon$

# Example

- $S \rightarrow SS$
- $S \rightarrow \varepsilon$
- $S \rightarrow aSb$
- $S \rightarrow bSa$

# Example

- $S \rightarrow aSbb|\varepsilon$

# Example

- $S \rightarrow aSb|aSbb|\varepsilon$