# Querying and Updating Probabilistic Information in XML

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INRIA FUTURS

Visit to *MOSTRARE*
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# The Hidden Web

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The set of webpages (which may or may not be dynamically generated) not accessible from the hyperlinked structure of the World Wide Web.

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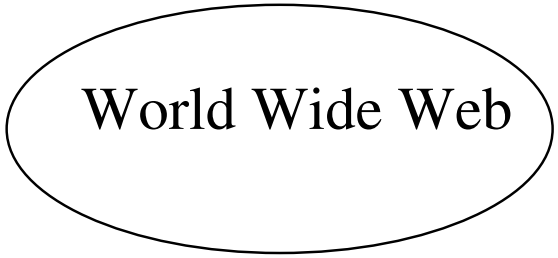
How to understand it and benefit from its content?

# Semantic Interpretation of the Hidden Web



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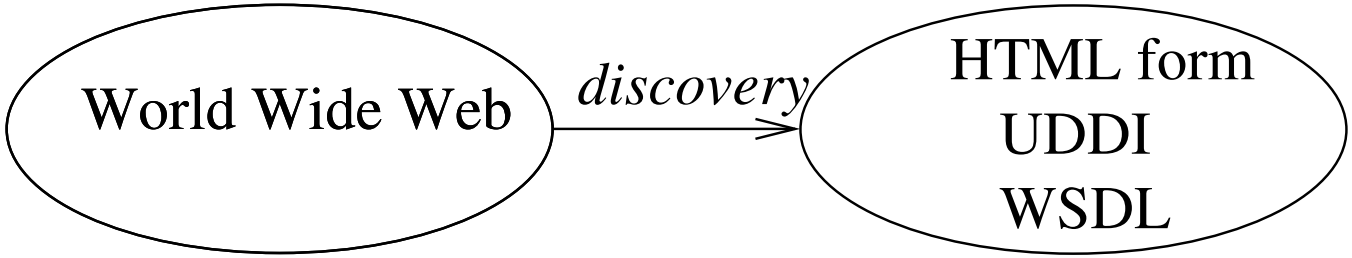

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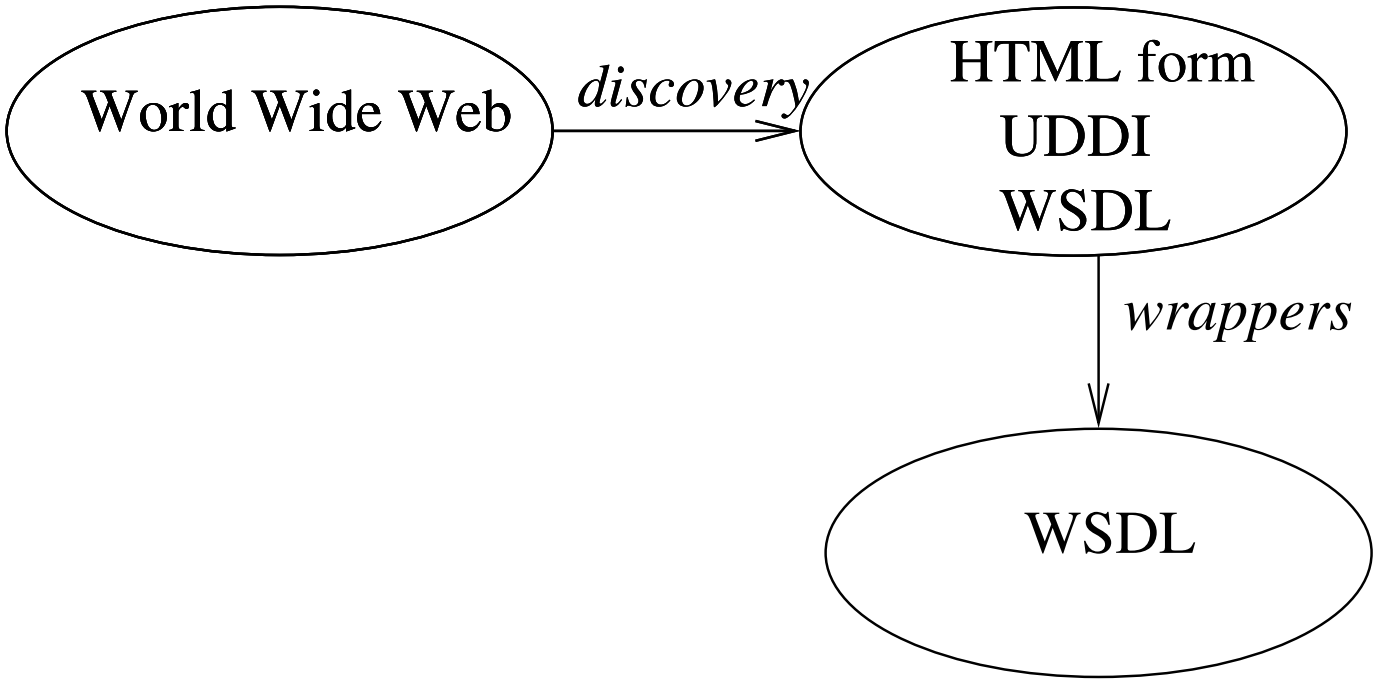

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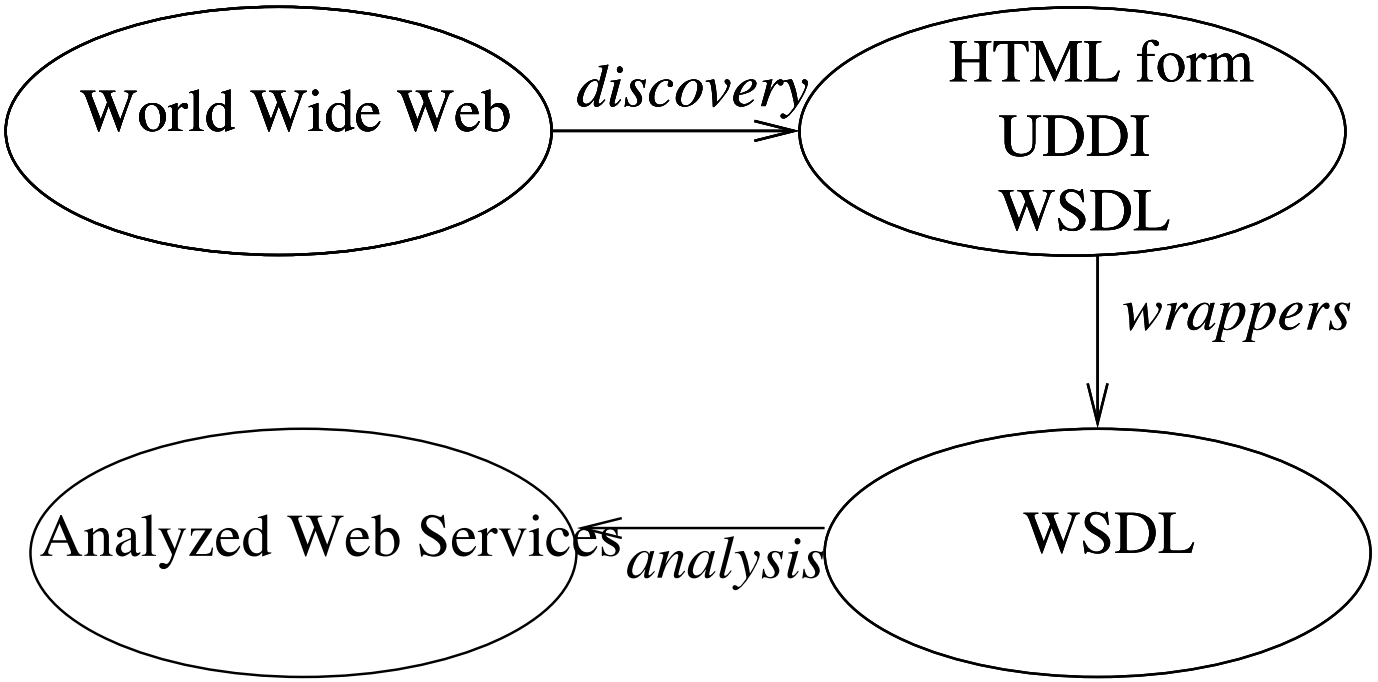

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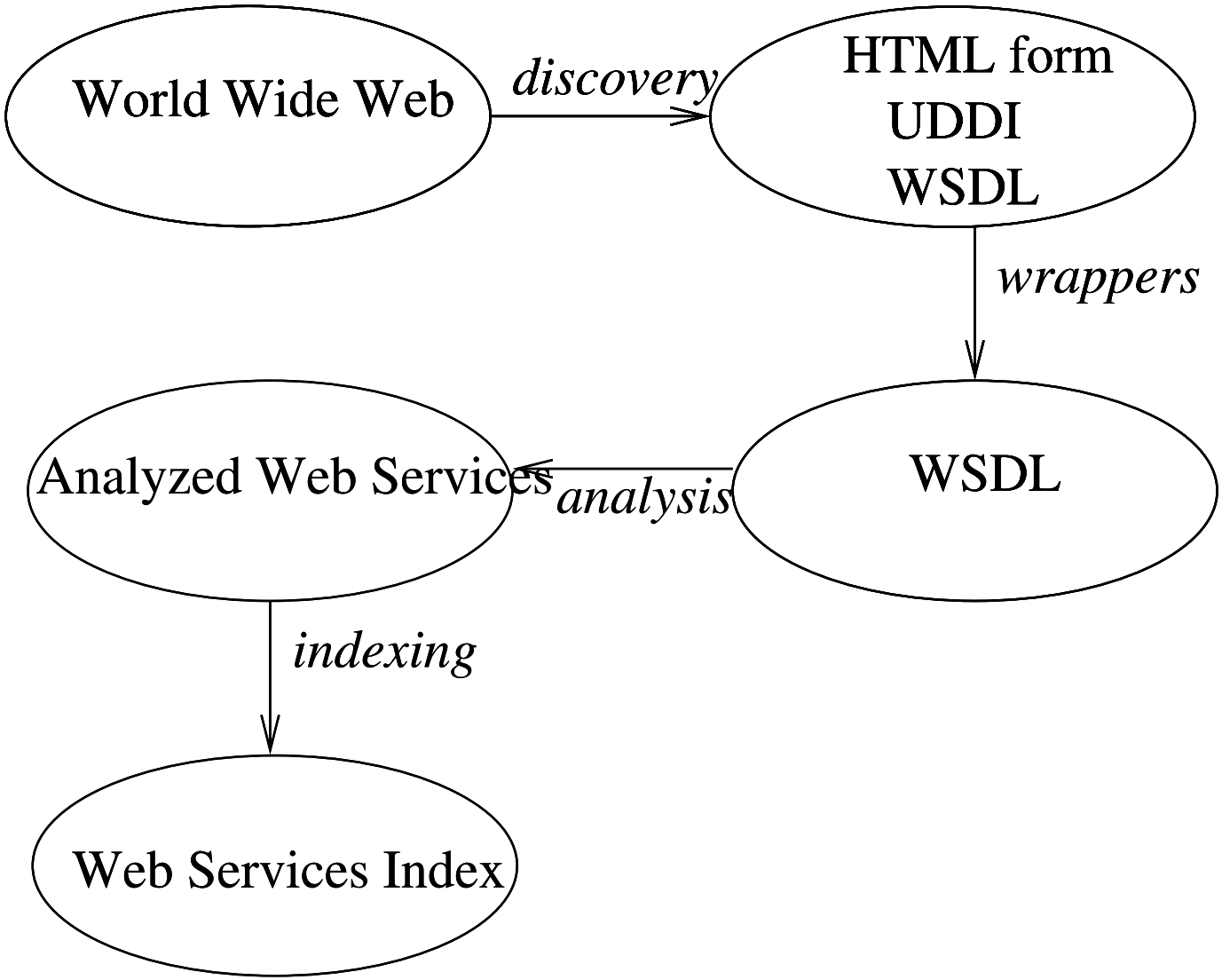

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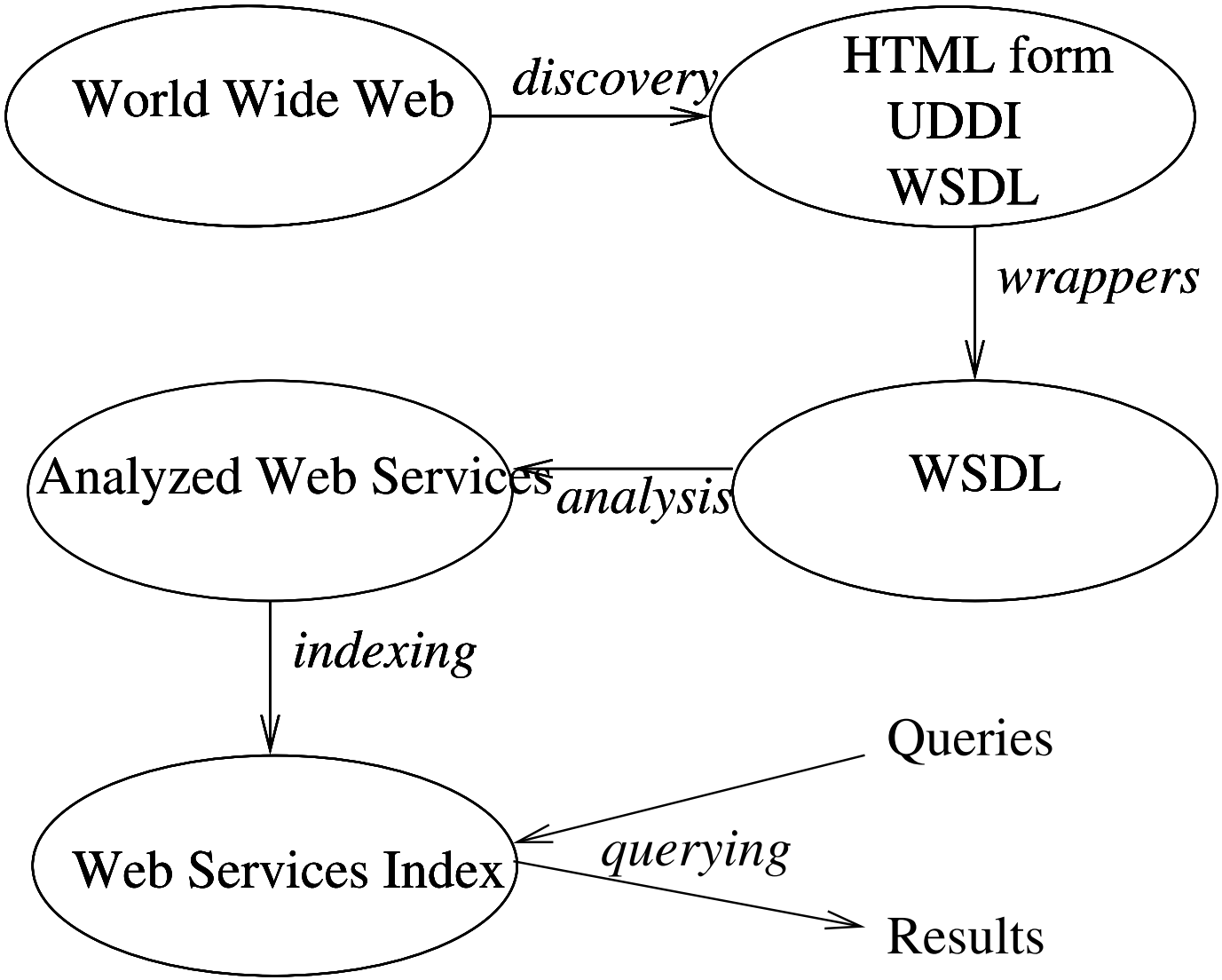
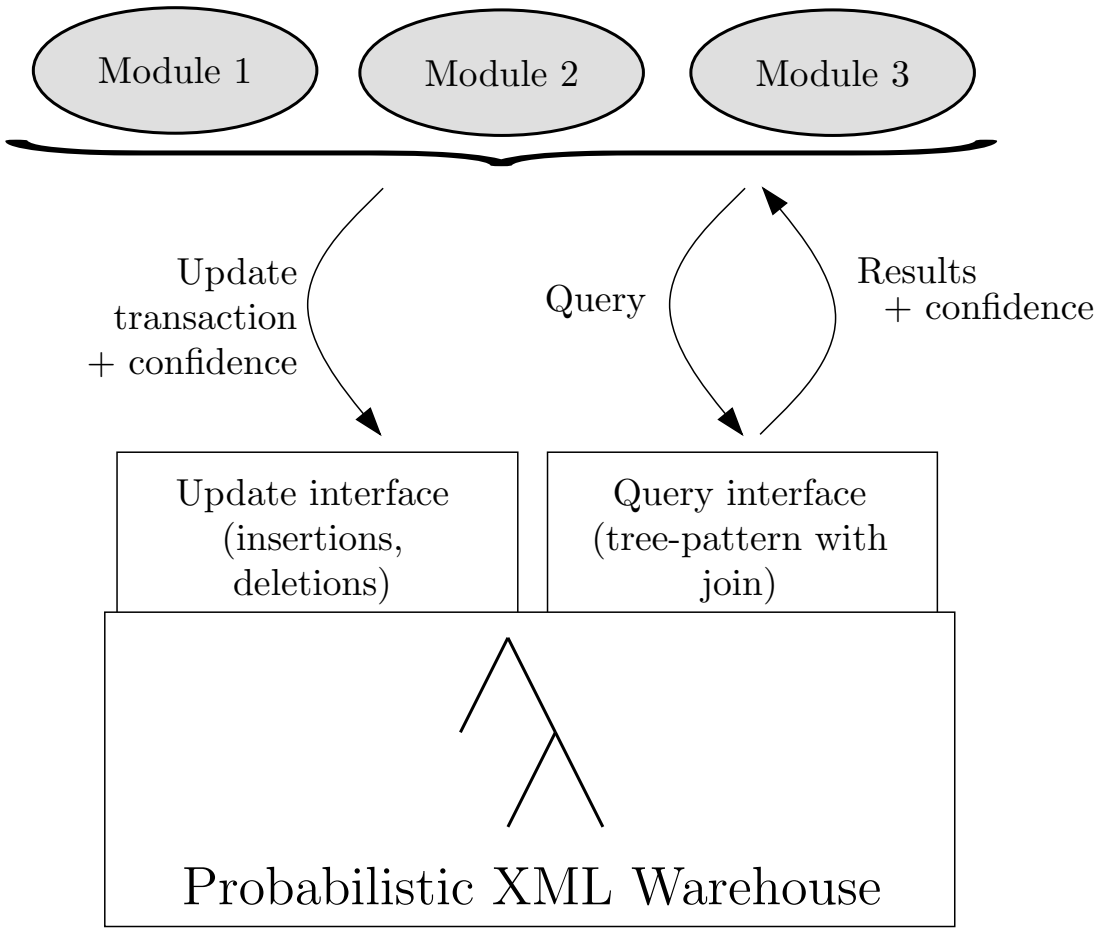


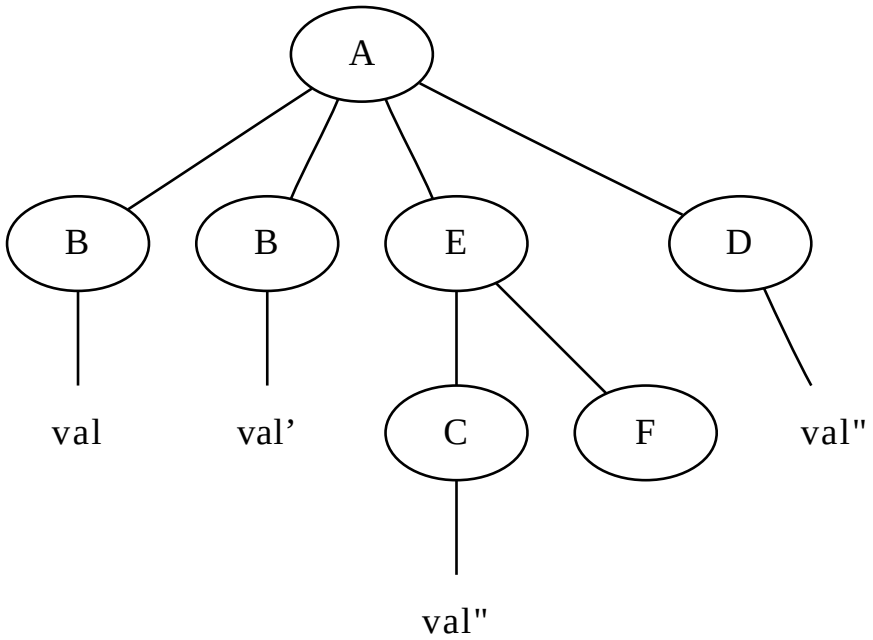
# A Probabilistic XML Warehouse



# Outline

# Data Trees

- Finite, unordered, trees.



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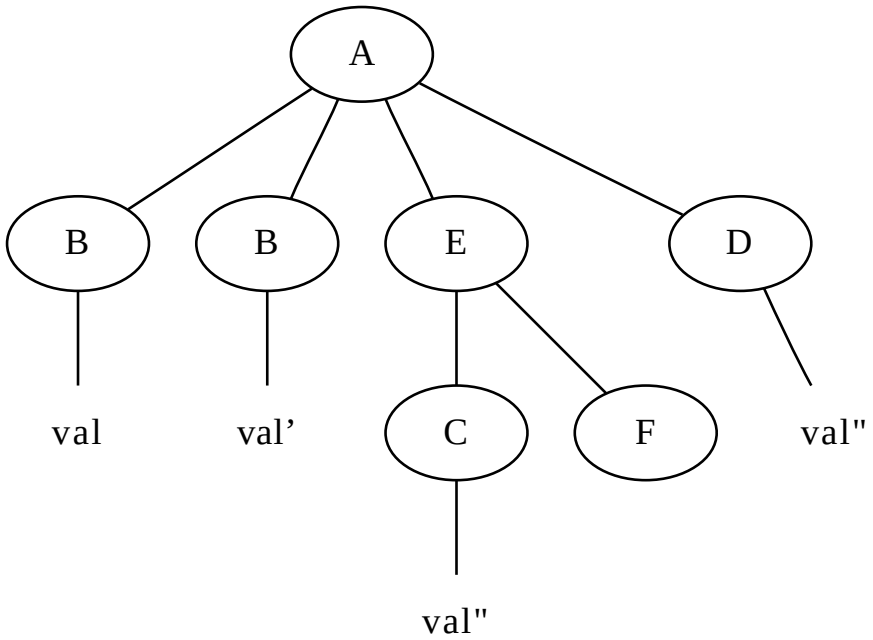

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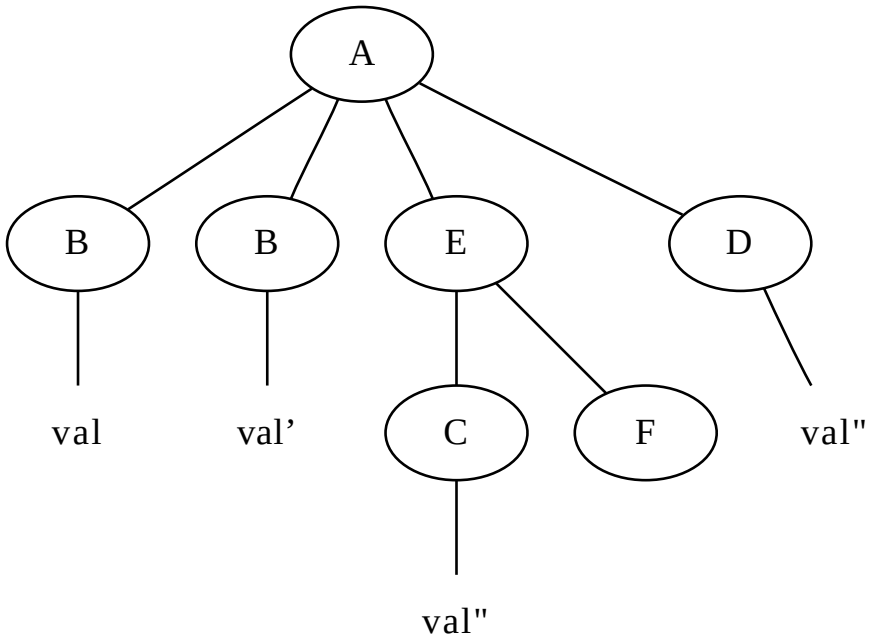
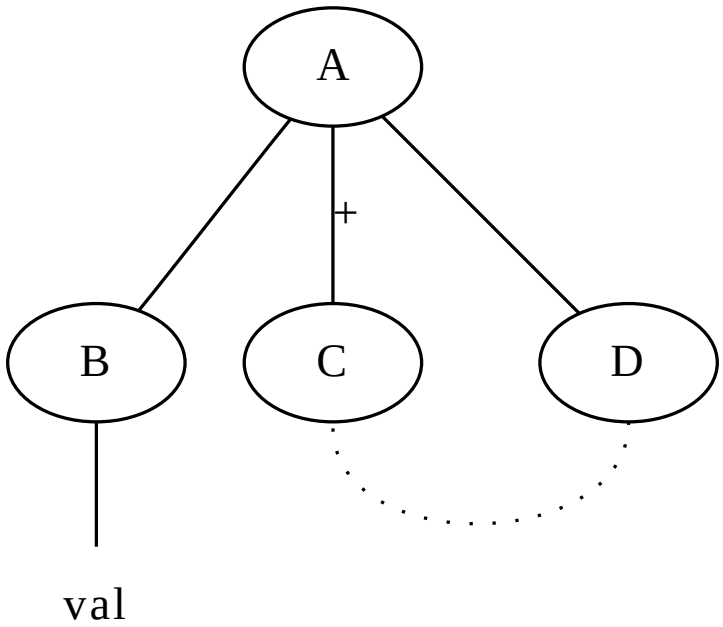


# Tree-Pattern With Join Queries

- Queries: Tree-Pattern With Join (TPWJ)



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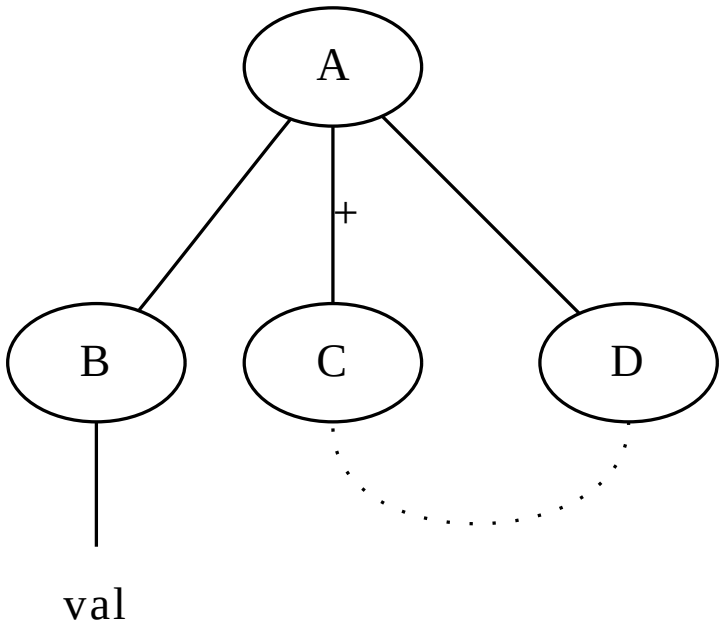

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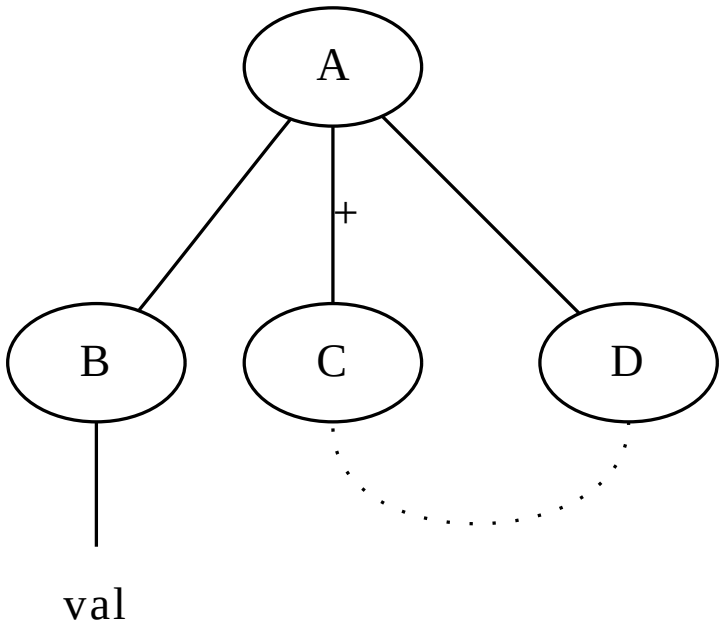
- Actually: any positive query



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- TPWJ query + mapping, stating where to perform operations.

# Outline

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Set of tree/probability pairs, one for each possible word.

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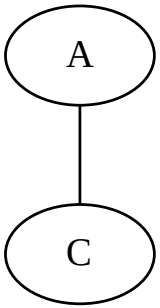
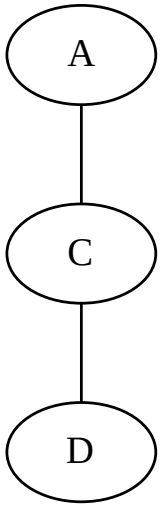
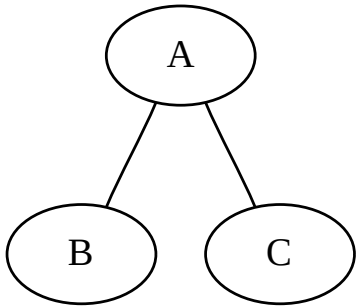


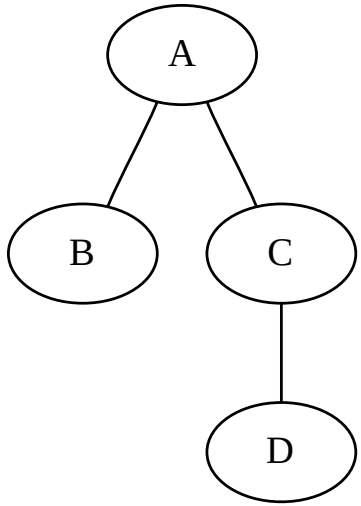

$P = 0.06$




$P = 0.14$




$P = 0.24$

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# Queries on PW sets

## Definition

If $T = \{(t_i, p_i)\}$, the result of query $Q$ over the fuzzy tree $T$ is the normalization of $\{(t, p_i) | t \in Q(t_i)\}$

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- Normalization: grouping of duplicates (summing probabilities)
- $(t, p) \in Q(T)$ means "the probability that $t$ matches $T$ is $p$".

# Updates on PW sets

## Definition

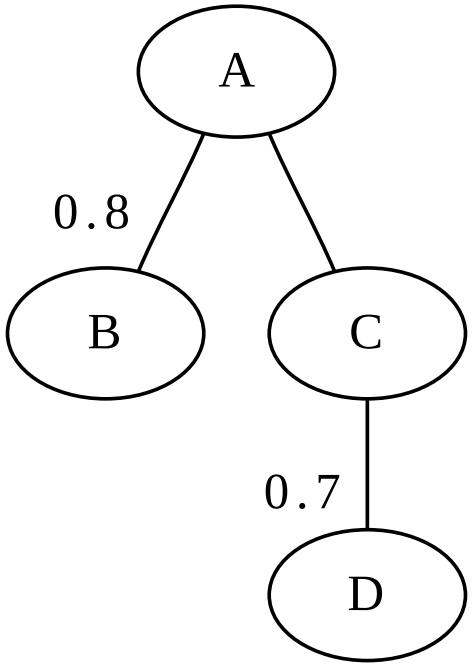
The result of an update $t$ with confidence $c$ on a fuzzy tree $T$ is the normalization of:

$$\begin{array}{ll} & \{(t, p) \in T \mid t \text{ is not selected by Q}\} \\ \bigcup & \{(\tau(t), p \cdot c) \mid t \text{ is selected by Q}\} \\ \bigcup & \{(t, p \cdot (1 - c)) \mid t \text{ is selected by Q}\} \end{array}$$

# Outline

# SP Trees

Data tree with probability assigned to each node.



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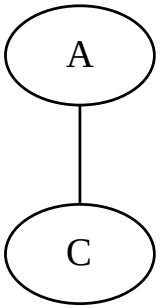
A node is assigned the probability $p$: means that the probability the node is in the tree if its parent is in the tree is $p$.

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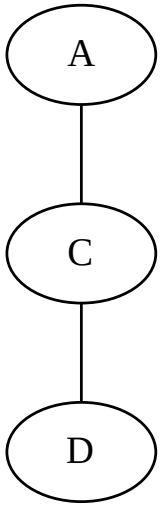


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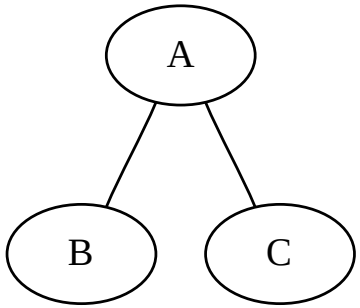


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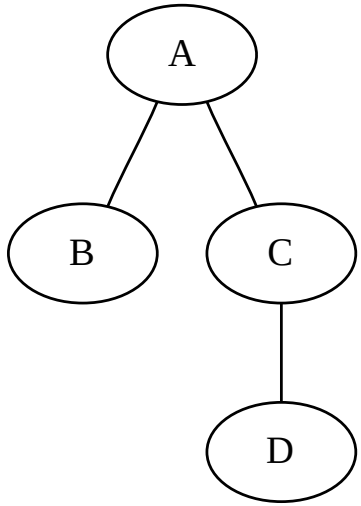


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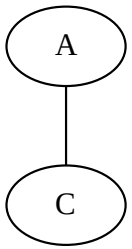
## Theorem

$Q([\![T]\!]) = Q(T)$

# Incompleteness of SP Trees

**Theorem**

*The SP tree model is incomplete.*

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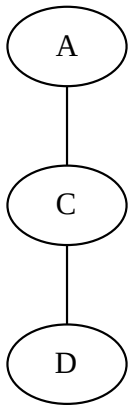


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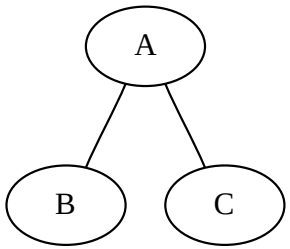


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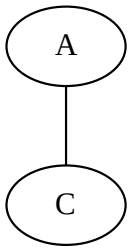


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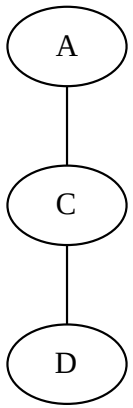


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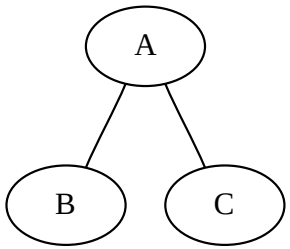


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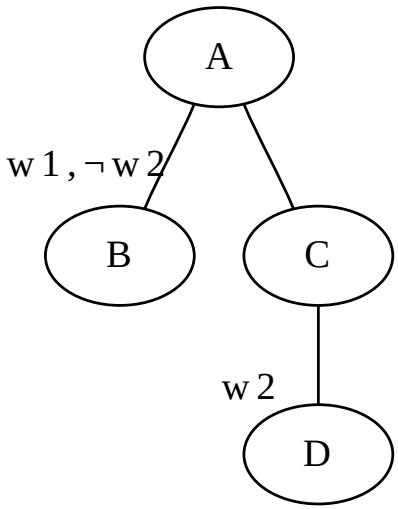
**Theorem**

*SP trees are not closed under updates.*

# Outline

# Fuzzy Trees

Data tree with event conditions (conjunction of probabilistic events or negations of probabilistic events) assigned to each node.




| Event | Proba. |
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| w1 | 0.8 |
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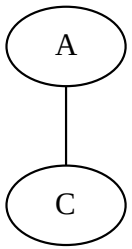


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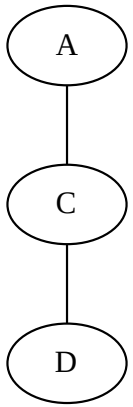


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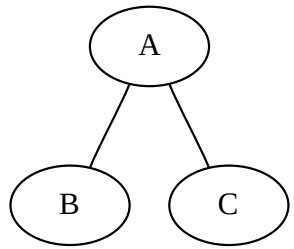


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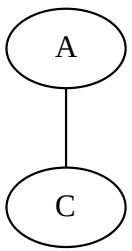


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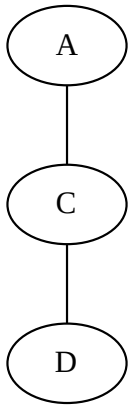


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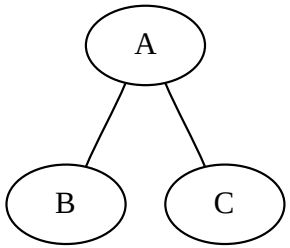


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**Theorem**

*The fuzzy tree model is as expressive as the PW model.*

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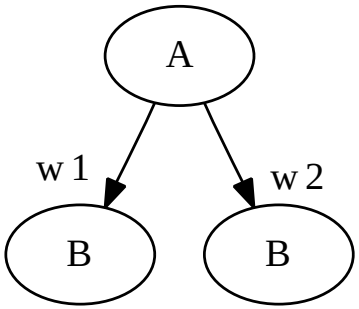
**Theorem**

*If* $(\tau, c)$ *is a probabilistic update transition and* $T$ *a fuzzy tree:* $[\![(\tau, c)(T)]\!] = (\tau, c)([\![T]\!])$

# Example: Deduplication

Deduplication of the two *B* nodes with confidence 0.9.

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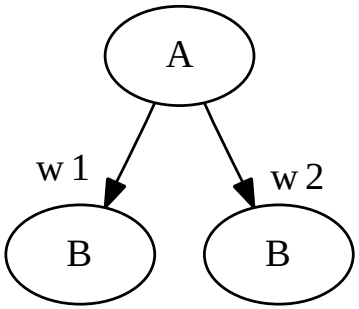


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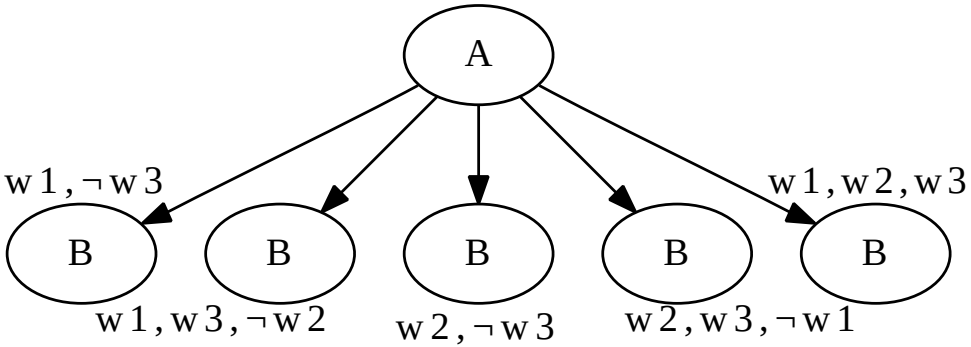


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- Special focus on updating, for managing a probabilistic warehouse.
- More expressive and as concise as a simple model, more concise and as expressive as the naïve model.

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