Compiler Construction

Trees

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Syntactic Tree continued …

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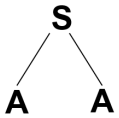

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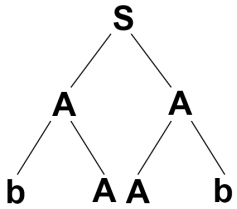

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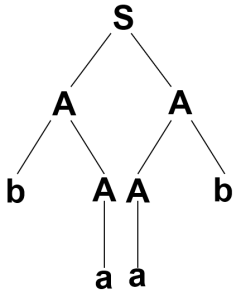

Total Language Tree

- For a given CFG, a tree with the start Symbol S as its root
- whose nodes are working strings of terminals and non-terminals
- The descendants of each node are all possible results of applying every production to the working string
- This tree is called **total language tree**

Total Language Tree example 1

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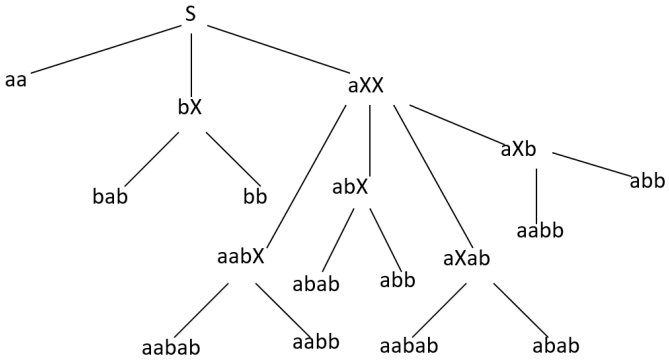

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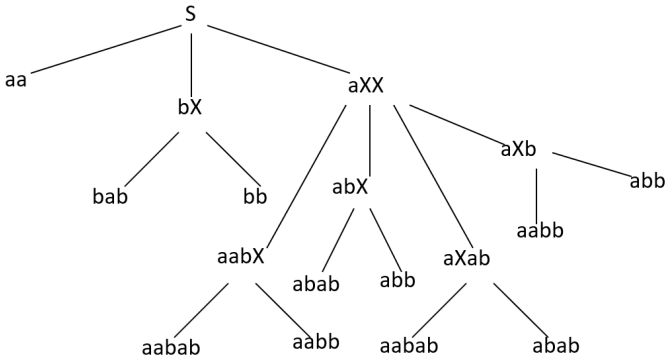

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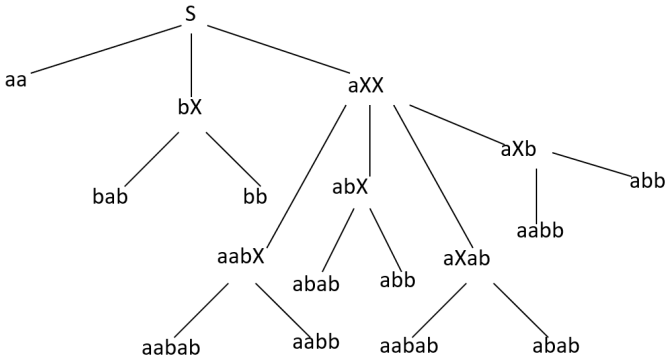
- $\{$aa, bab, bb, aabab, aabb, abab, abb$\}$



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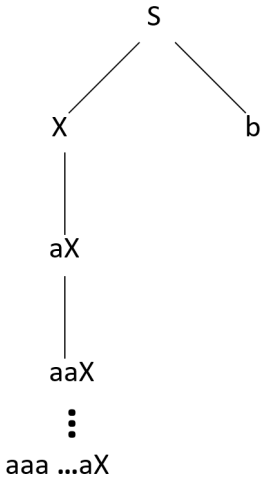

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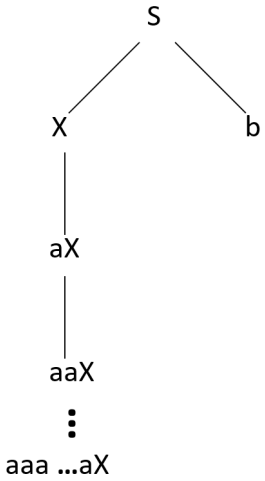
- It is to be noted that the only word generated by this language is, $\{b\}$



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- Finite Automaton (FA) can be converted into corresponding CFG

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  - Each state 'i' of the FA creates a non-terminal symbol 'A'
  - If a state 'i' has a transaction to the state 'j' on a symbol 'a', i.e., δ(i,a) = j, then introduce a production rule of the following,
    $A_i \rightarrow aA_j$

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- If state 'i' is the start state, then A_i is the start symbol (non-terminal) of the grammar.

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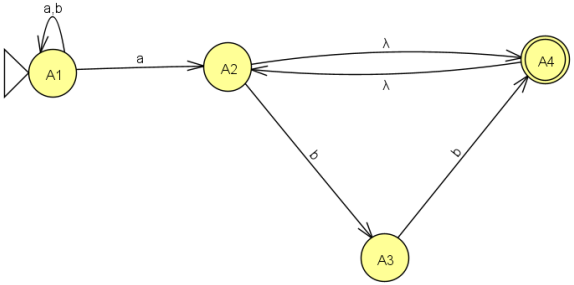

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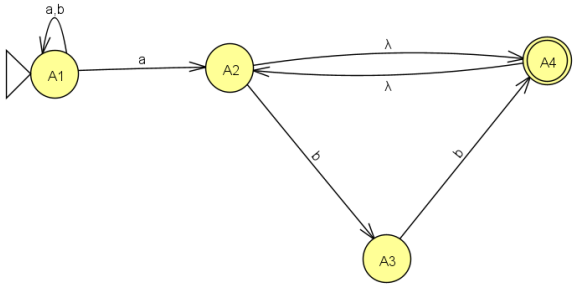

$$A_1 \rightarrow aA_1$$
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$$A_3 \rightarrow bA_4$$
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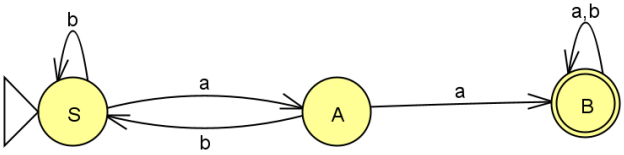

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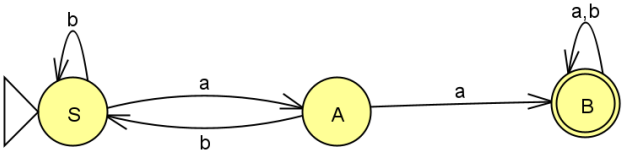

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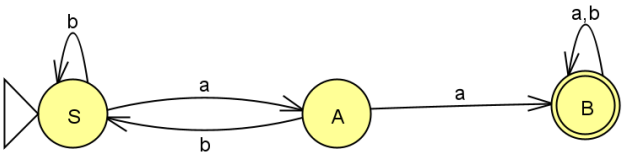

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- It may be noted that the number of terminals in the above CFG is equal to the number of states of corresponding FA
- where S corresponds to the initial state
- each transition defines a production

RE to CFG: Example 3

- Construct FA and grammar for the following RE,

$$(a|b)^* bbb(a|b)^*$$