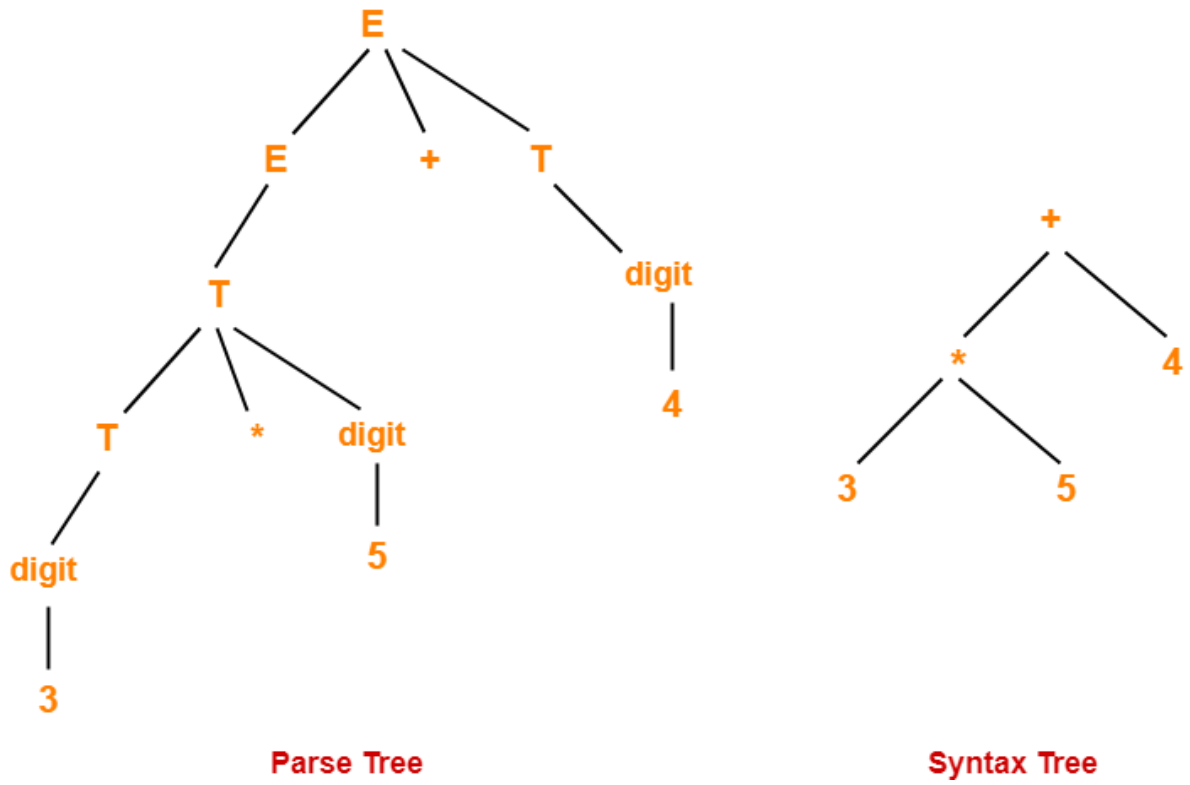
Syntax Trees

Syntax trees are abstract or compact representation of parse trees.

They are also called as **Abstract Syntax Trees**.

Example-



Parse Trees Vs Syntax Trees-

Parse Tree	Syntax Tree
Parse tree is a graphical representation of the replacement process in a derivation.	Syntax tree is the compact form of a parse tree.

Each interior node represents a grammar rule. Each leaf node represents a terminal.	Each interior node represents an operator. Each leaf node represents an operand.
Parse trees provide every characteristic information from the real syntax.	Syntax trees do not provide every characteristic information from the real syntax.
Parse trees are comparatively less dense than syntax trees.	Syntax trees are comparatively more dense than parse trees.

NOTE-

Syntax trees are called as **Abstract Syntax Trees** because-

- They are abstract representation of the parse trees.
- They do not provide every characteristic information from the real syntax.
- For example- no rule nodes, no parenthesis etc.

PRACTICE PROBLEMS BASED ON SYNTAX TREES-

Problem-01:

Considering the following grammar-

$$E \rightarrow E + T \mid T$$

$$T \rightarrow T \times F \mid F$$

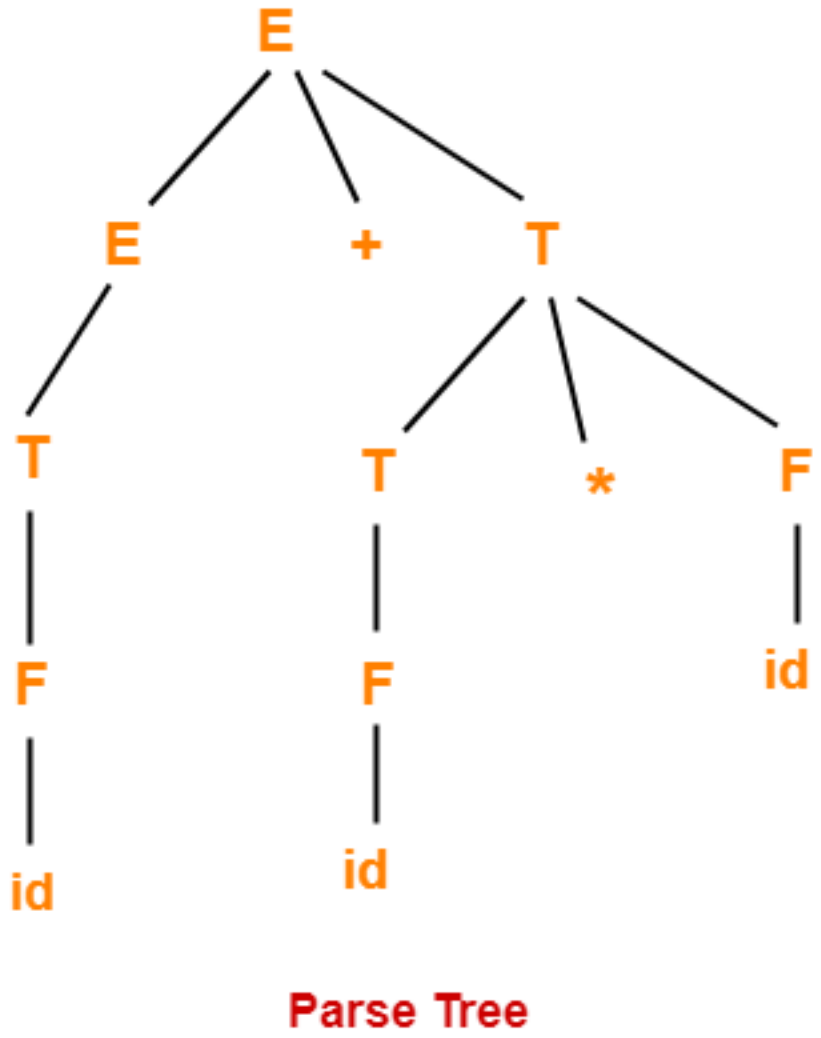
$$F \rightarrow (E) \mid id$$

Generate the following for the string id + id x id

1. Parse tree
2. Syntax tree
3. Directed Acyclic Graph (DAG)

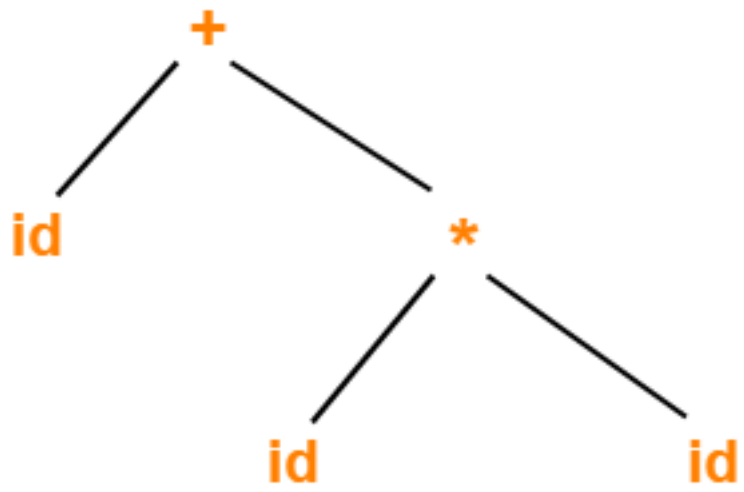
Solution-

Parse Tree-



Parse Tree

Syntax Tree-



Syntax Tree

Problem-02:

Construct a syntax tree for the following arithmetic expression-

(a + b) * (c – d) + ((e / f) * (a + b))

Solution-

Step-01:

We convert the given arithmetic expression into a postfix expression as-

(a + b) * (c – d) + ((e / f) * (a + b))

ab+ * (c – d) + ((e / f) * (a + b))

ab+ * cd- + ((e / f) * (a + b))

ab+ * cd- + (ef/ * (a + b))

ab+ * cd- + (ef/ * ab+)

ab+ * cd- + ef/ab+*

ab+cd-* + ef/ab+*

ab+cd-*ef/ab+*+

Step-02:

We draw a syntax tree for the above postfix expression.

Steps Involved

Start pushing the symbols of the postfix expression into the stack one by one.

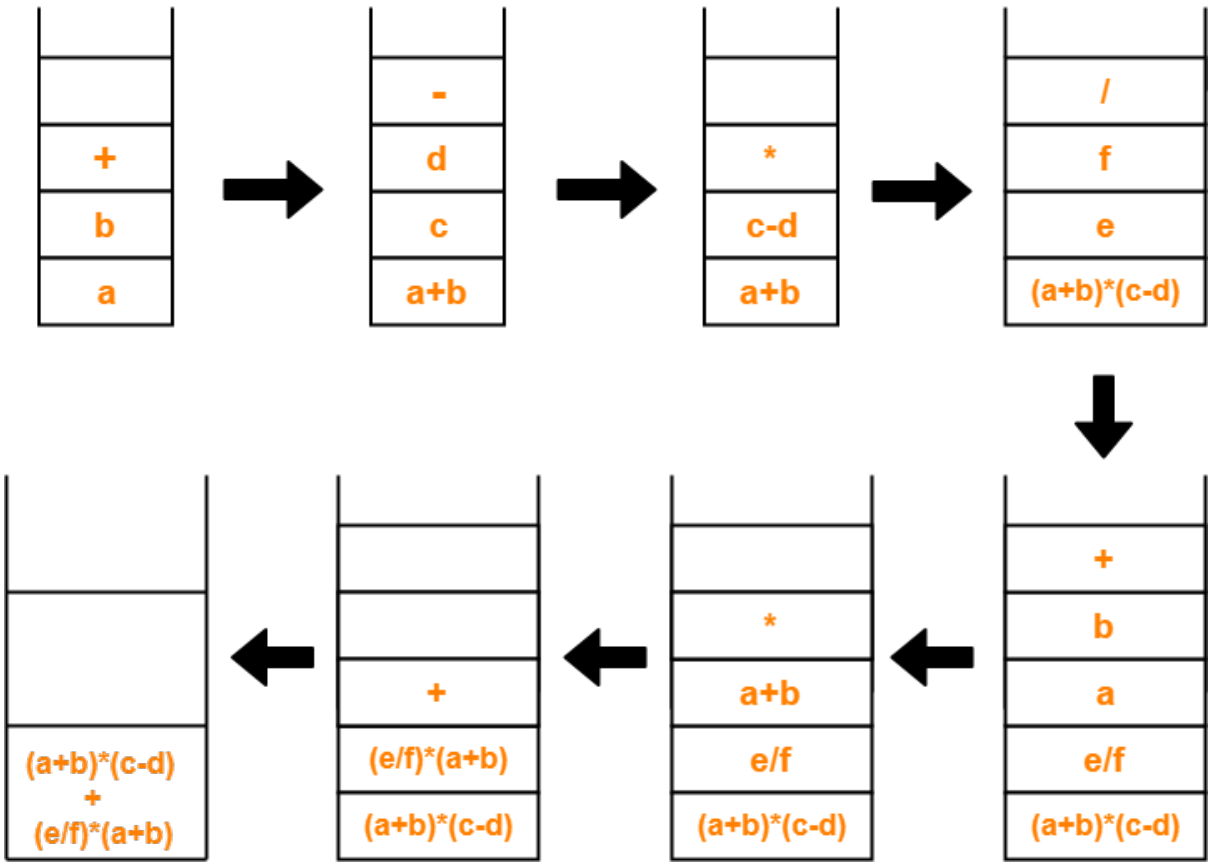
When an operand is encountered,

- Push it into the stack.

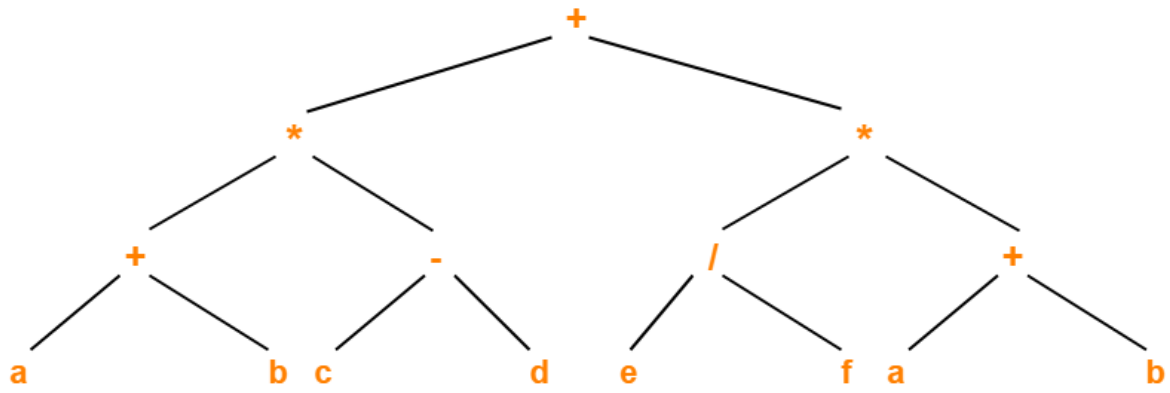
When an operator is encountered

- Push it into the stack.
- Pop the operator and the two symbols below it from the stack.
- Perform the operation on the two operands using the operator you have in hand.
- Push the result back into the stack.

Continue in the similar manner and draw the syntax tree simultaneously.



The generated syntax tree is-



Syntax Tree