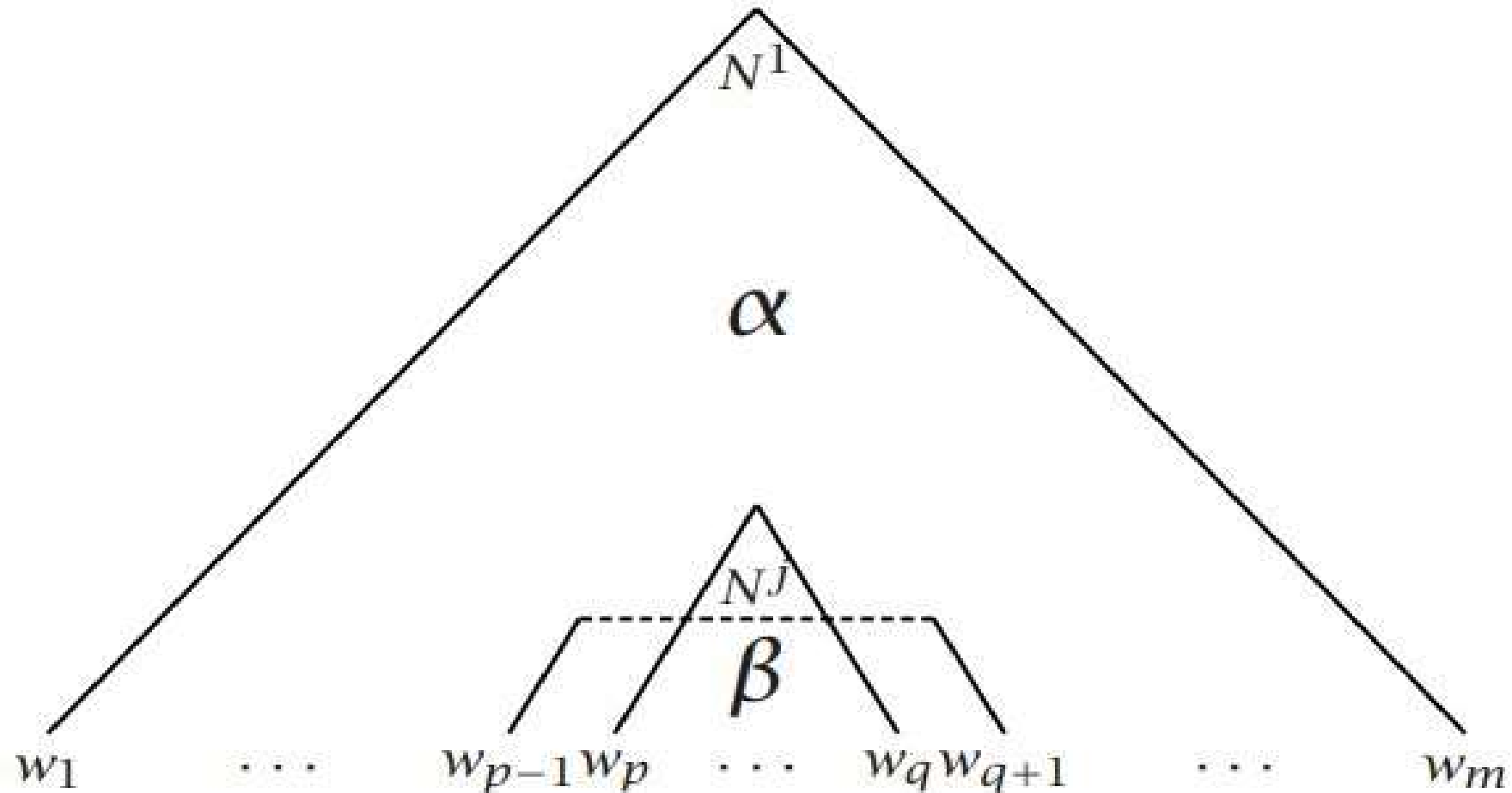

Inside and outside probabilities in PCFGs

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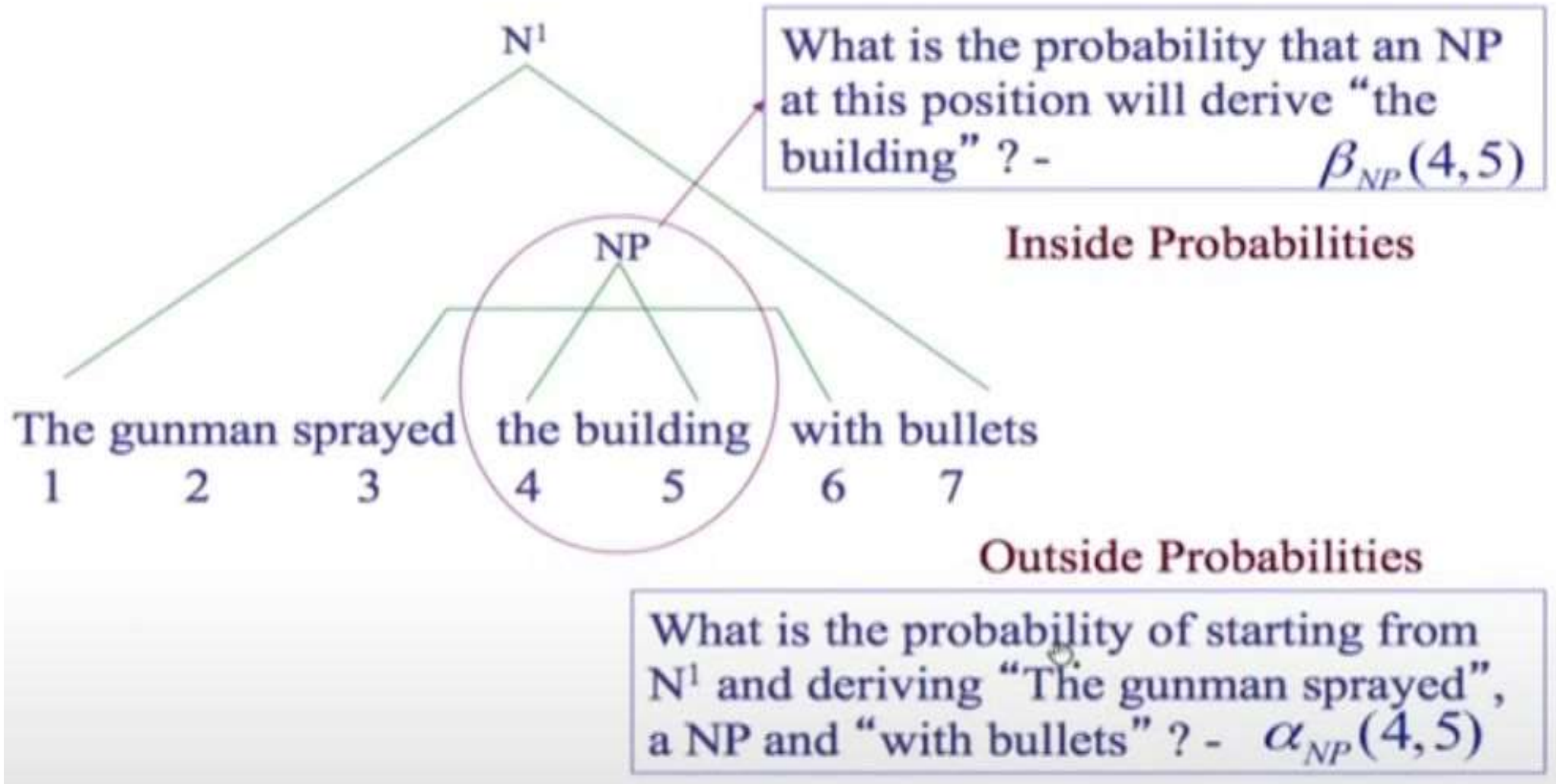


Outside: $\alpha_j(p, q) = P(w_{1(p-1)}, N^j_{pq}, w_{(q+1)m} | G)$
Inside: $\beta_j(p, q) = P(w_{pq} | N^j_{pq}, G)$

It is parameterized for certain node of the tree.

- So sentence having words W_1 to W_m , N^1 is a non-terminal that derives whole sequence of a words using the grammar.
- Now we can put parameter N^J , that N^J is having non-terminal NP, VP, JJ etc.
- Now assume that N^J is deriving sequence /words W_P to W_Q .
- With respect to this assumption we can define inside and outside probability.

Example

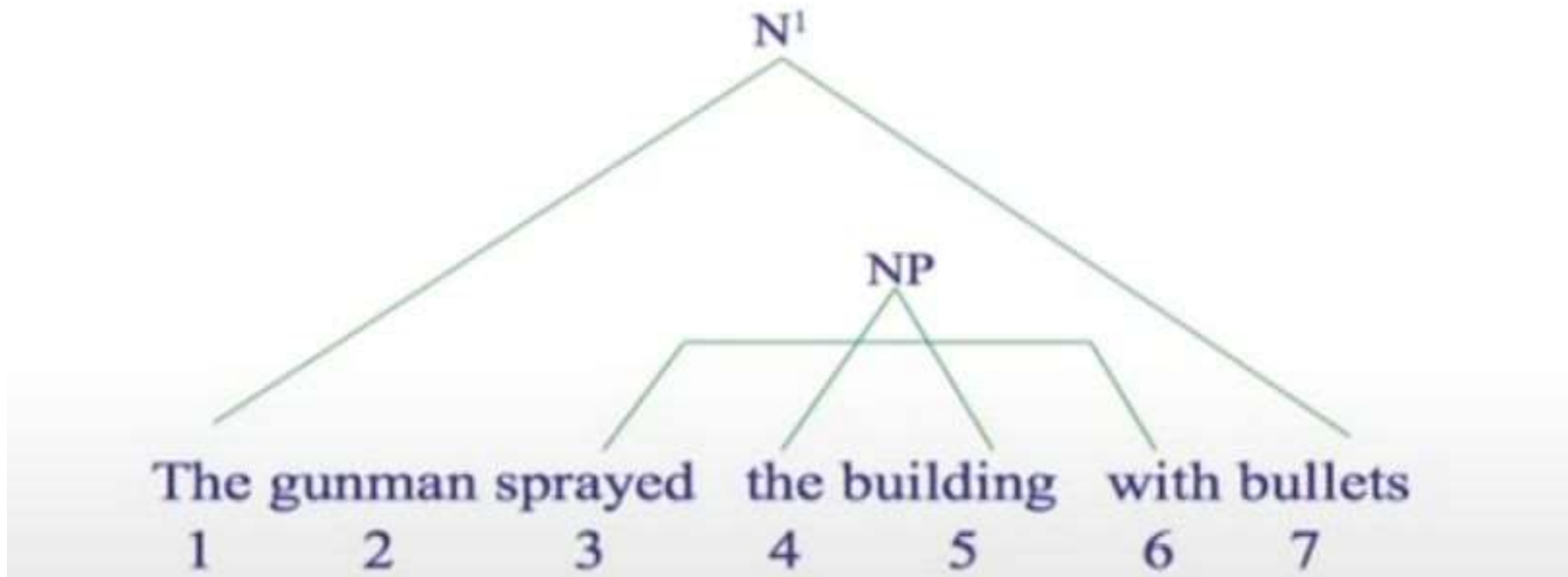


Inside Outside Probabilities

$\alpha_{NP}(4,5)$ for "the building"

$= P(\text{The gunman sprayed, } NP_{4,5}, \text{ with bullets} \mid G)$

$\beta_{NP}(4,5)$ for "the building" $= P(\text{the building} \mid NP_{4,5}, G)$



Inside Probabilities: Base Step

$$\beta_j(p, q) = P(w_{pq} | N^j_{pq}, G)$$

Base case

$$\beta_j(k, k) = P(w_{kk} | N^j_{kk}, G)$$
$$\Leftrightarrow P(N^j \rightarrow w_k | G)$$

Base case for pre-terminals only

E.g., suppose $N^j = NN$ is being considered and $NN \rightarrow \text{building}$ is one of the rules with probability 0.5

$$\beta_{NN}(5, 5) = P(\text{building} | NN_{5,5}, G) = P(NN_{5,5} \rightarrow \text{building} | G)$$