Structural Relations

The mathematical properties of phrase structure trees

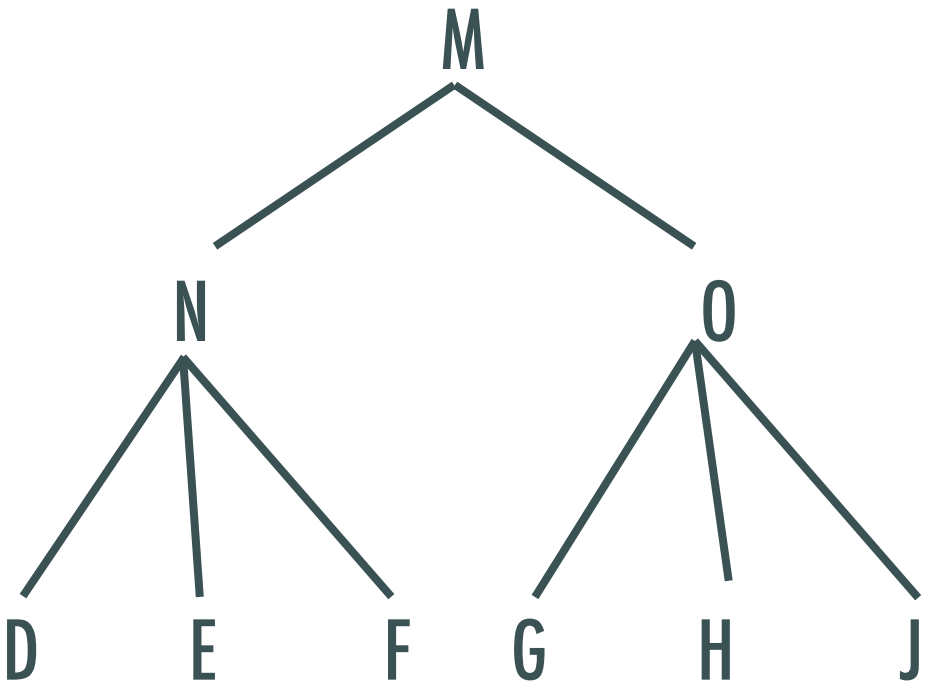
Objectives

1. Identify dominance in a tree.
2. Distinguish dominance from immediate dominance.
3. Understand the relationship between exhaustive domination and constituency.
4. Identify precedence in a tree.
5. Understand the constraint against crossing lines.
6. Identify c-command in a tree.
7. Distinguish symmetric from asymmetric c-command.
8. Identify different government relations.
9. Define structurally subject, object, oblique, object of a preposition and indirect object.

Structural Relations

- Structural relations: the formal relationships between items of a tree
- Why should we care? We want to be able to talk about specific relationships in terms of structures.

Some basic terms



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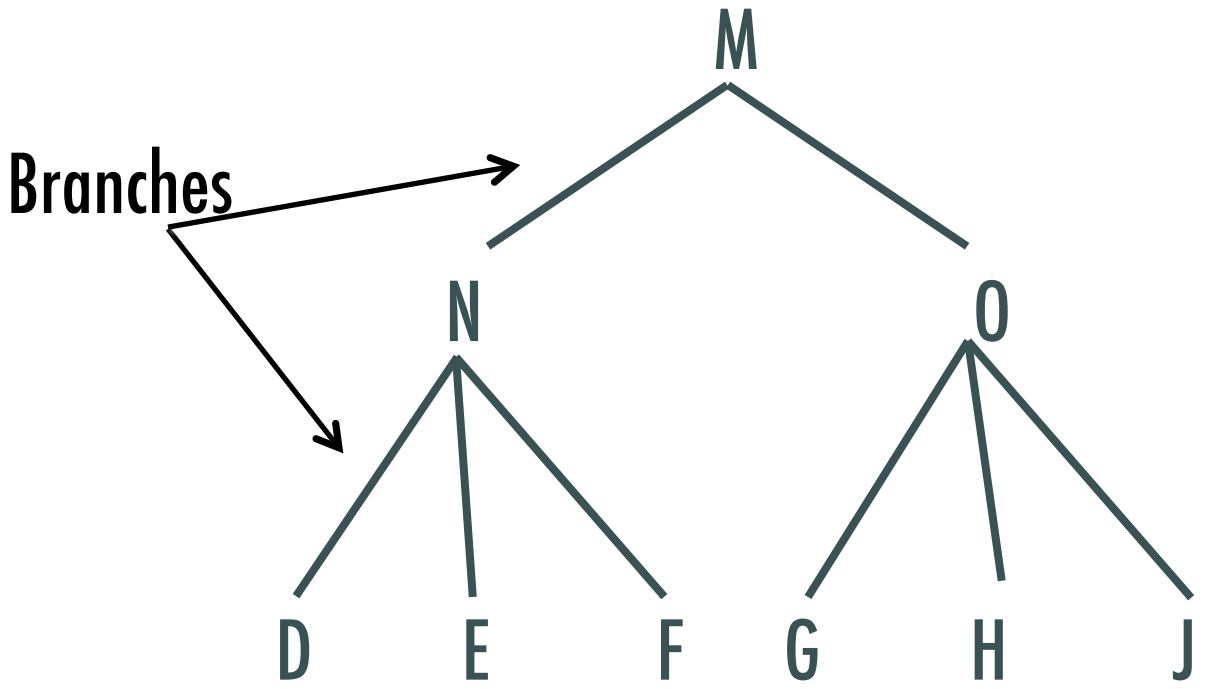

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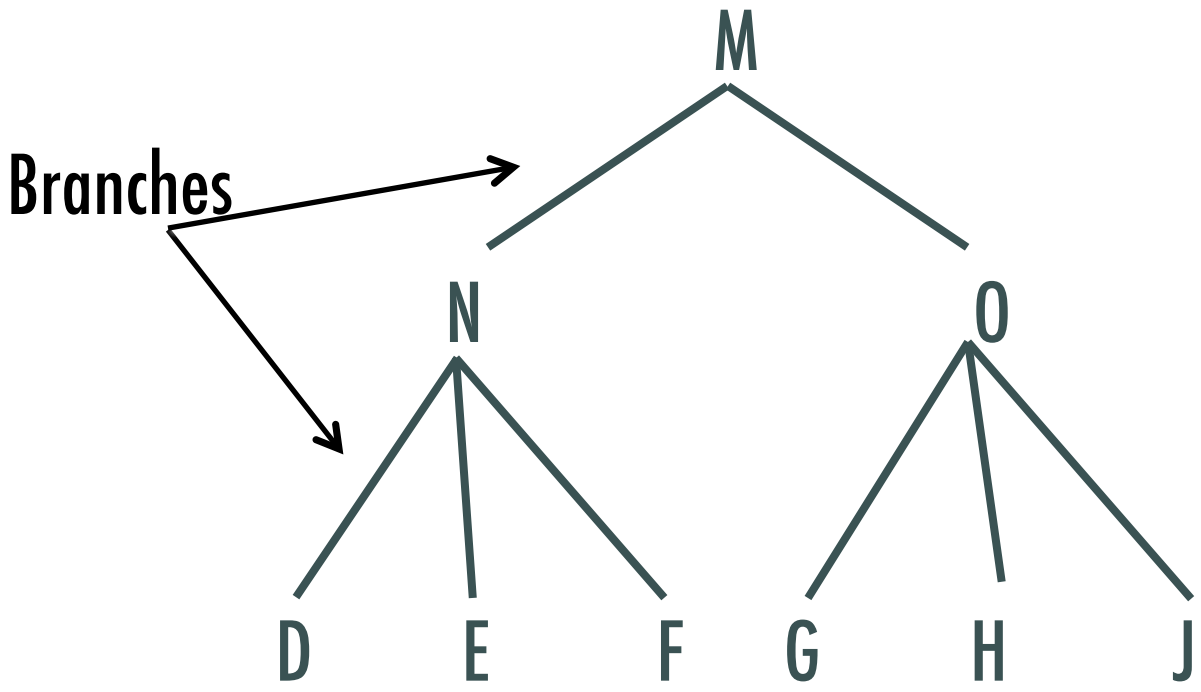

Labels: M,N,O,D,E,F,G,H,J

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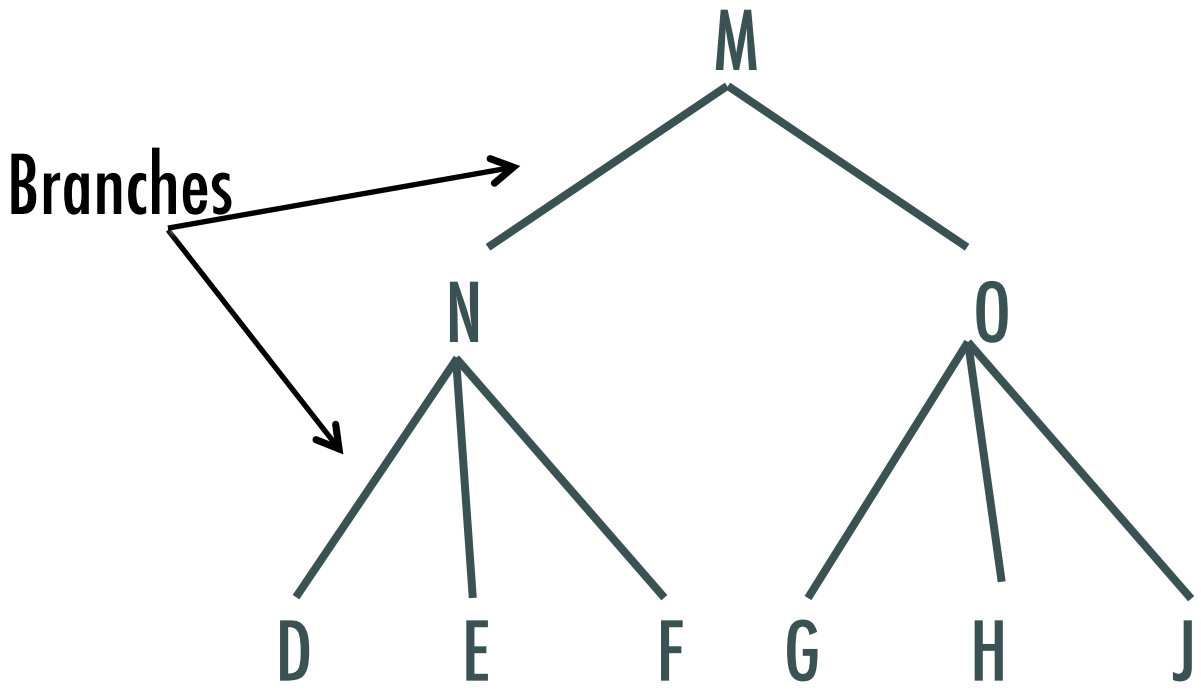

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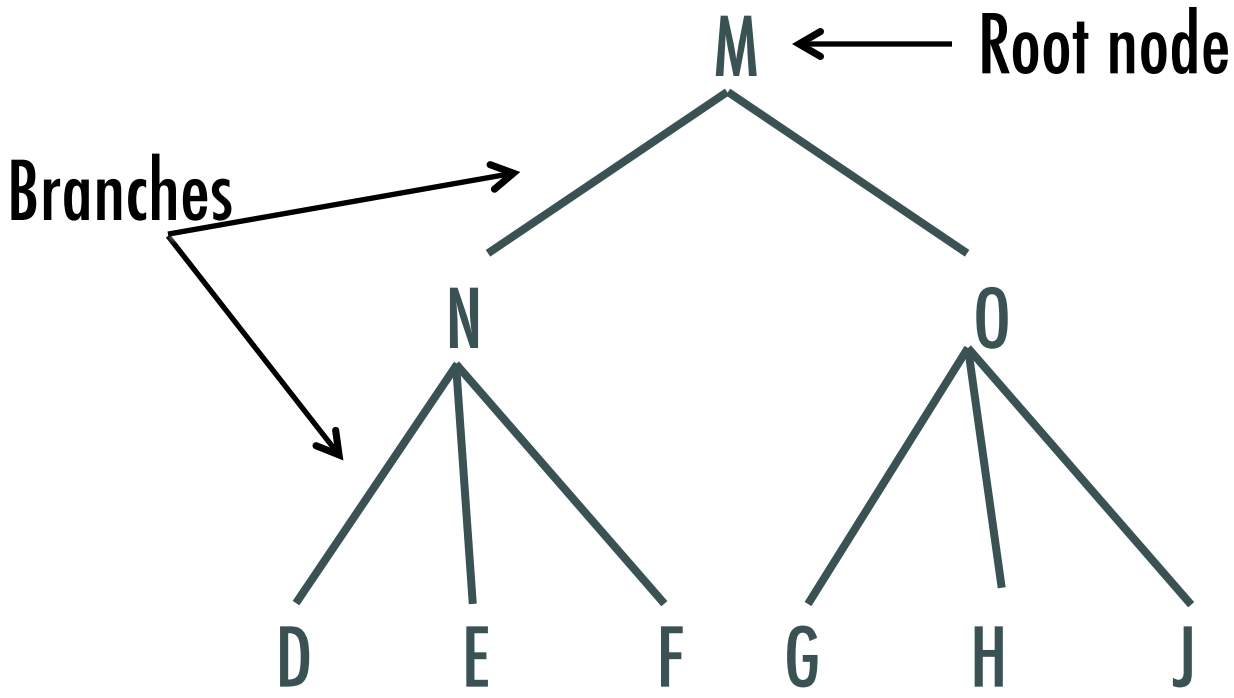

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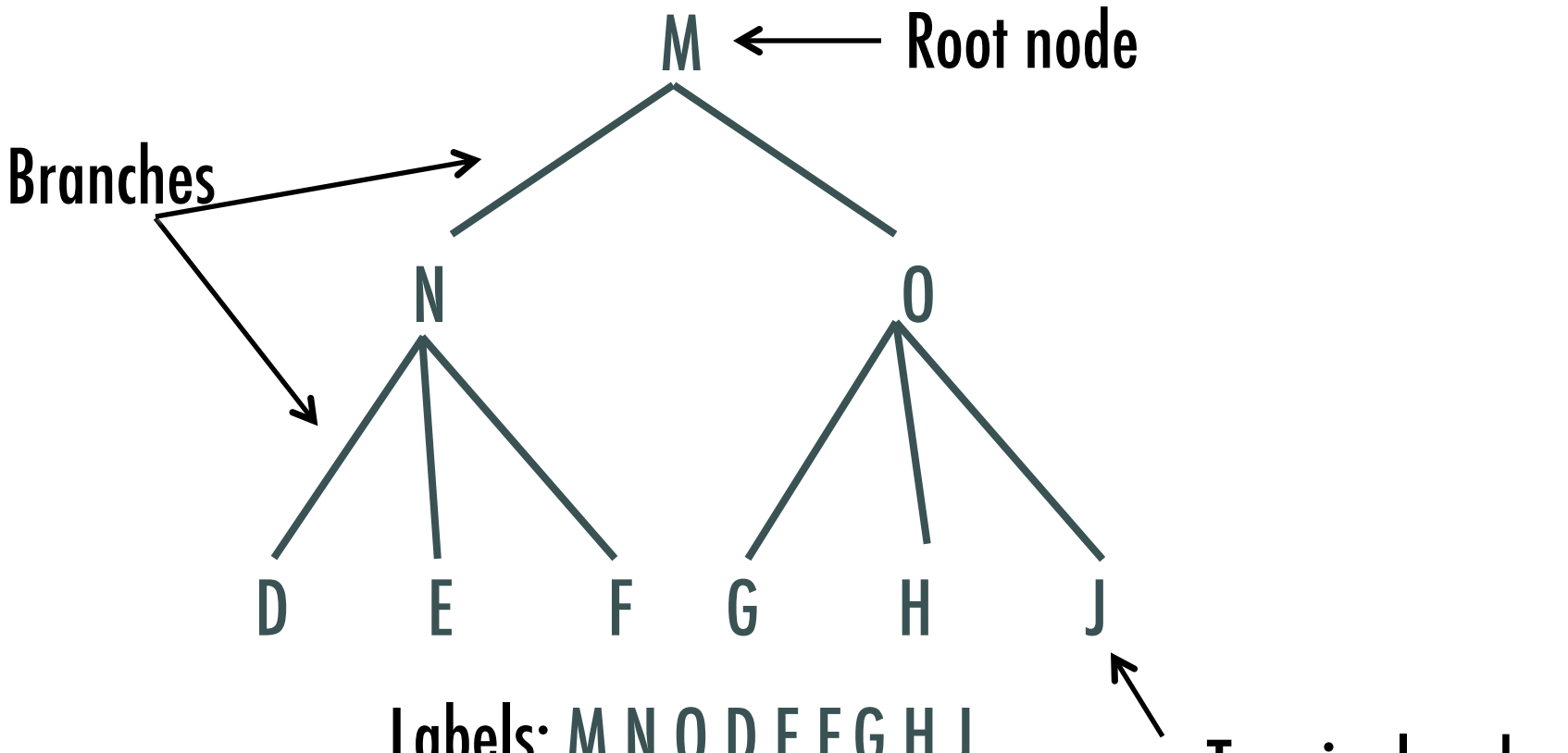

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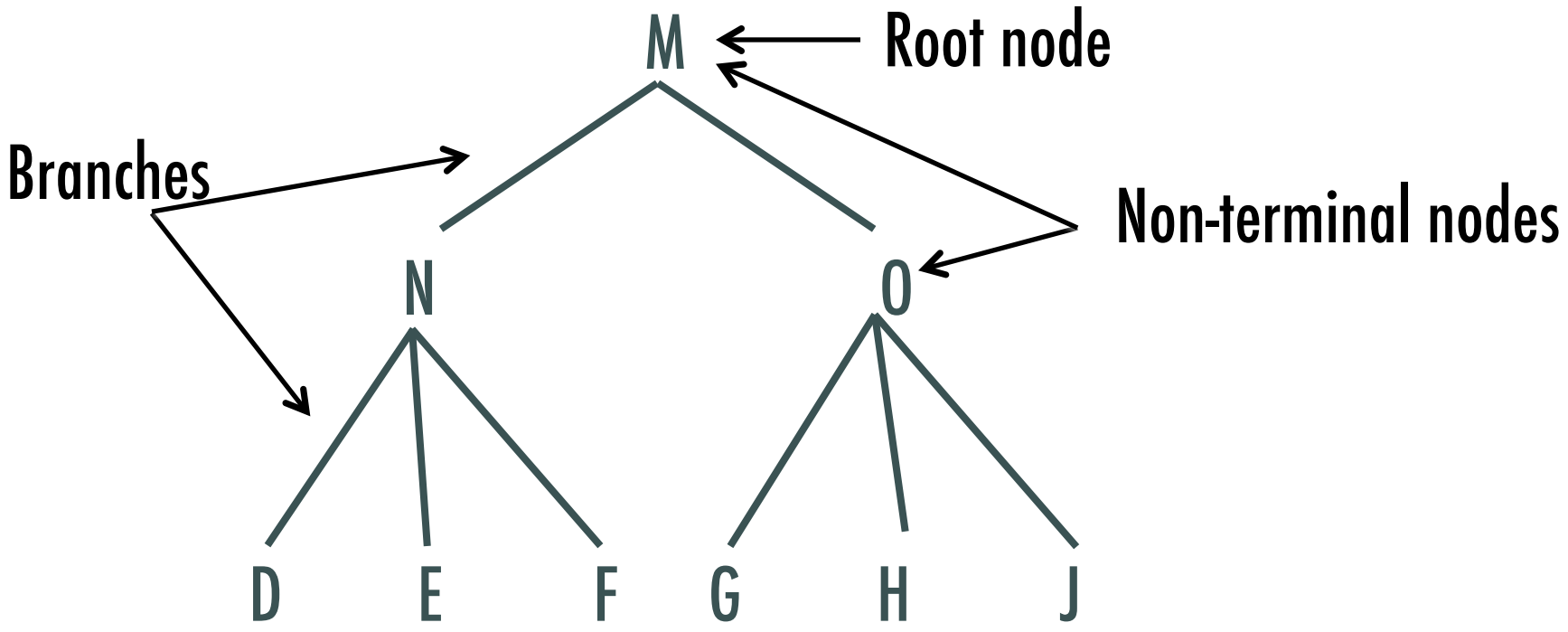

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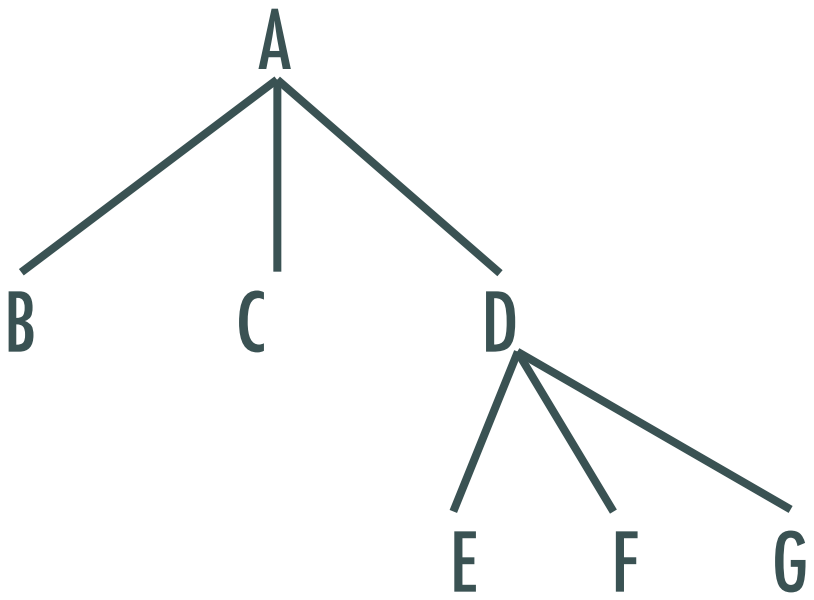

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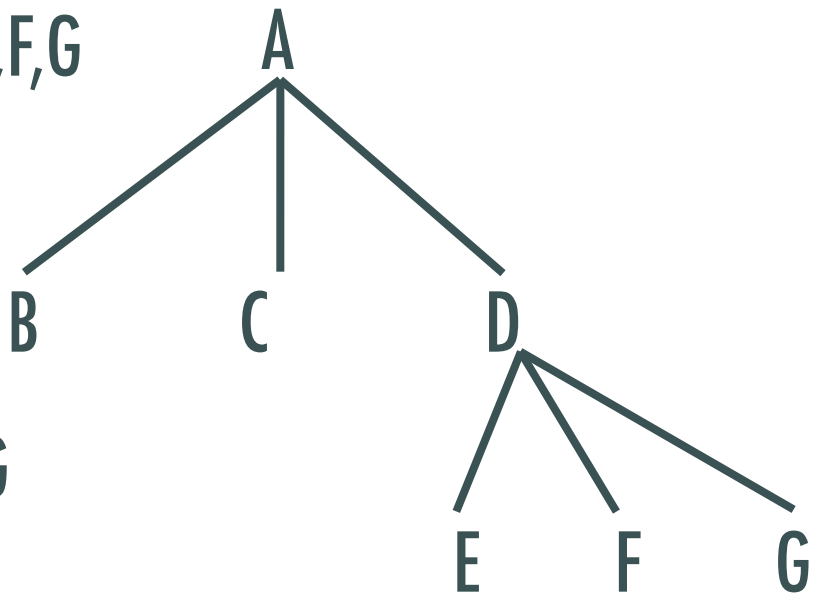
A dominates B,C,D,E,F,G

D dominates E,F,G



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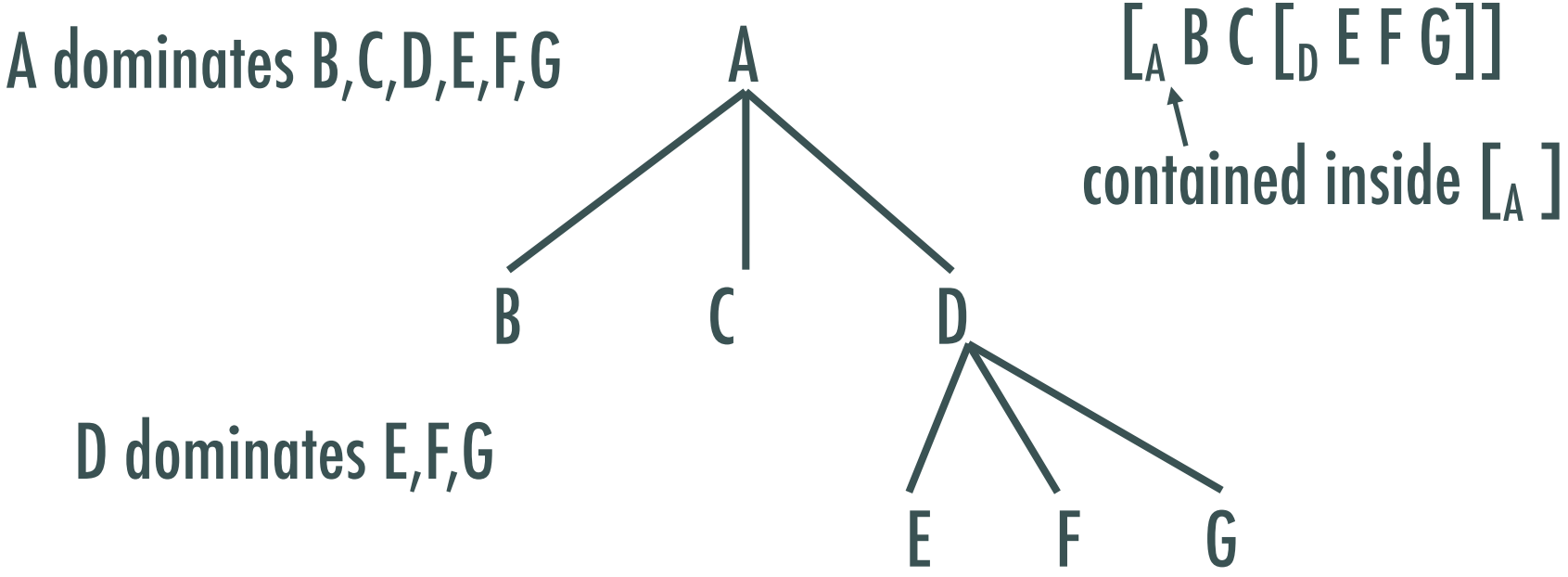

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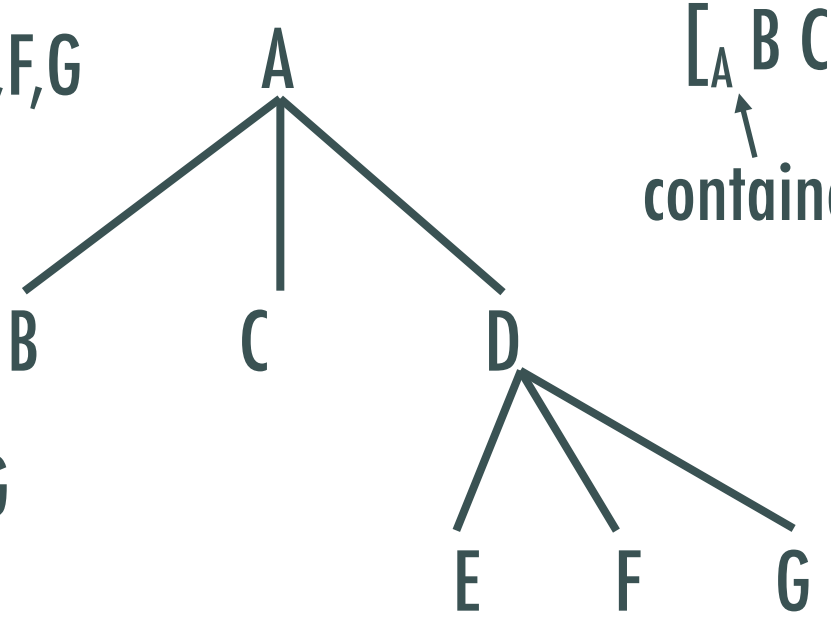

$[_A$ B C $[_D$ E F G]]

contained inside $[_A$]

D dominates E,F,G

Another way to think of it: "on top of"

Domination

- A slightly more formal definition:
  - Domination: Node A dominates node B if and only if A is higher up in the tree than B and if you can trace a line from A to B going only downwards.

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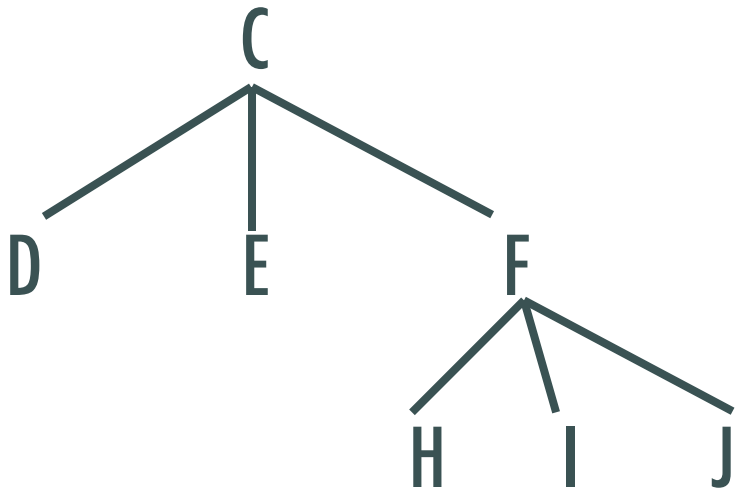

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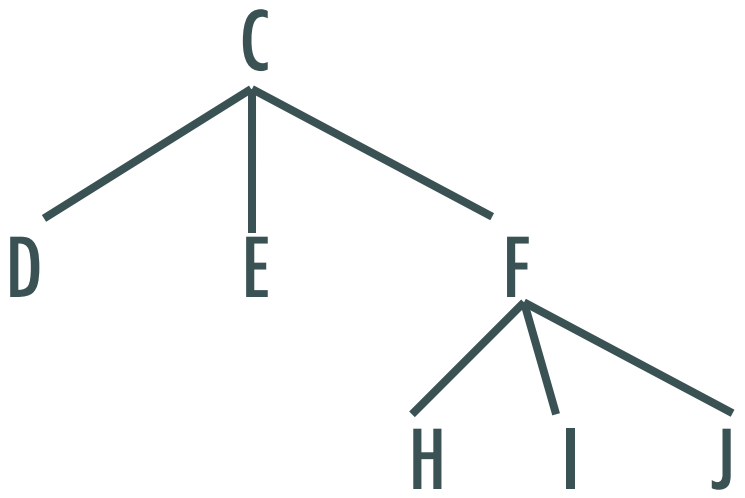


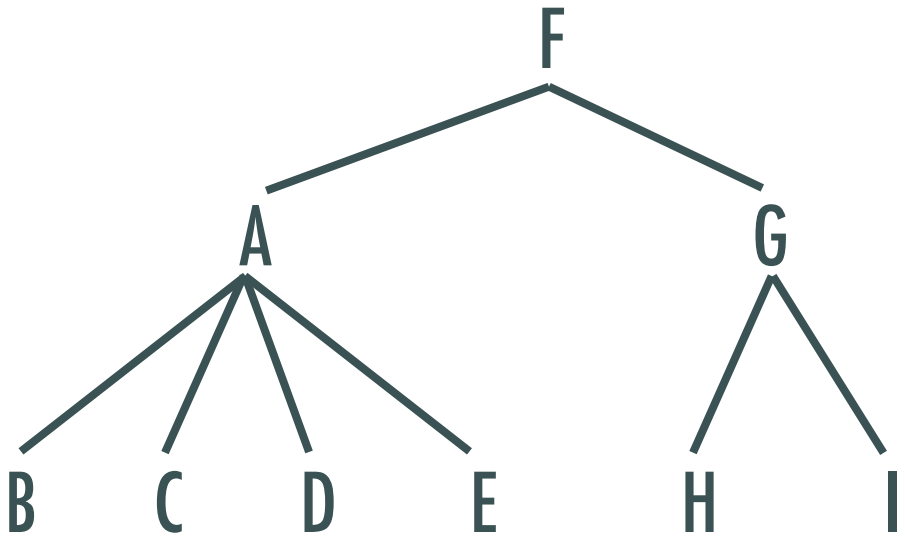
C dominates D, E, F, H, I, J

but C immediately dominates only D, E, F

Exhaustive Domination

- Node A exhaustively dominates a SET of TERMINAL nodes {B,C,…,D},
  - provided it dominates all the members of the set (so that there is no member of the set that is not dominated by A)
  - AND there is no terminal node G dominated by A that is not a member of the set.

Exhaustive Domination



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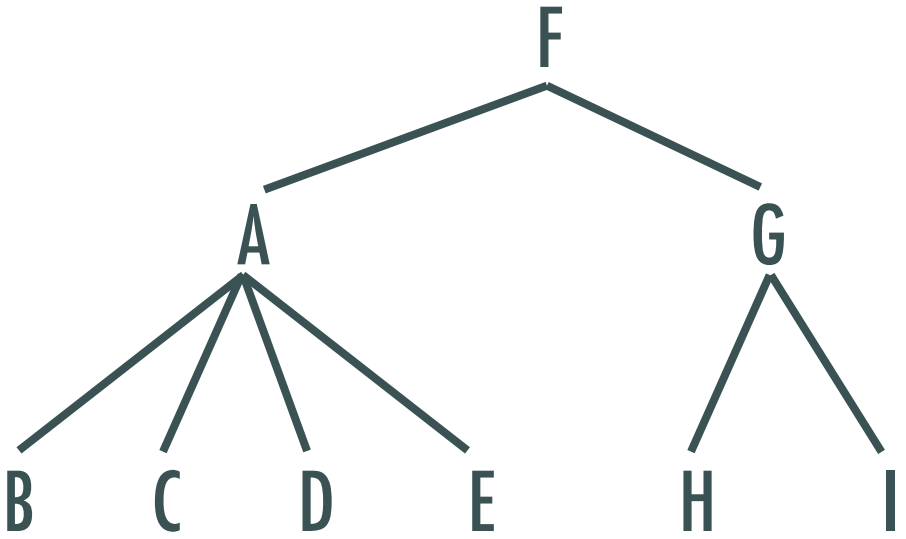

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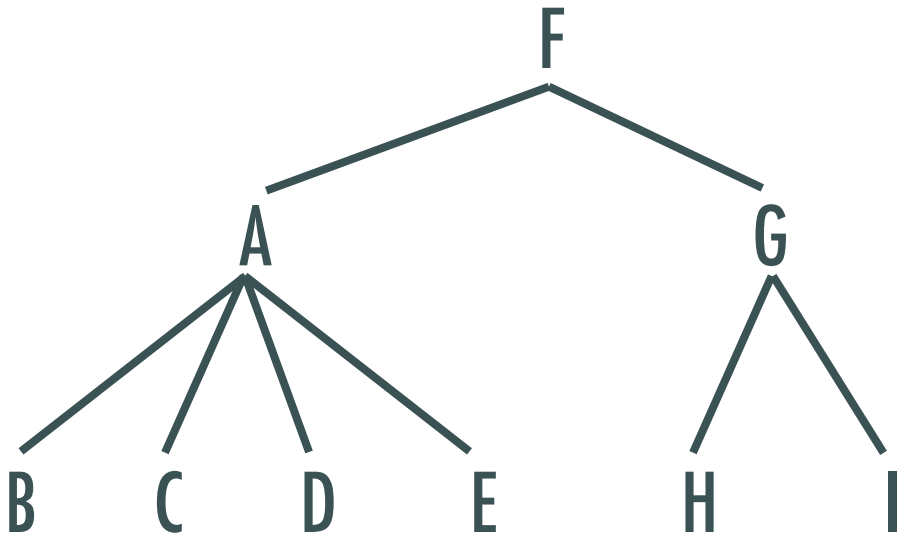

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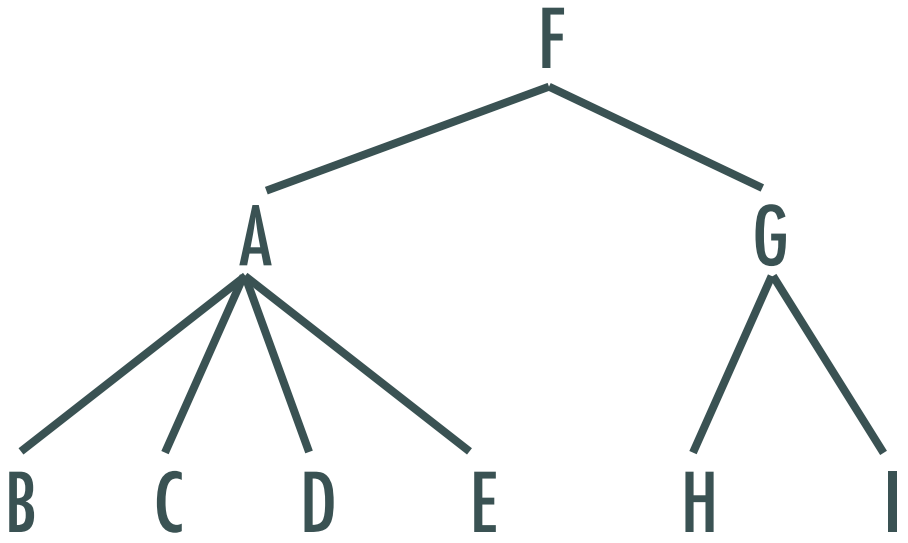

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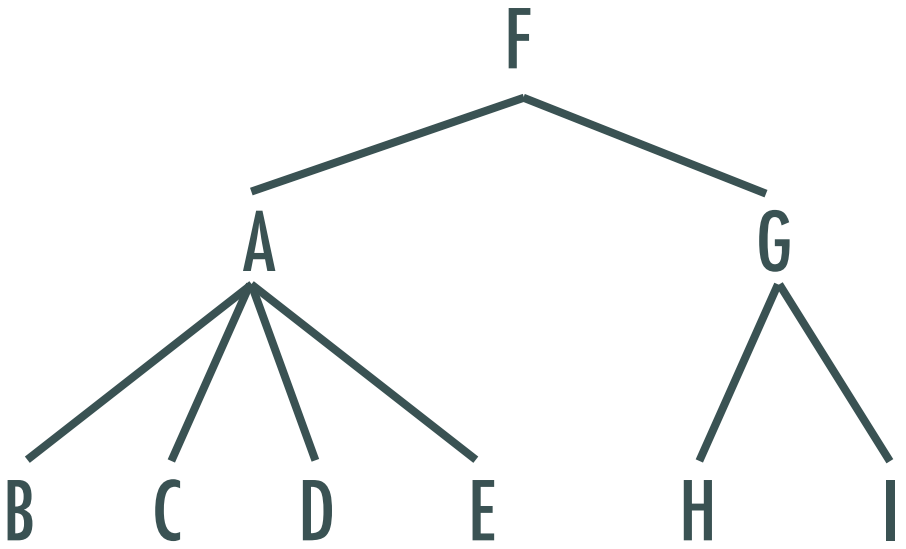

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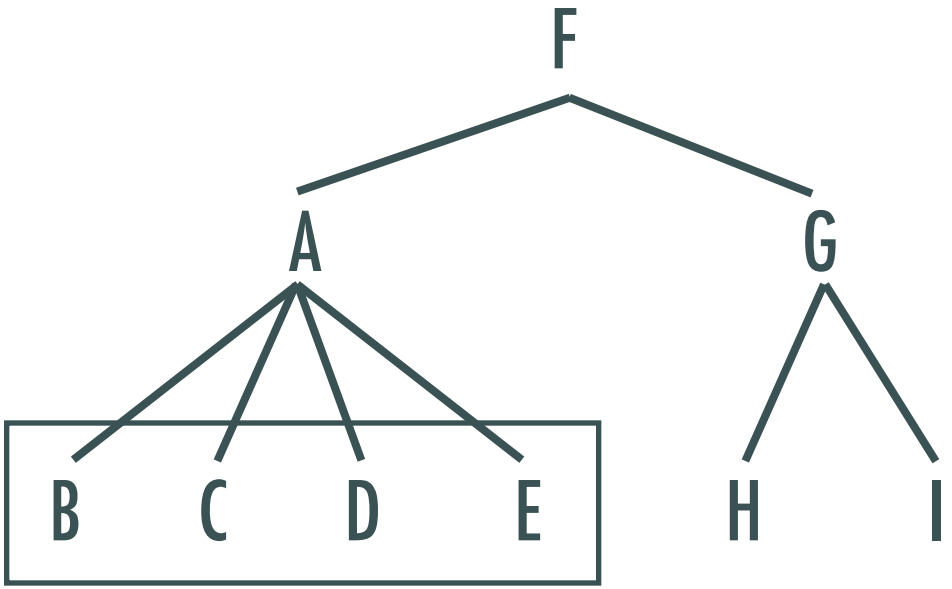

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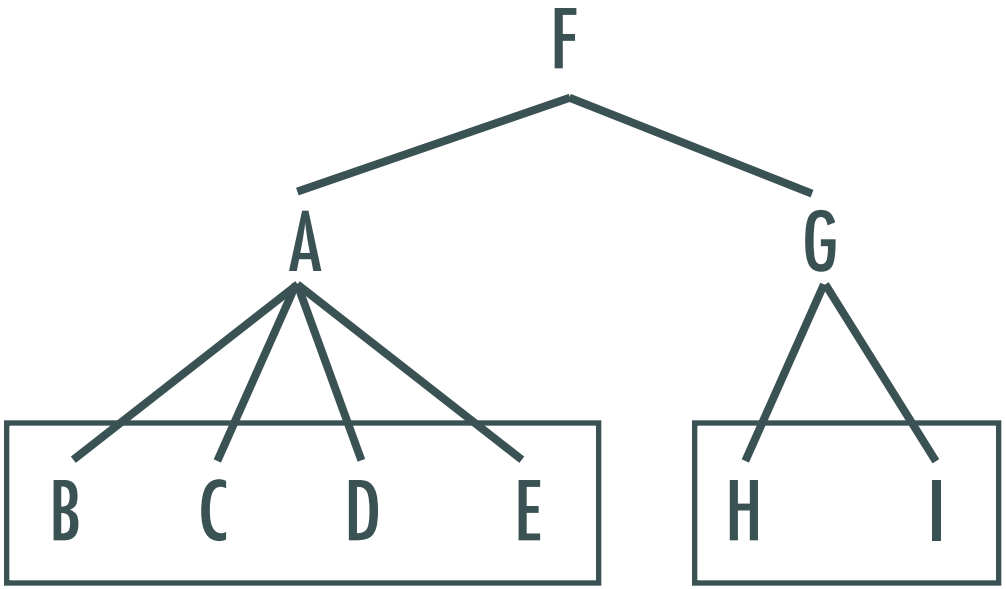

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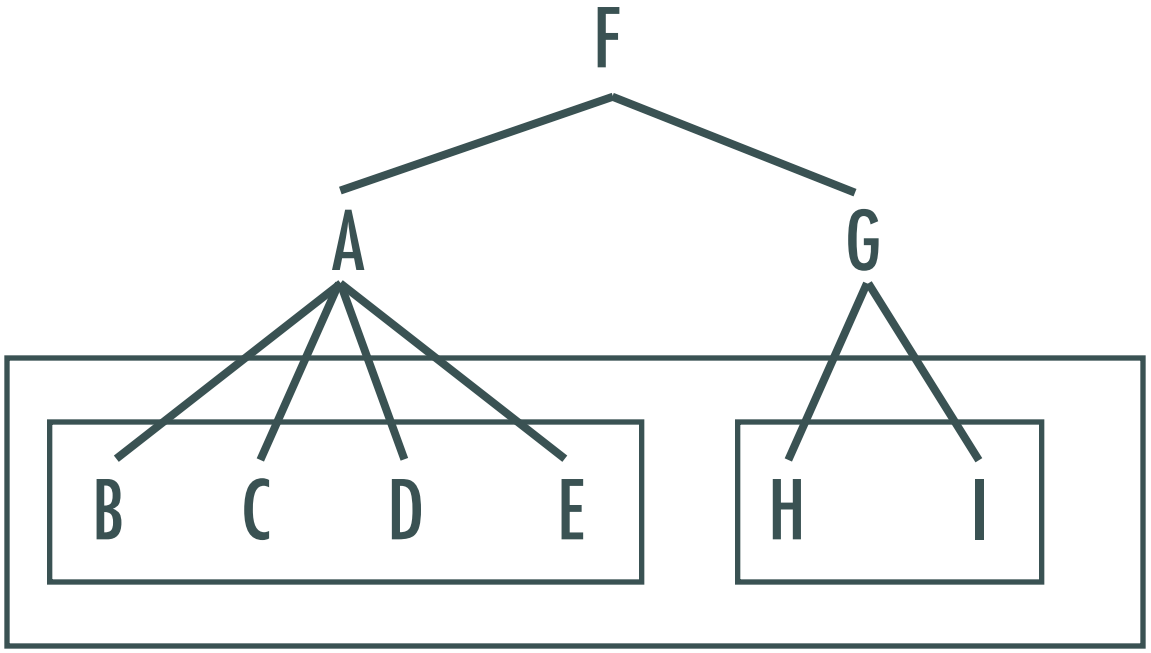

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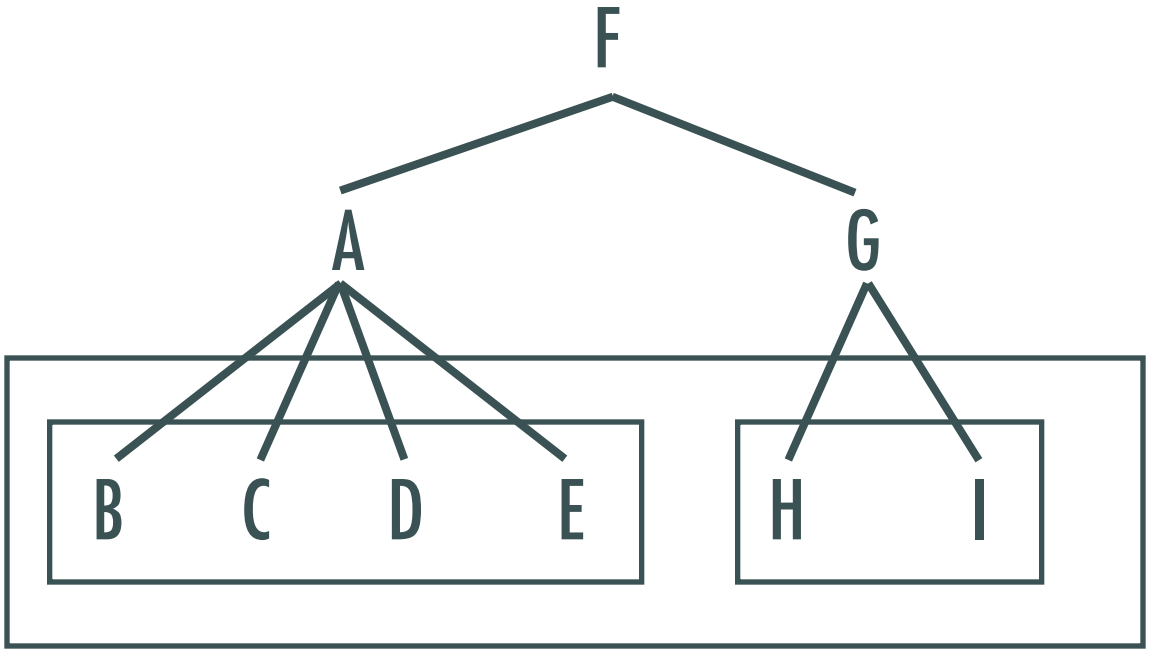

{E, H} are NOT a constituent

Constituent vs Constituent of

- Constituent of does NOT mean the same thing as constituent.
- Essentially 'constituent of' is the opposite of domination.
- A dominates B, then we say B is a constituent of A.
- immediate constituent of is the opposite of immediate domination.

Some Informal Terms

- Mother: the node that immediately dominates another.
- Daughter: the node that is immediately dominated by another (is an immediate constituent of another).
- Sisters: two nodes that share the same mother.

Root and Terminal Nodes

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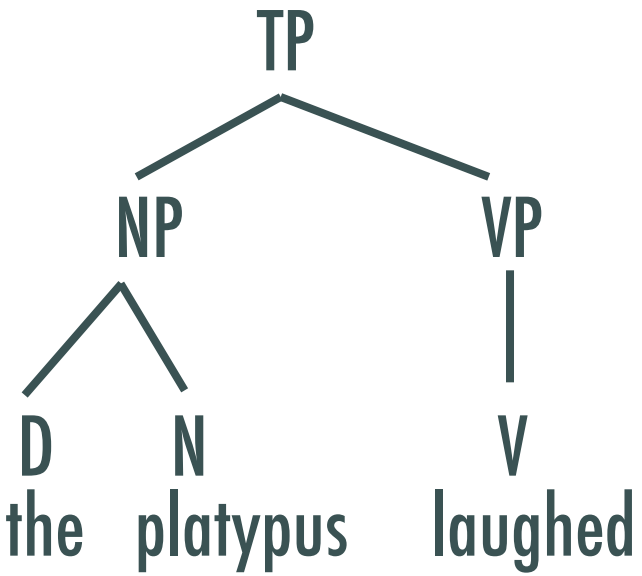

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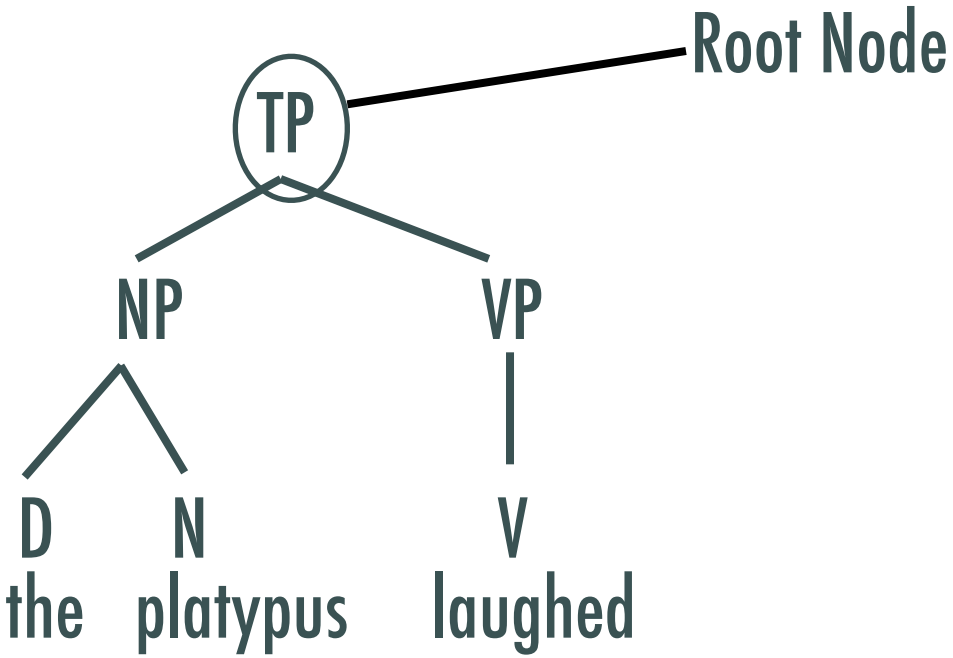

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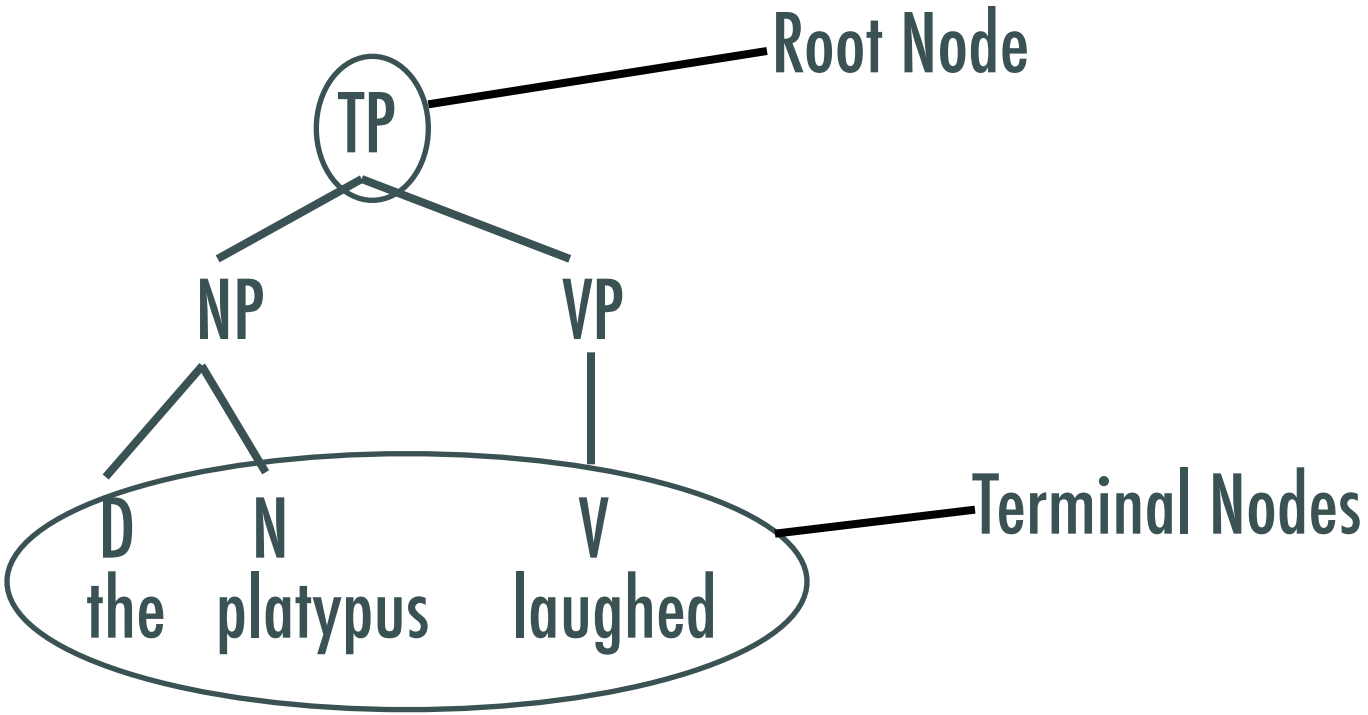

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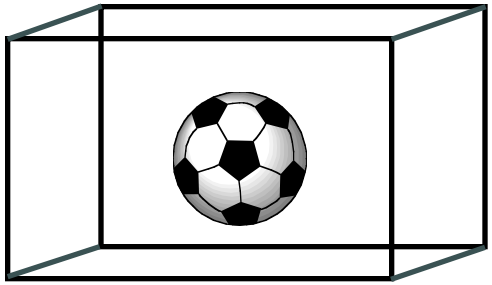

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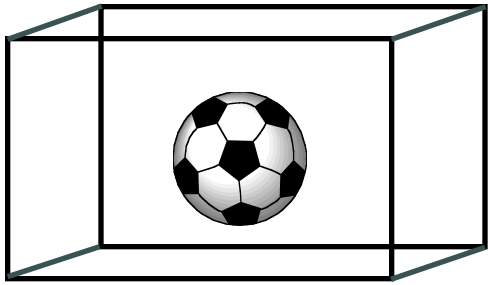

Is the ball to the left or right of the box?

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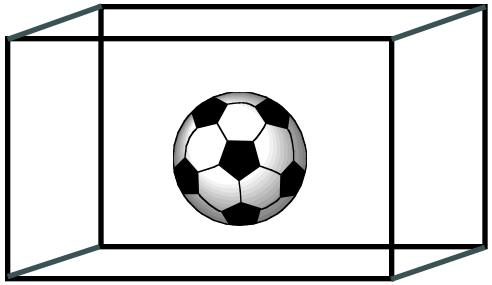

Is the ball to the left or right of the box?
Neither! You can't precede or follow something that dominates (contains) you or you dominate (contain).

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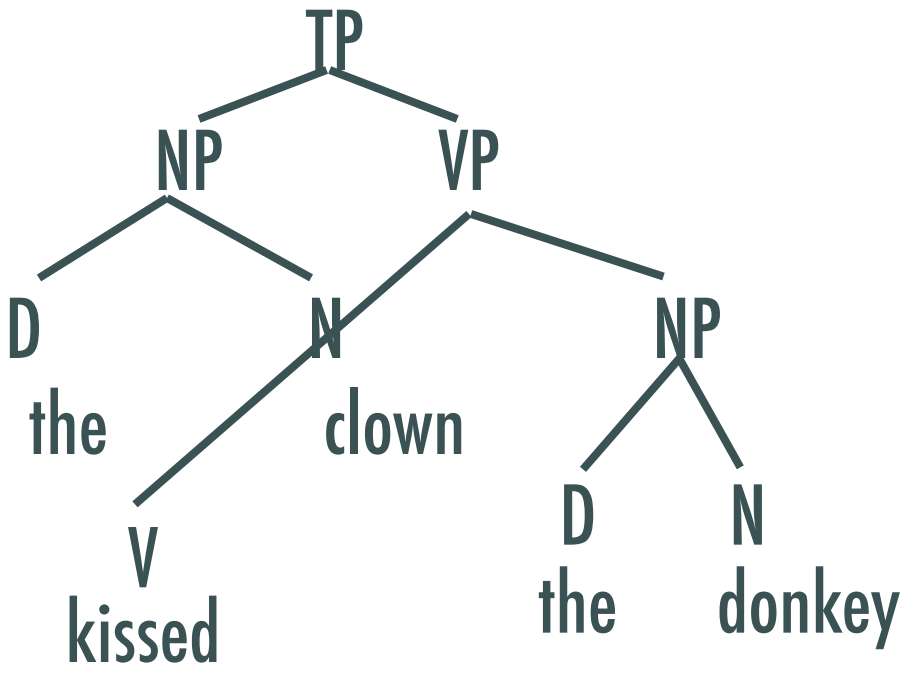

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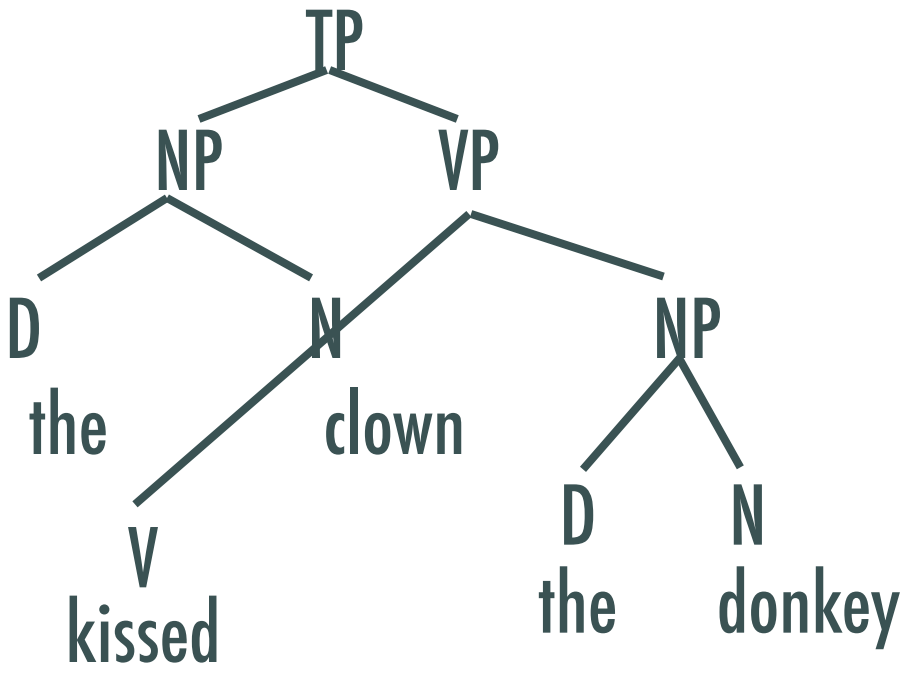

Does kiss precede clown?
Obviously not!

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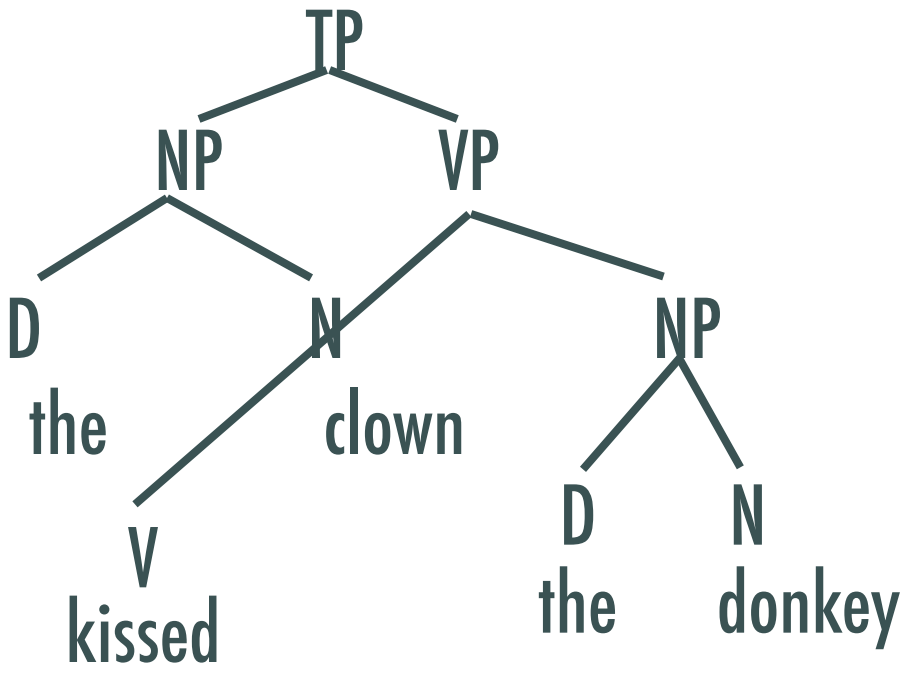

Does kiss precede clown?
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What is crucial here is that the dominator of clown precedes the dominator of kissed

Sister-Precedence

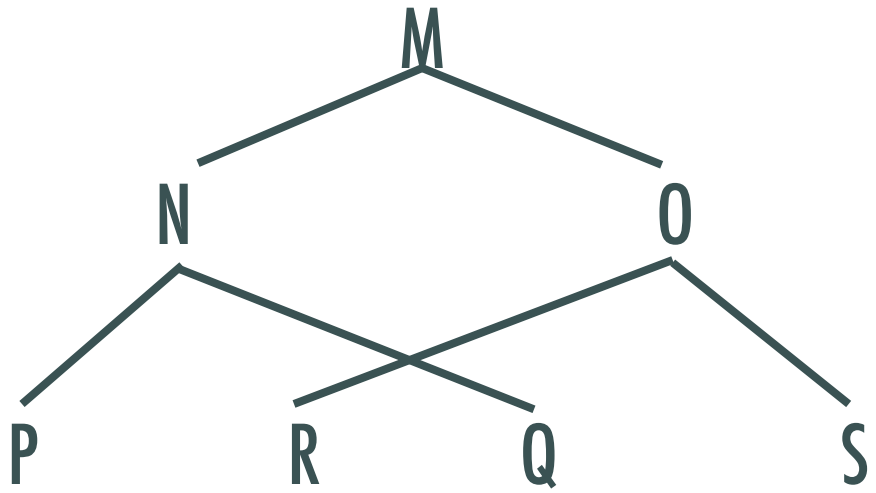
- In order to define precedence we're going to need a more local relation that refers to dominance. This is sister-precedence:
- A **sister-precedes** B if and only if
  - A and B are immediately dominated by the same node
  - A appears to the left of B

Precedence

- A Precedes B if and only iff
  - A does not dominate B and B does not dominate A AND
  - A (or some node dominating A) sister-precedes B (or some node dominating B).

No Crossing Branches Constraint

- If one node X precedes another node Y then X and all nodes dominated by X must precede Y and all nodes dominated by Y.



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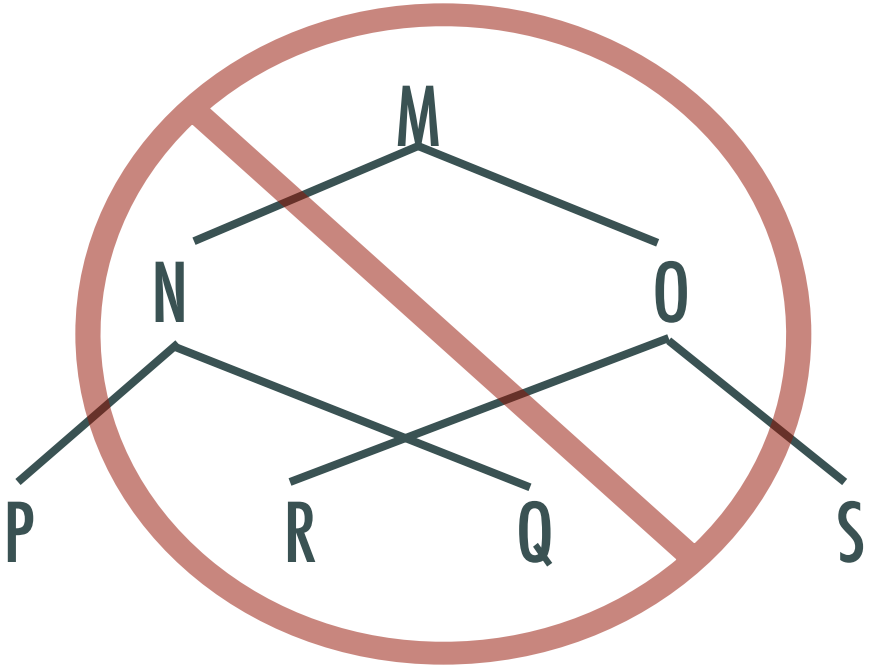

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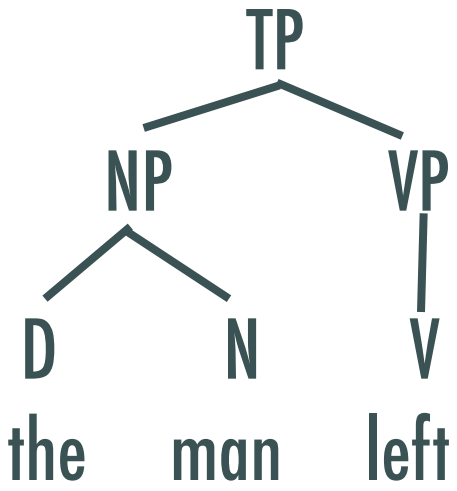

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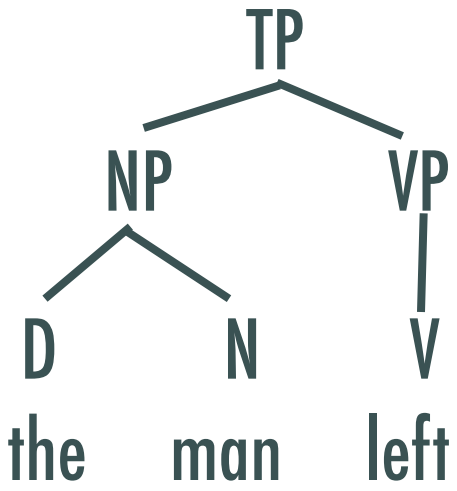

NP sister-precedes VP

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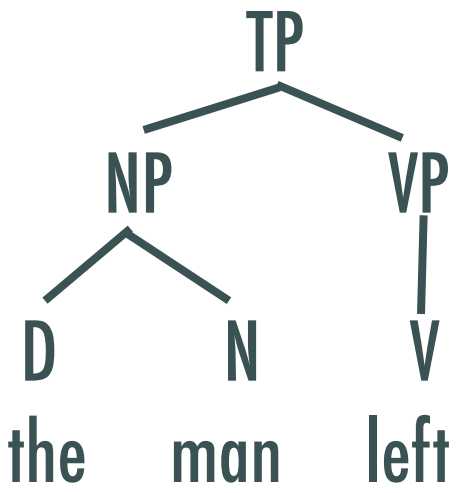

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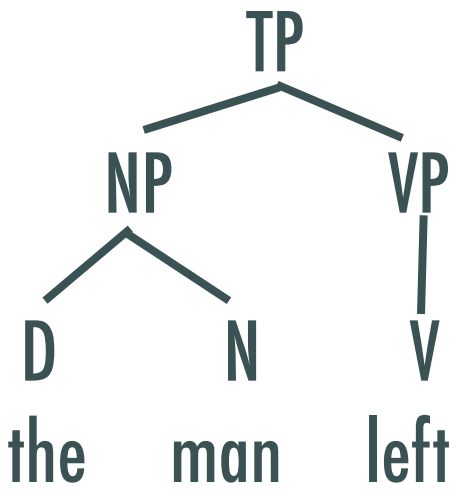
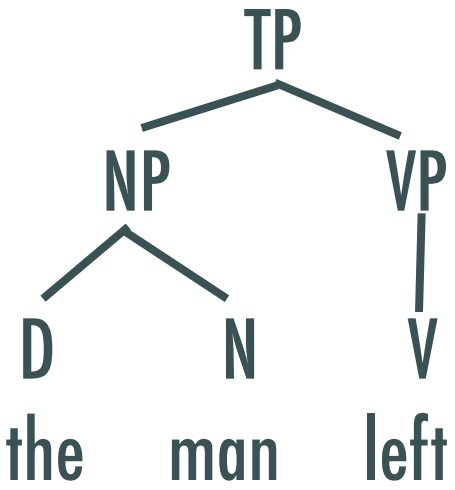


NP sister-precedes VP

D sister precedes N

N does NOT sister precede V (nor does D)

Sister-Precedence ≠ Immediate Precedence



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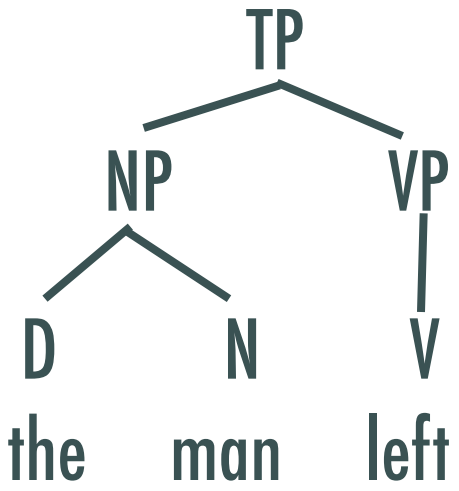

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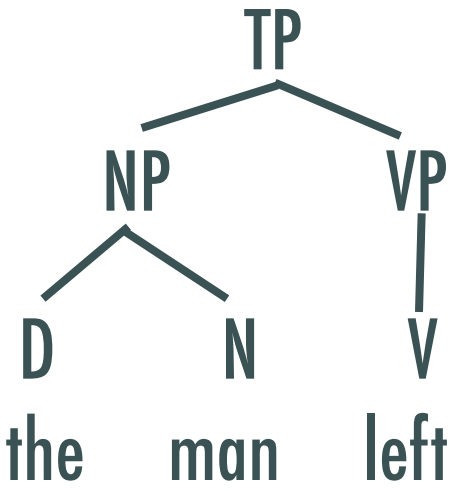

N does NOT sister-precede V

But N does immediately precede V

C-command

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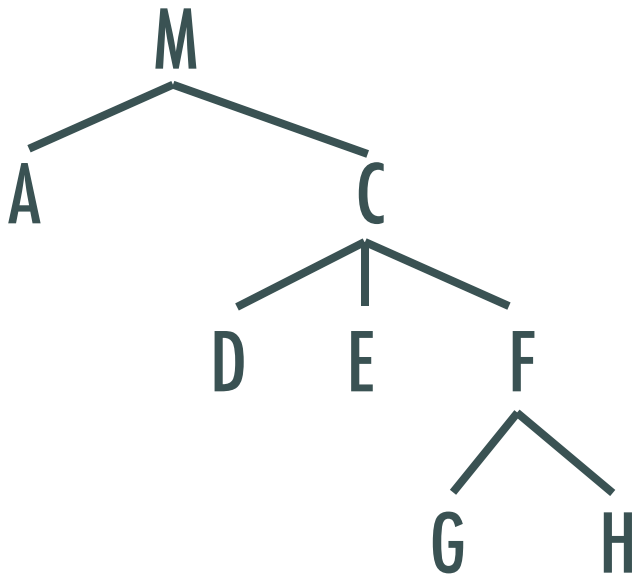

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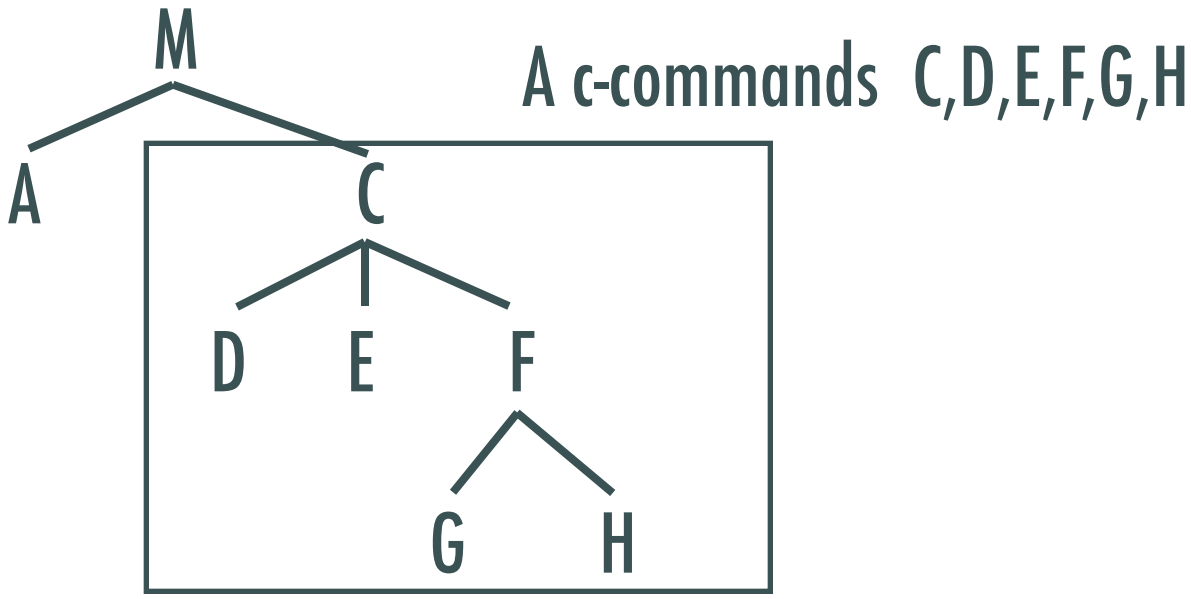

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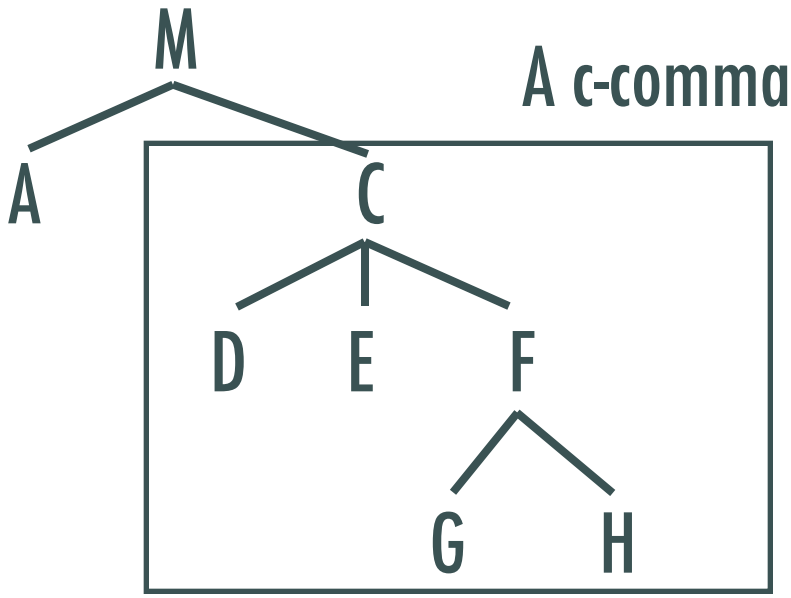

A c-commands C,D,E,F,G,H

Note: D does NOT c-command A

C-command

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Sisterhood & Aunthood

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Sisterhood & Aunthood

you can't command something you dominate

Symmetric C-command

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- A symmetrically c-commands B, if A c-commands B AND B c-commands A

Symmetric C-command

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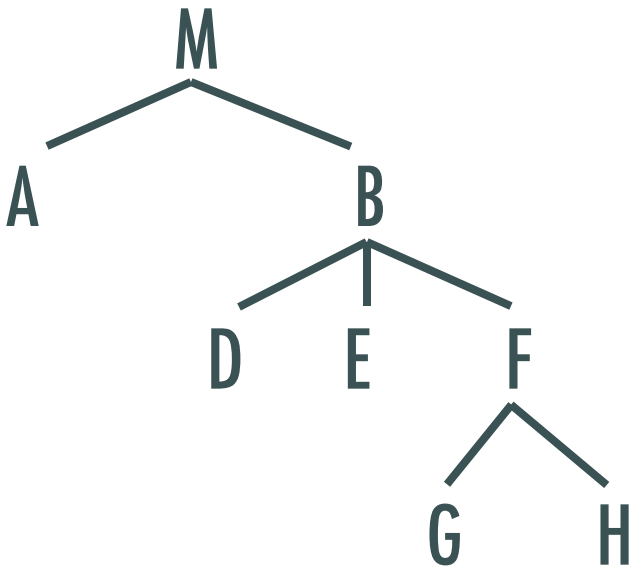

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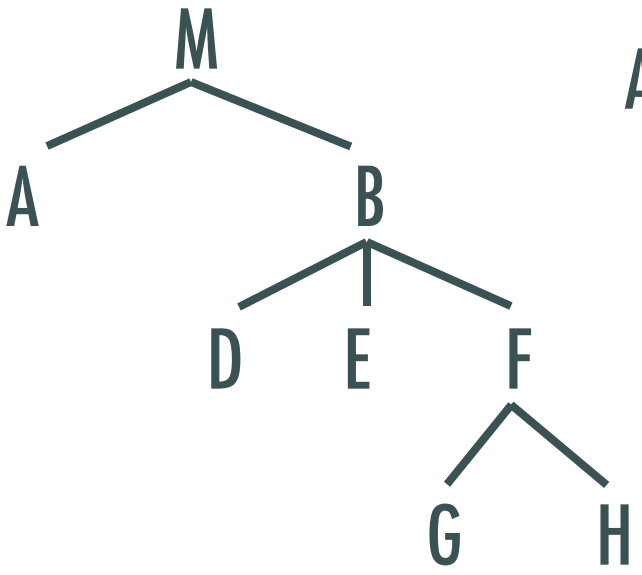

A & B symmetrically c-command one another

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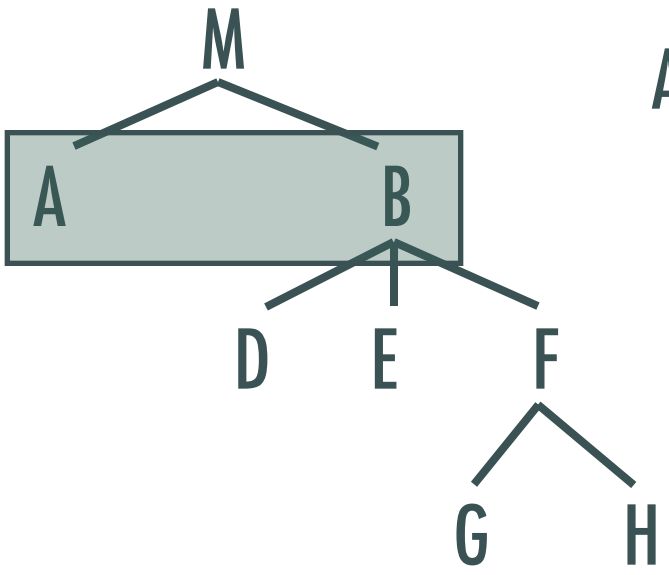

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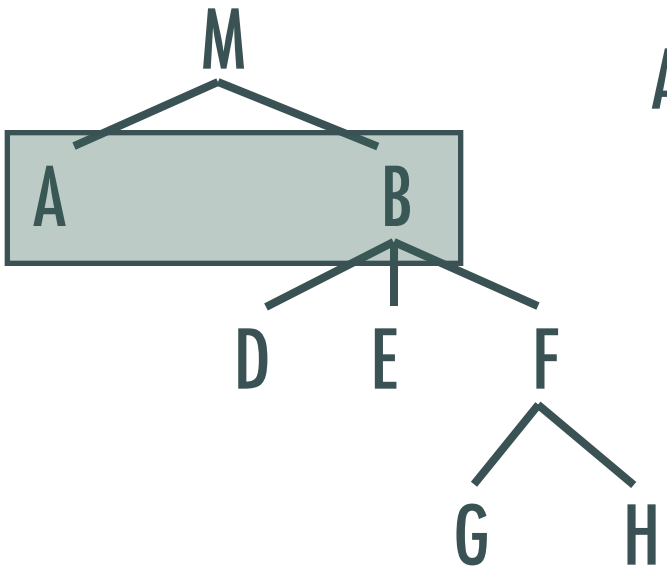

A & B symmetrically c-command one another

A does NOT symmetrically c-command D

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- A asymmetrically c-commands B, if A c-commands B but B does NOT c-command A.
  - (intuitively -- A is B's aunt)

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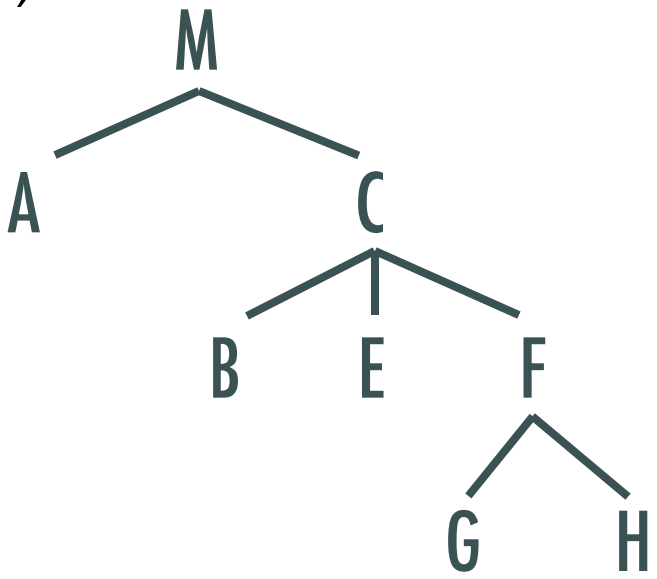

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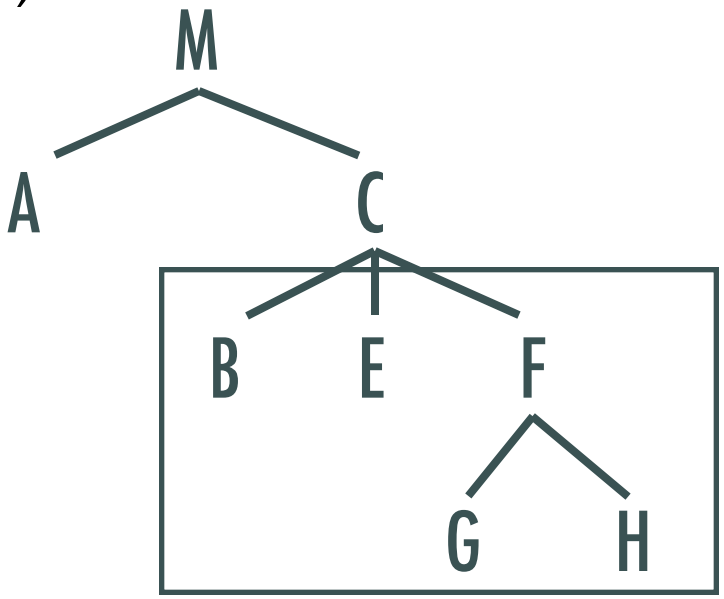
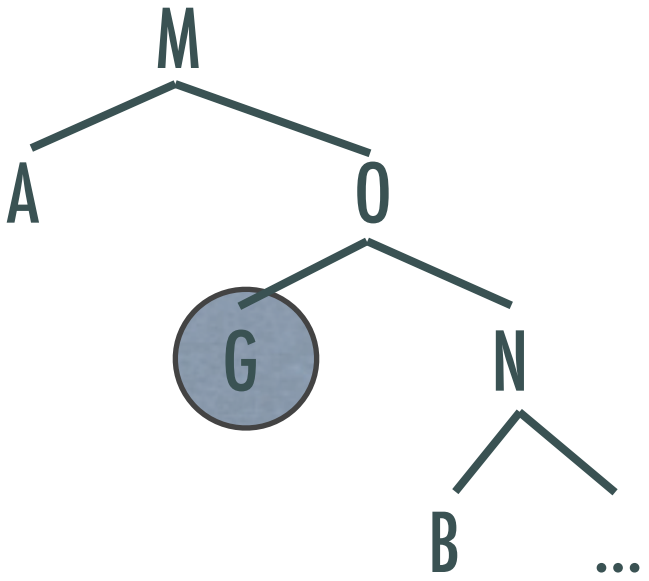


Government

- Local version of c-command
- Government (first version): Node A governs node B if A c-commands B, and there is no node G, such that G is c-commanded by A and G asymmetrically c-commands B.

Intervenor



Relativized Government

Government

Node A governs node B if A c-commands B and there is no node G such that G is c-commanded by A and G asymmetrically c-commands B.

Phrase-government: If A is a phrase, then G must also be a phrase.

Head-government: If A is a head (word), G must also be a head.

Grammatical Relations

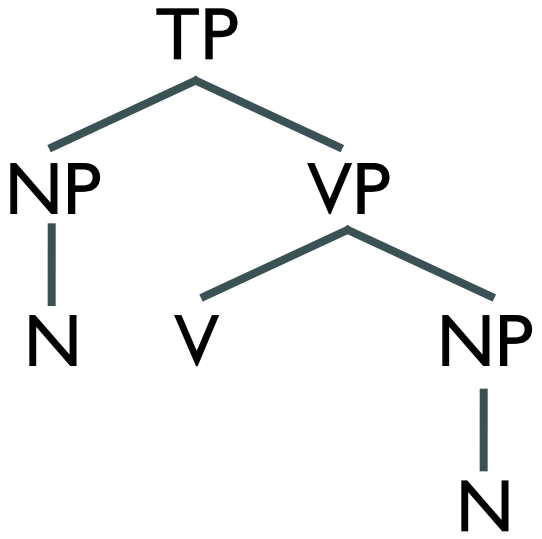
- Subject: NP/CP daughter of TP
- Object of a Preposition: NP daughter of PP
- Direct Object:
  - With verbs of type $V_{[NP\_\_NP]}$, $V_{[NP\_\_CP]}$ and $V_{[NP\_\_NP\ PP]}$, the NP or CP daughter of VP
  - With verbs of type $V_{[NP\ \_\_\ NP\ \{NP/CP\}]}$, an NP or CP daughter of VP that is preceded by an NP daughter of VP.

Grammatical Relations

- Indirect Object: This is the 1st object indicating the goal of a verb of transfer (a ditransitive) or the PP of the same kind of verb:
  - With verbs of type V[NP__ NP PP], the PP daughter of VP immediately preceded by an NP daughter of VP.
  - With verbs of type V[NP __ NP {NP/CP}], the NP daughter of VP immediately preceded by V (i.e. the first NP daughter of VP)
- Oblique: any other NP/PP in the sentence.

Grammatical Relations

Grammatical Relations



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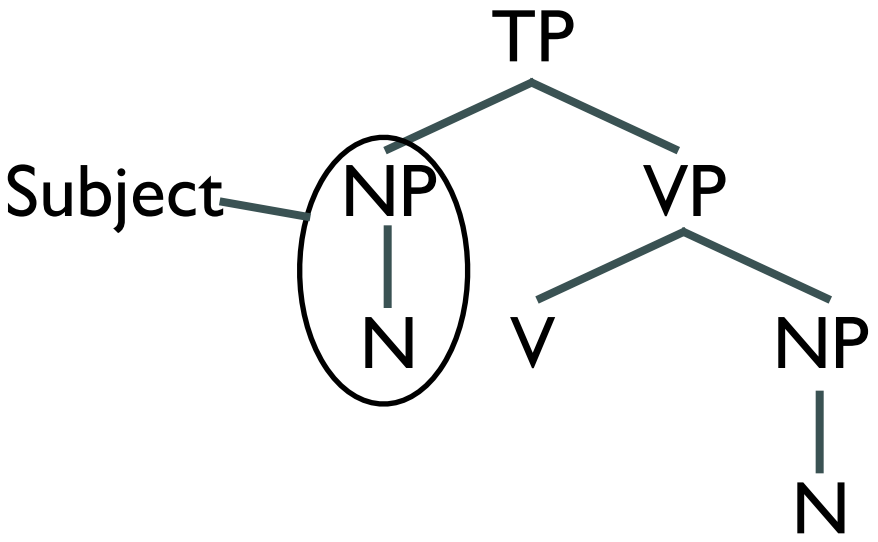

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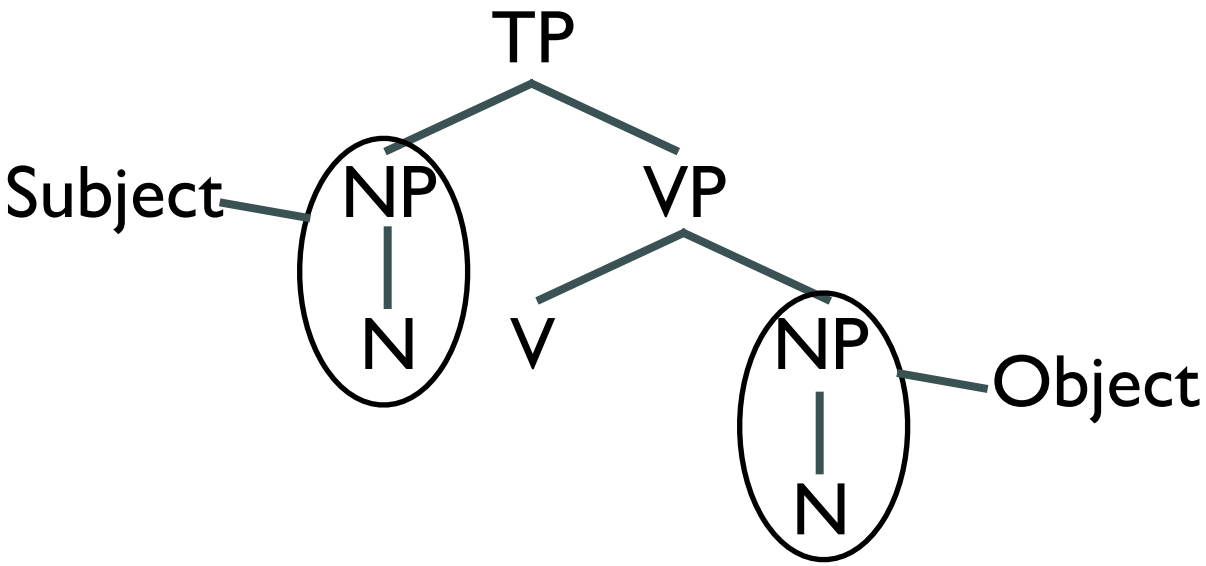

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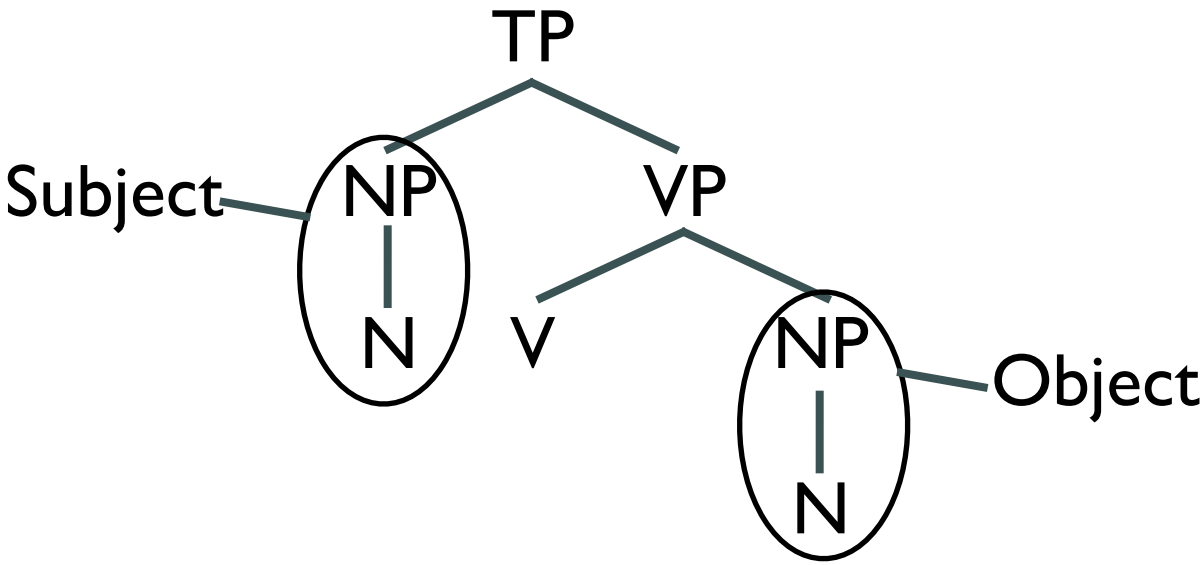

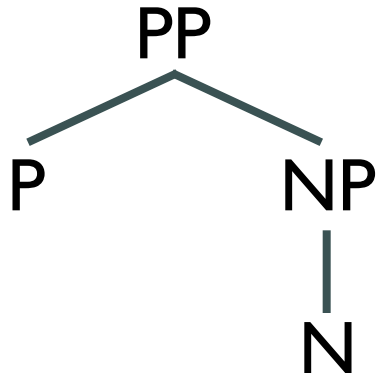

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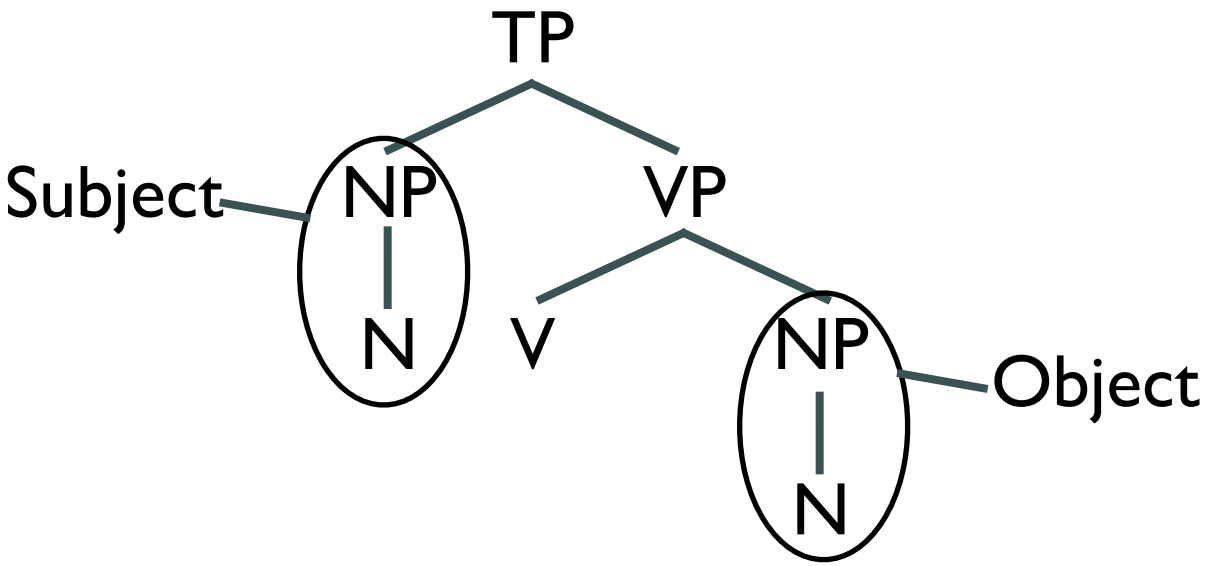

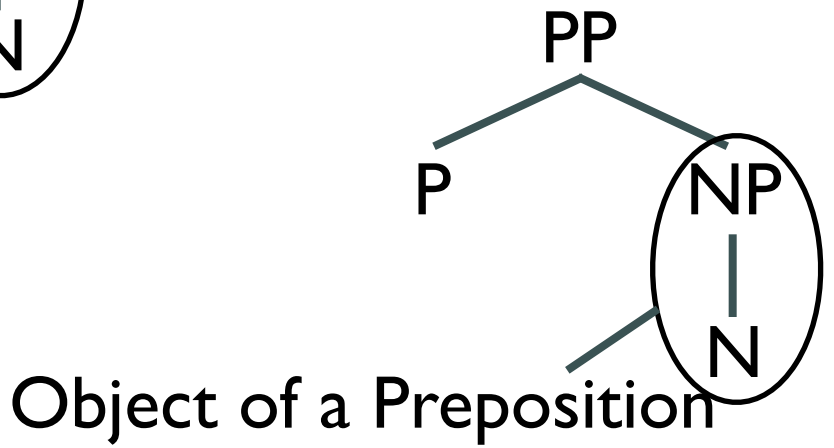

Grammatical Relations

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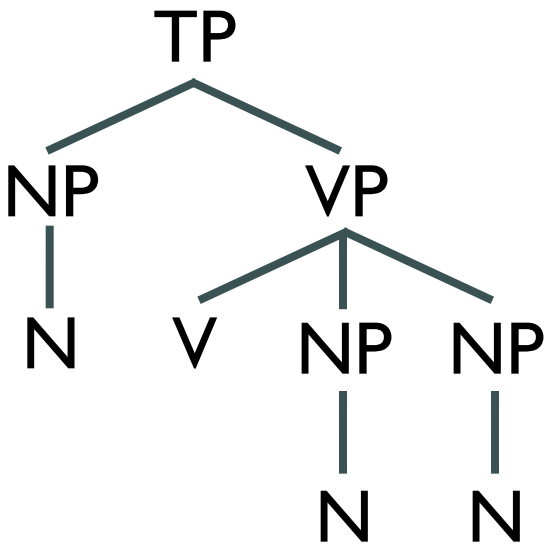

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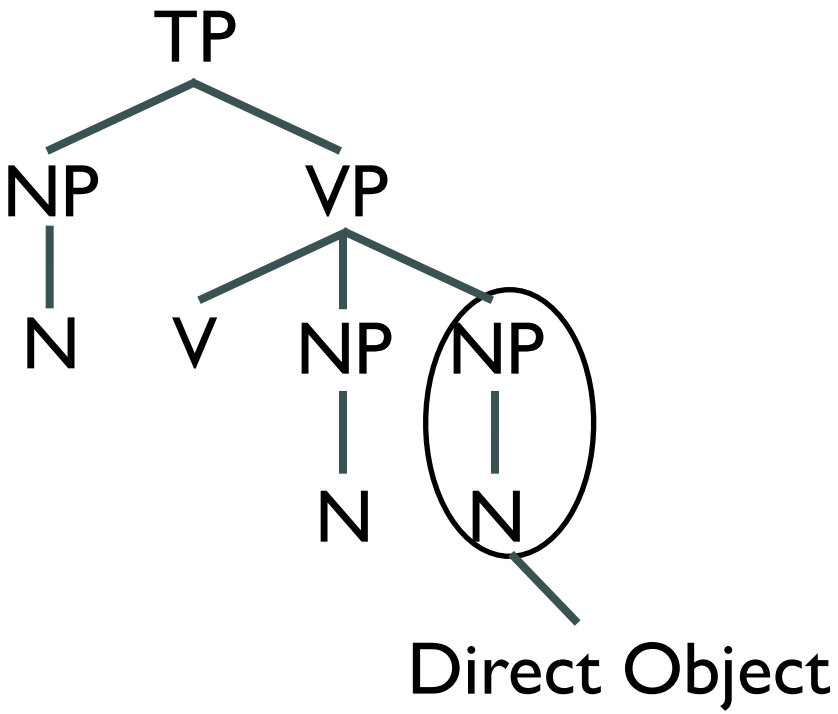

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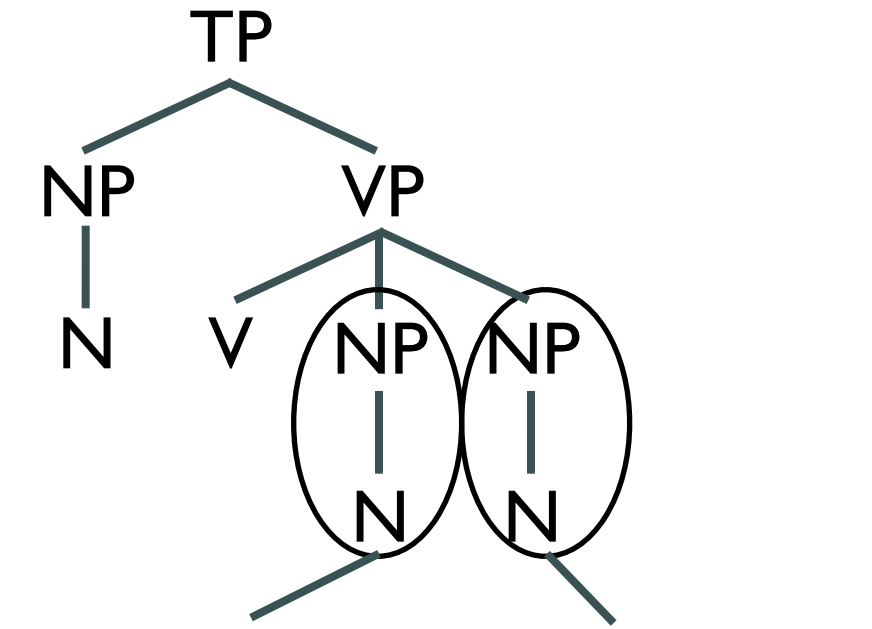

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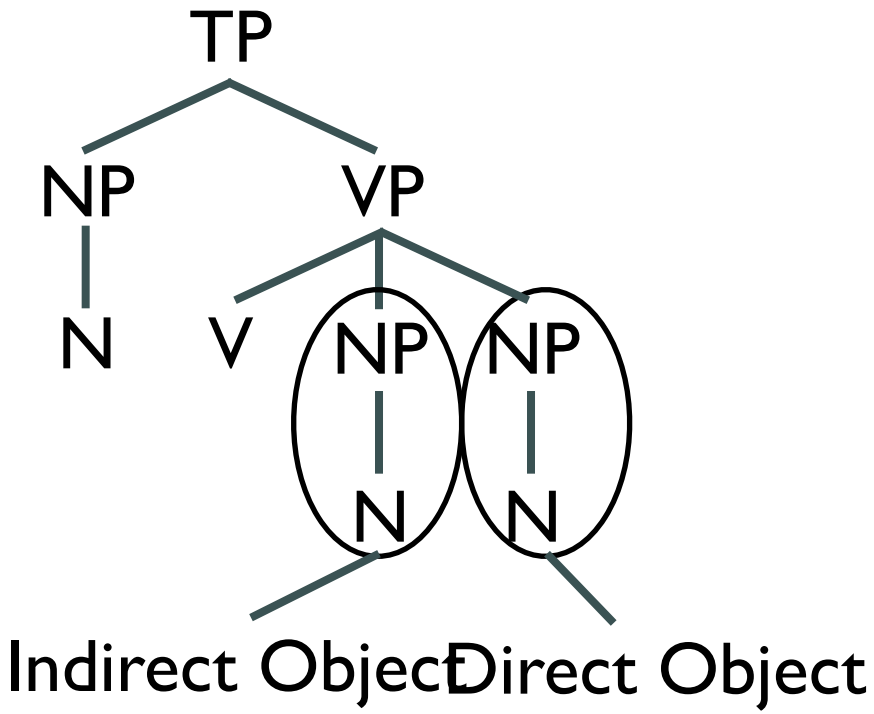

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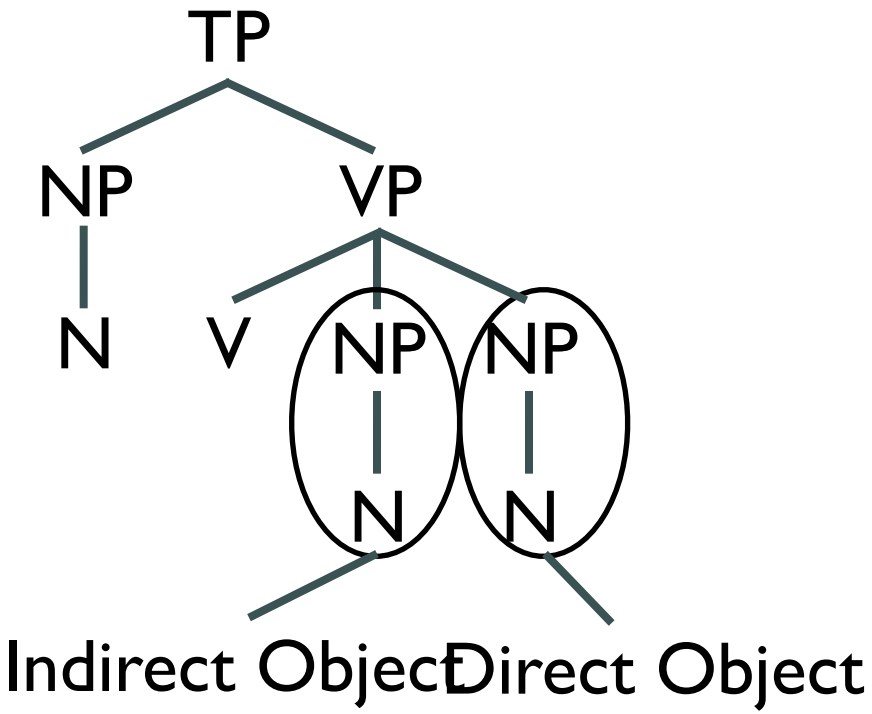

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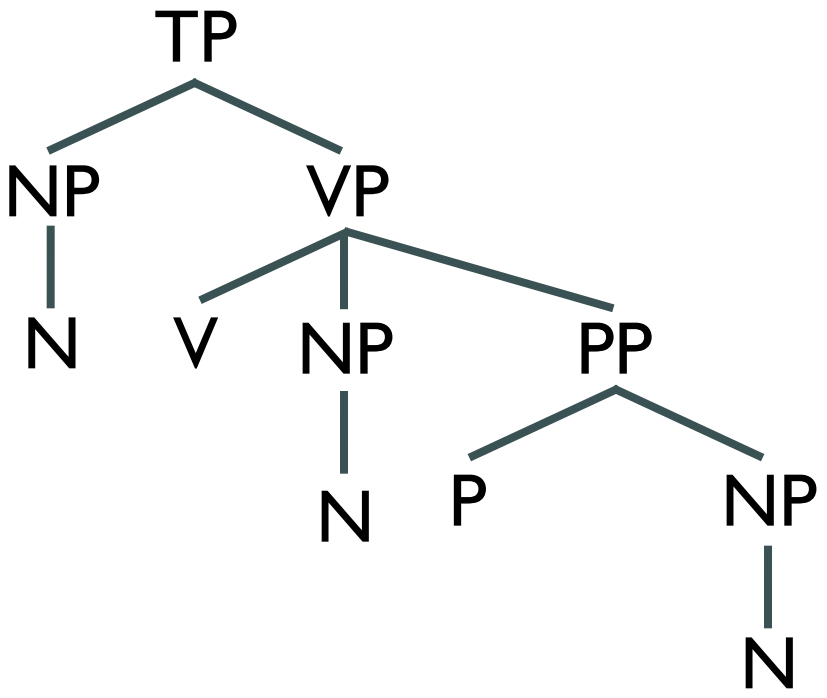

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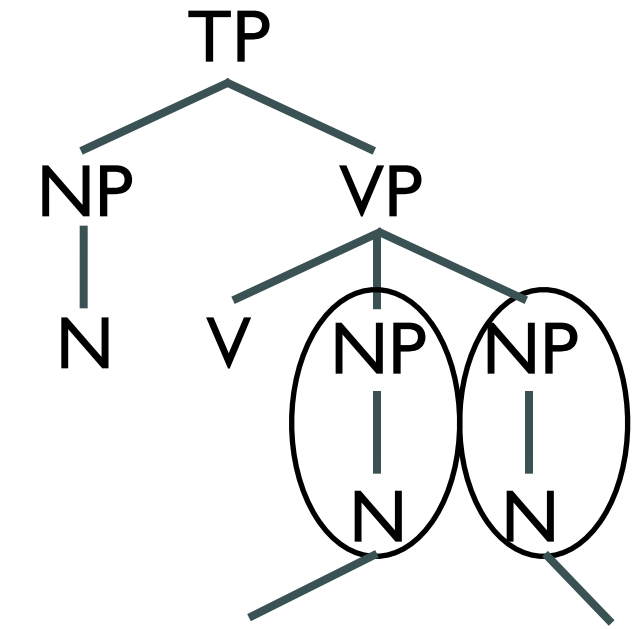
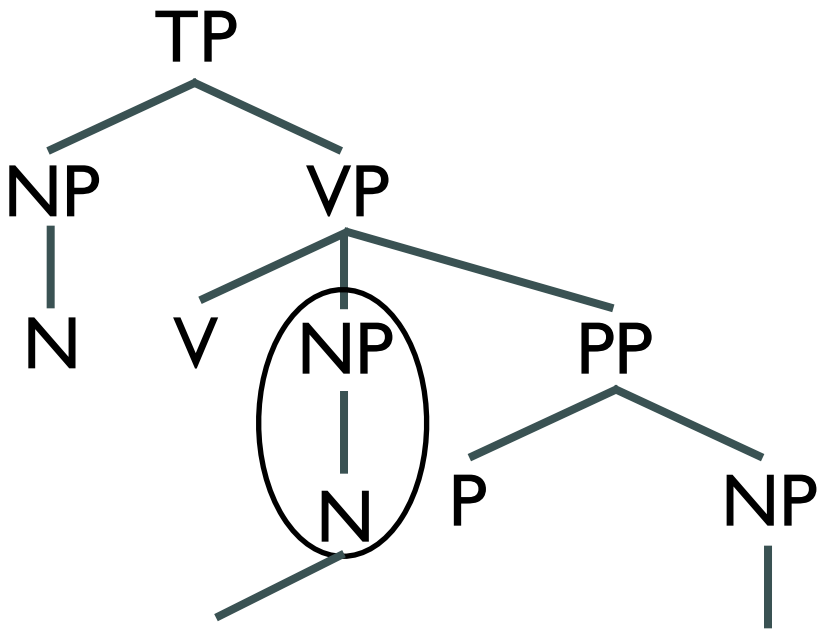


Indirect Object Direct Object



Direct Object

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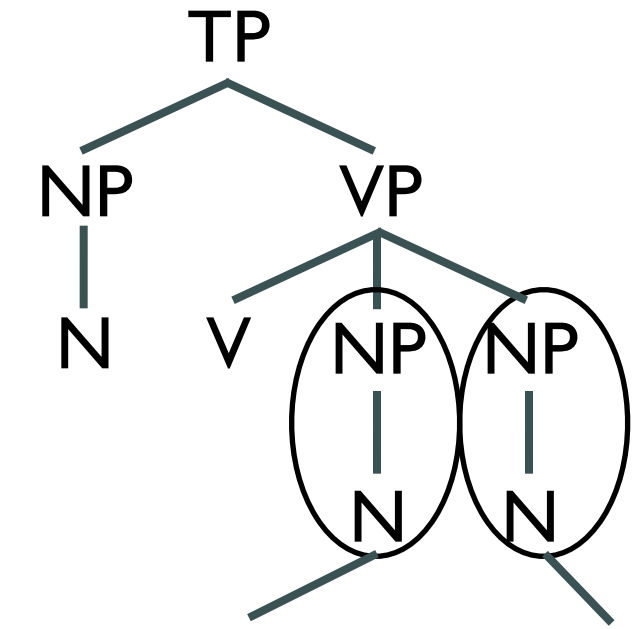
I gave the book <u>to Adam</u>

Grammatical Relations



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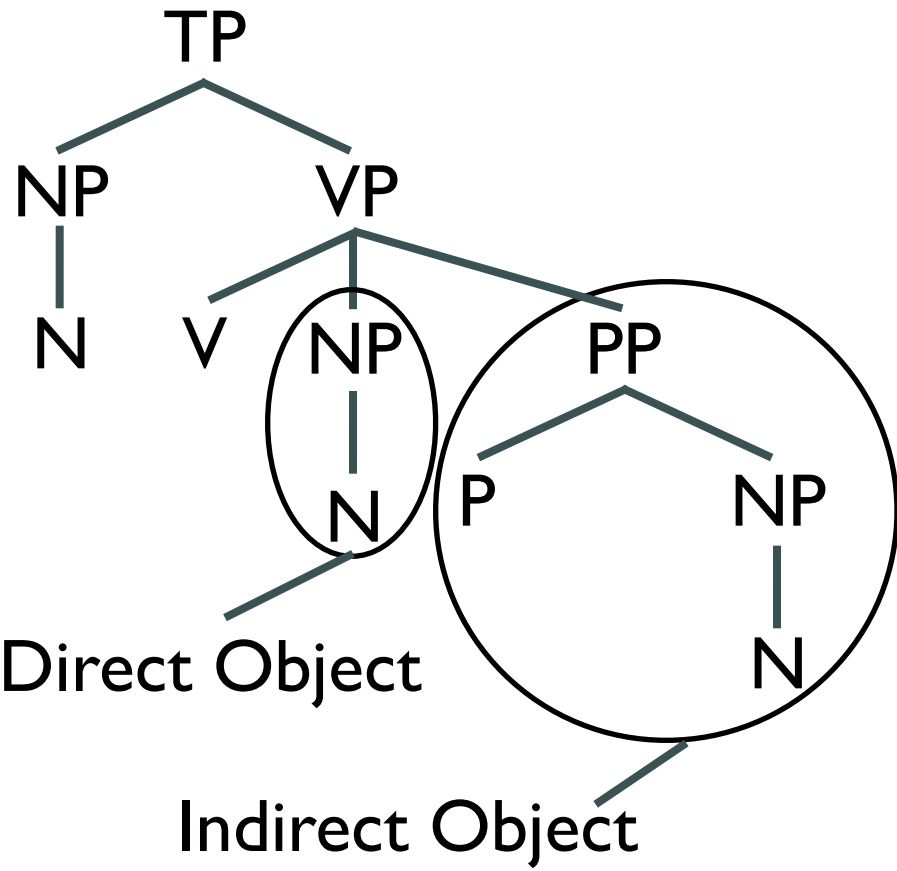

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Summary

- Structural Relations: relationships between nodes.
- Dominance (=containment)
  - immediate dominance (=motherhood)
  - exhaustive dominance (=constituent)
- Precedence (≃to the left)
  - immediate precedence (=adjacent & to the left)

Summary

- C-command: sisters & nieces
  - Symmetric C-command: sisters
  - Asymmetric C-command: Aunt asymmetrically c-commands nieces
- Grammatical Relations: Subject, Direct Object, Indirect Object, Object of a Preposition.