
How Certain is Recommended Trust-Information?

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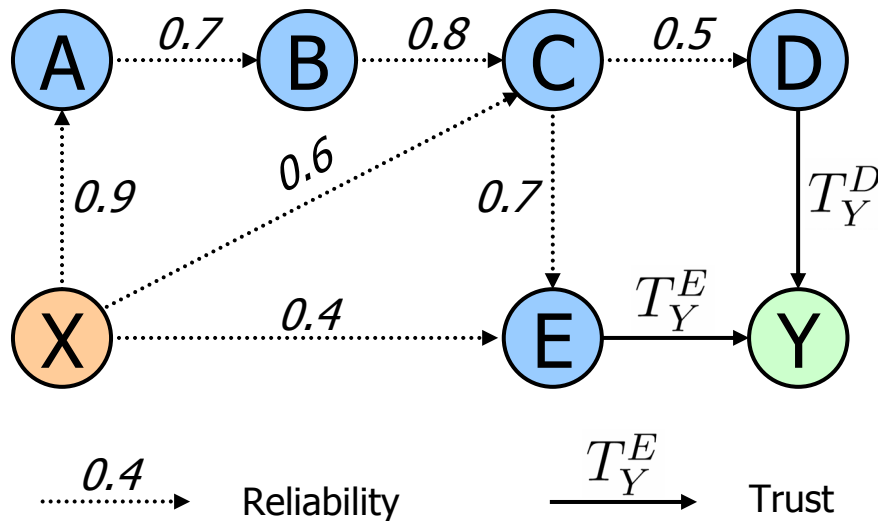
How Far Can Recommended Trust Be The Base of a Trust Decision?

- One expects that part of the **information is given by malicious participants**
- Trust-information given by a **recommender may be reliable or not**
- **Condensing recommended trust-information of different sources to one value is not reasonable**

Strategy for a Trust-Decision

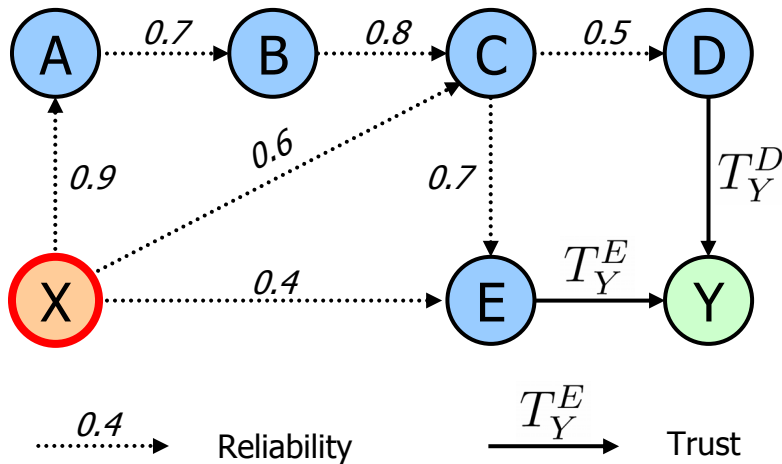
- **Keep recommended trust-information untouched**
- X builds a **network of relations**, using **recommended** and **direct information**
- If X performs a **trust-decision** towards Y, the **network of relations** is **transformed** into a **decision tree**
- X chooses a **path by random** to **reduce** the influence of malicious nodes
- Passing a node, X **chooses by random** if it **trusts** the **recommended information** or not
- With **higher chance** paths are chosen, where it is **more certain** not to end in an un-trusted node
- At the end, the **trust-decision** is done on the base of a **direct-trust-information** or on the base of **no information**

Network of Reliability and Trust

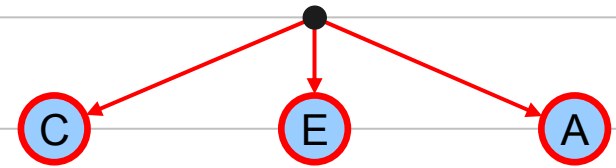
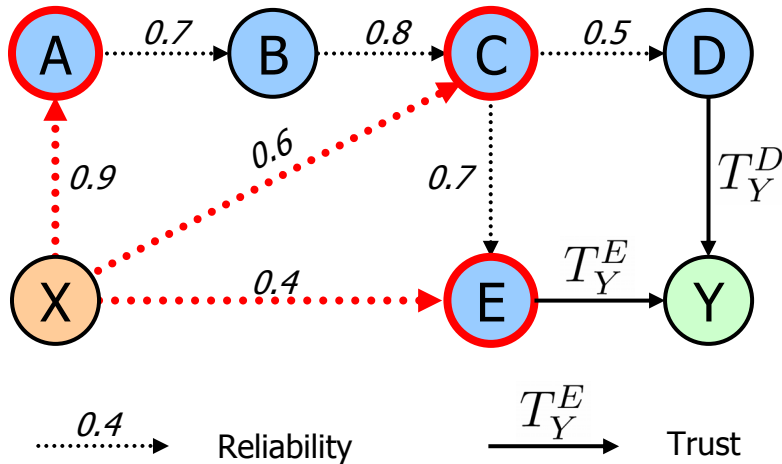


- **Trust:**
Complex structure, not a probability
- **Reliability:**
probability that given information is reliable

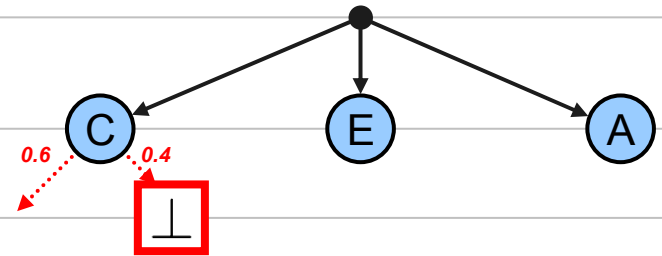
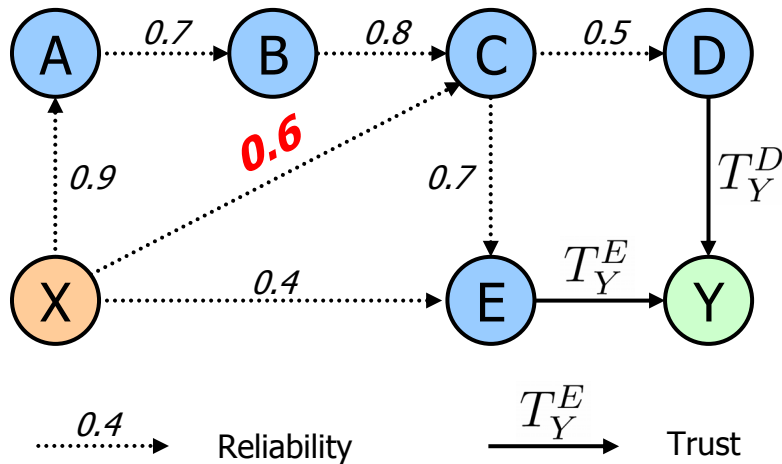
Transformation of the Network Into a Decision Tree



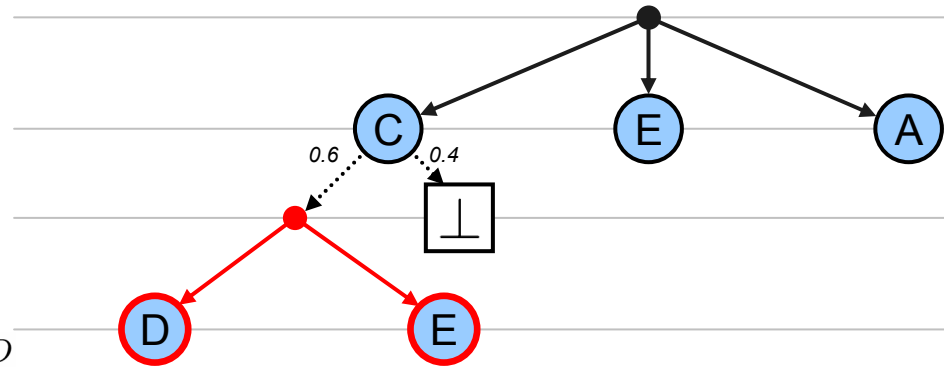
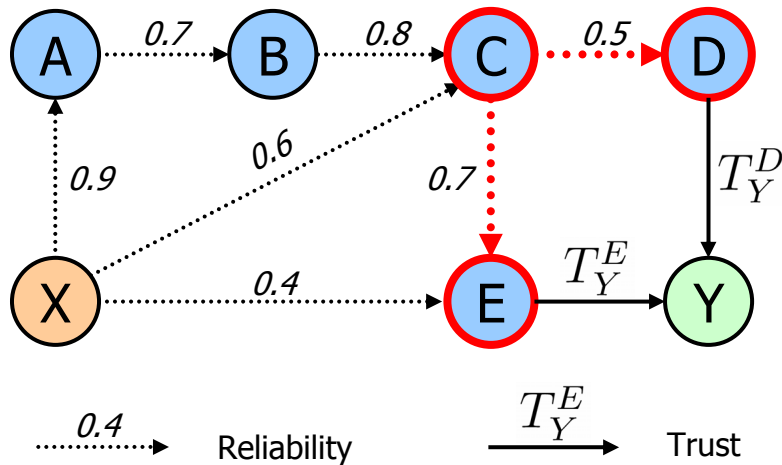
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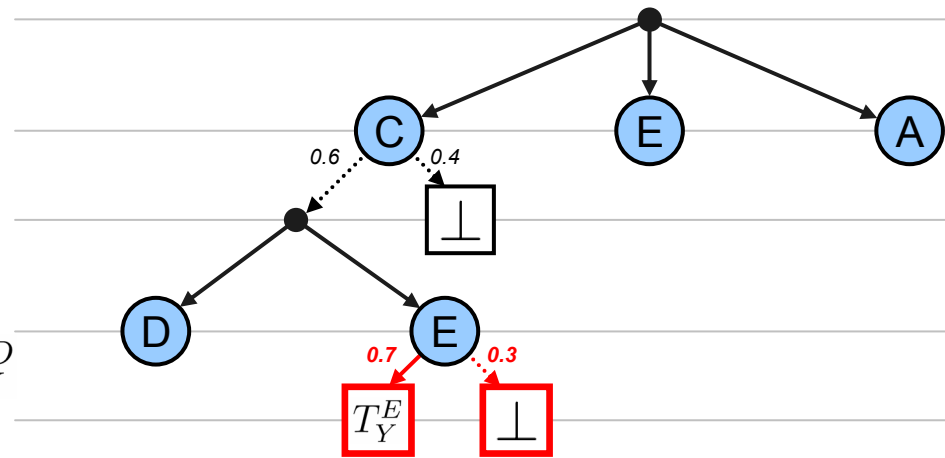
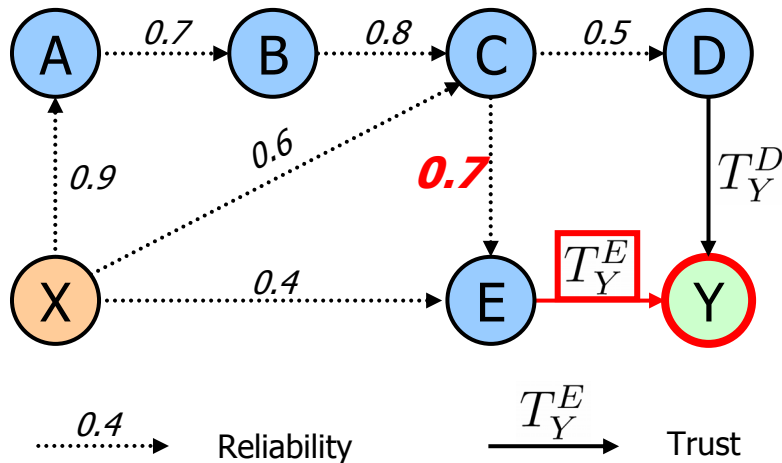
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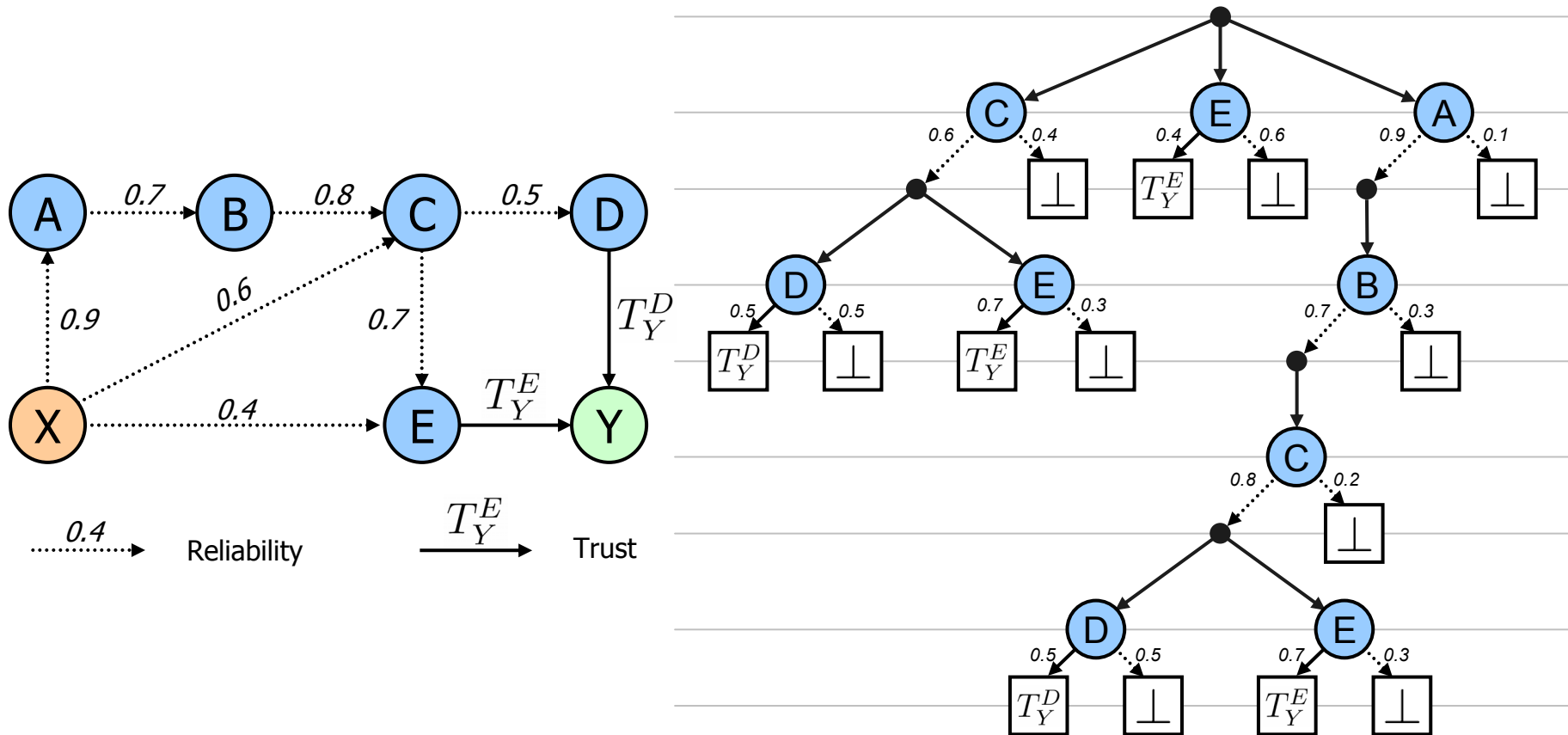
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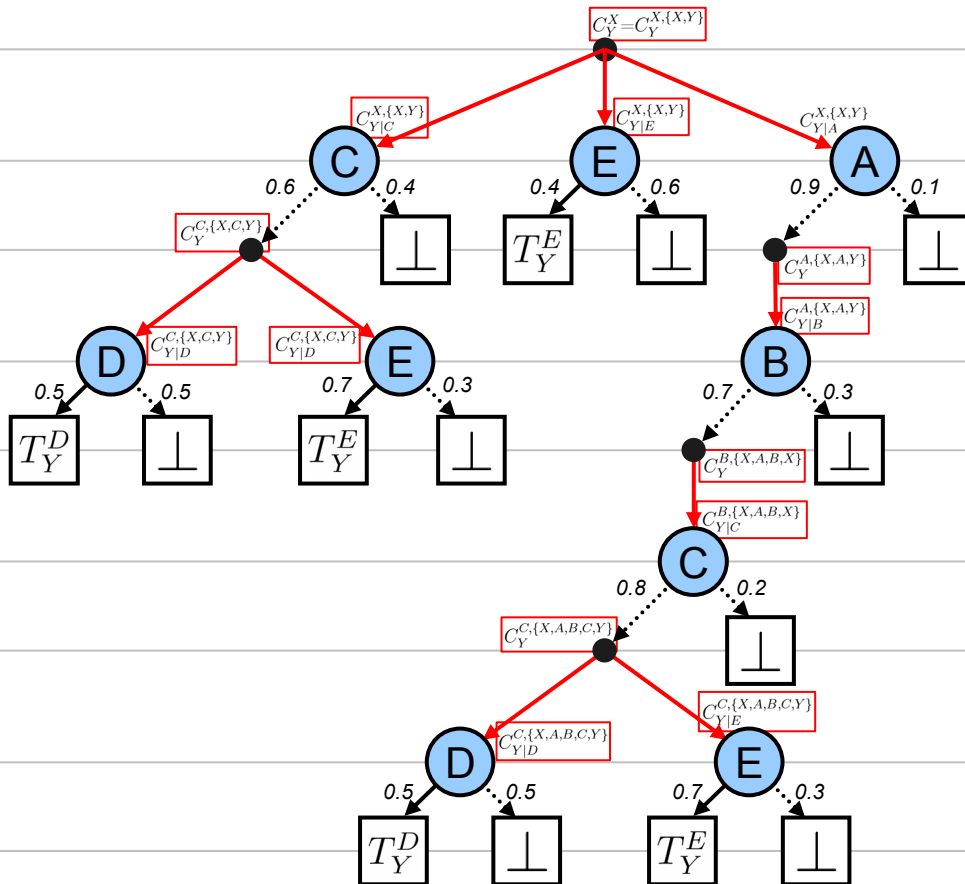
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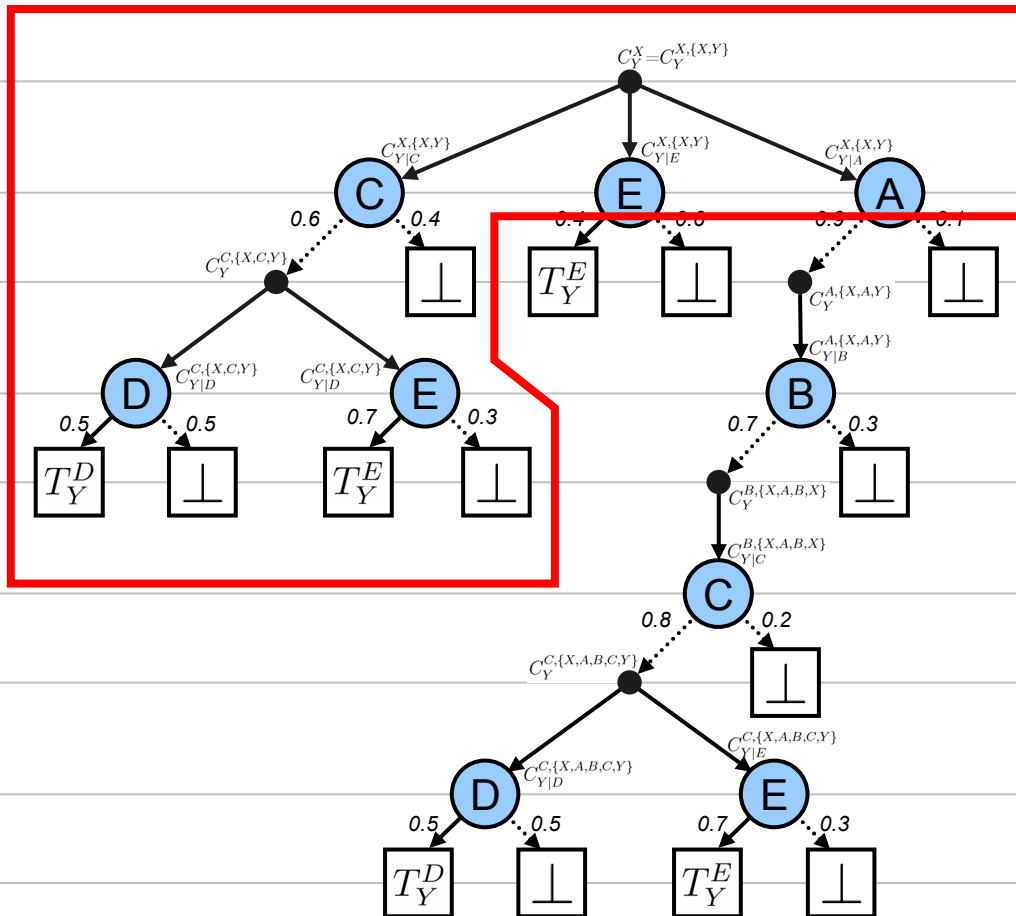


Weighs of the Edges Certainty



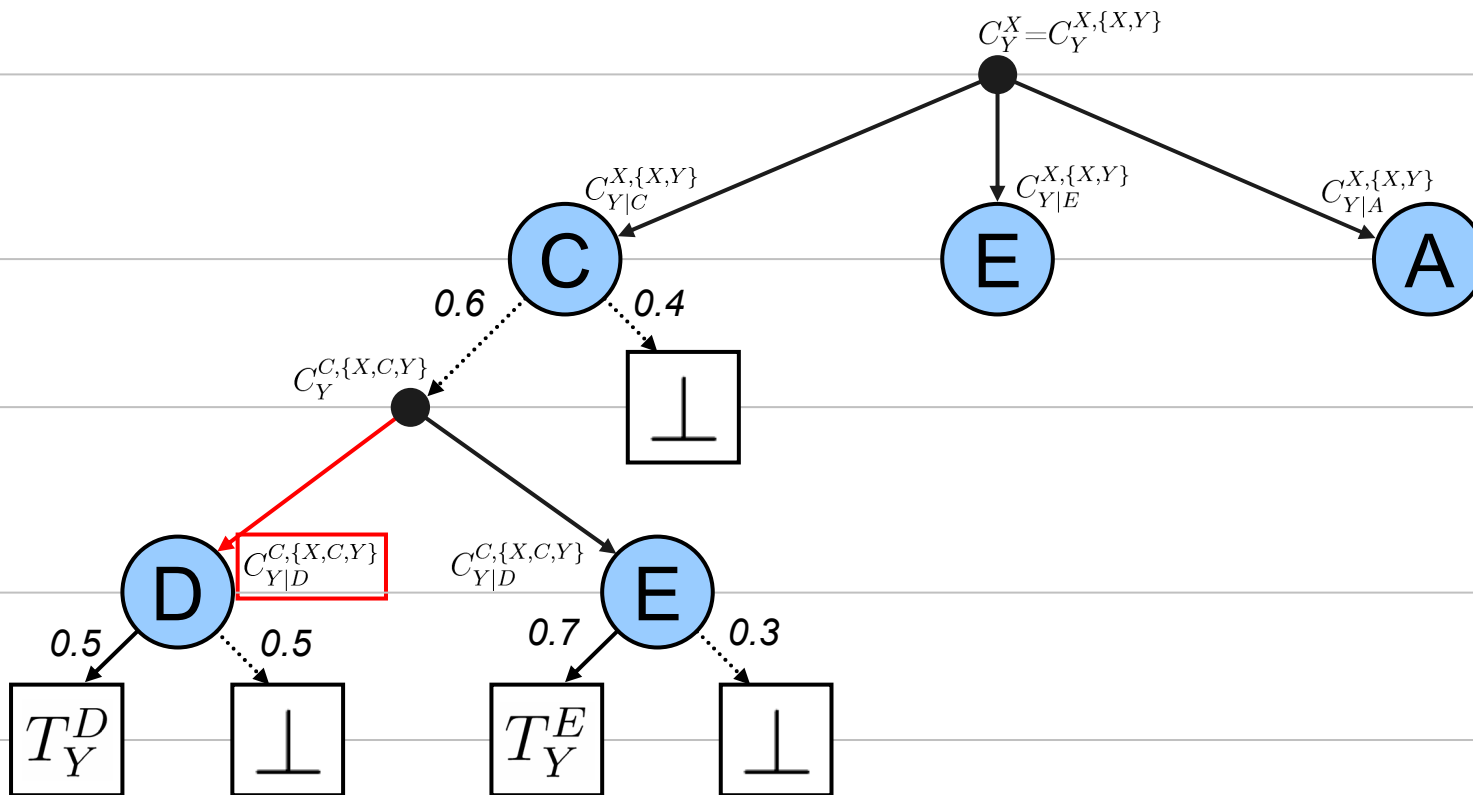
- **Certainty:** Probability to reach a trust information
- Certainty refers to the **sub-tree** if a node has been reached
- Certainty at a given node is the **weight for the edge**, pointing to the node

Weighs of the Edges Certainty



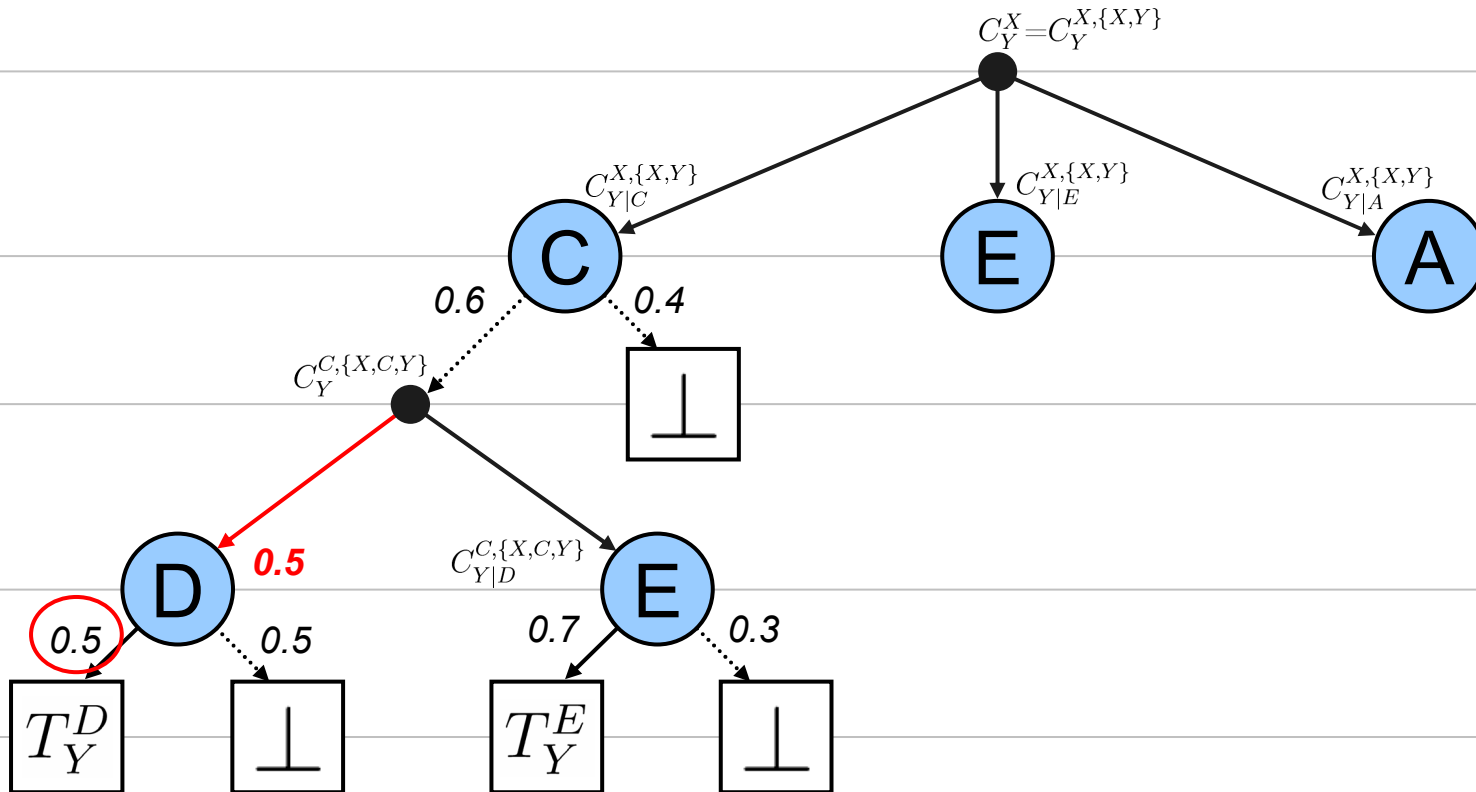
Weighs of the Edges

Certainty



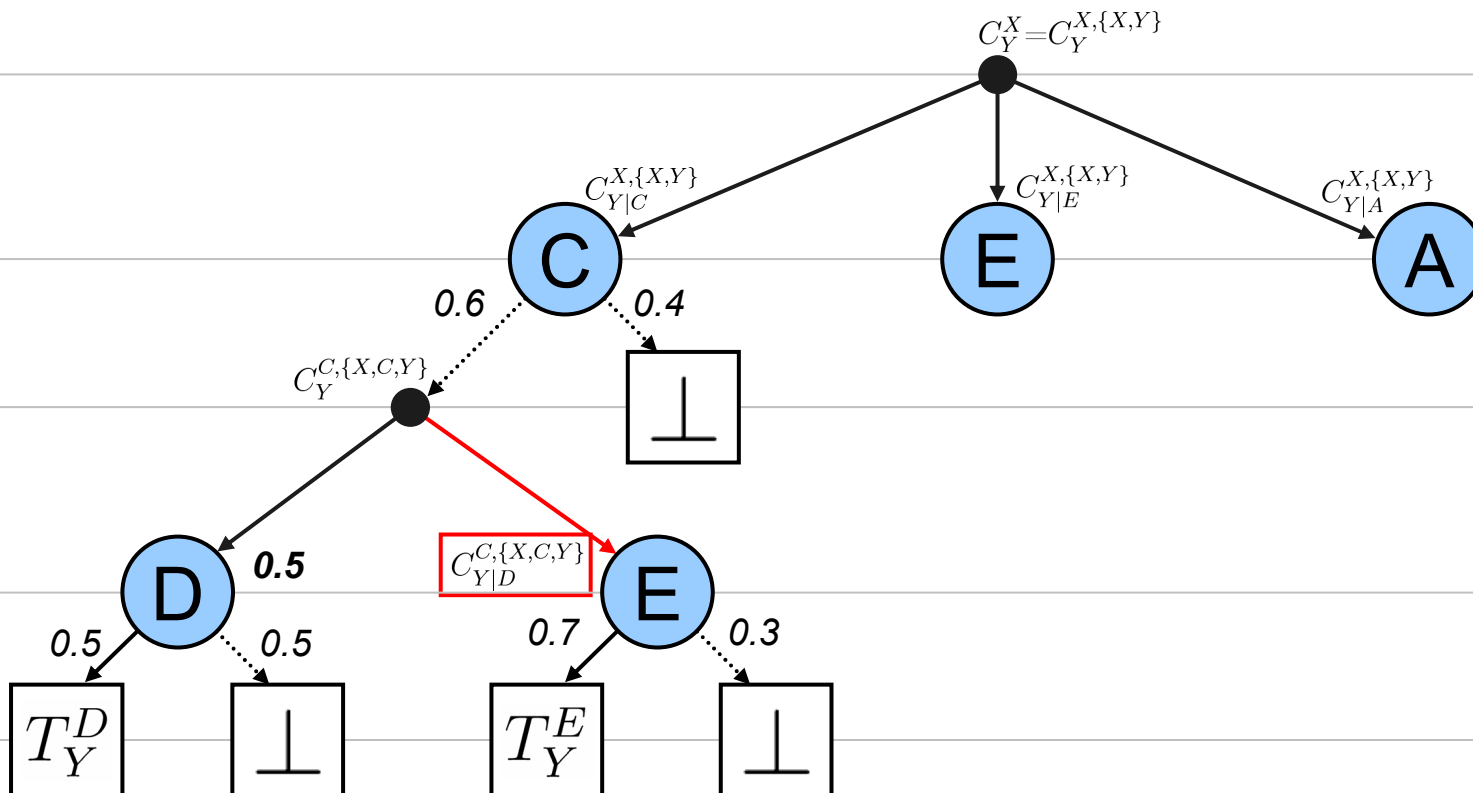
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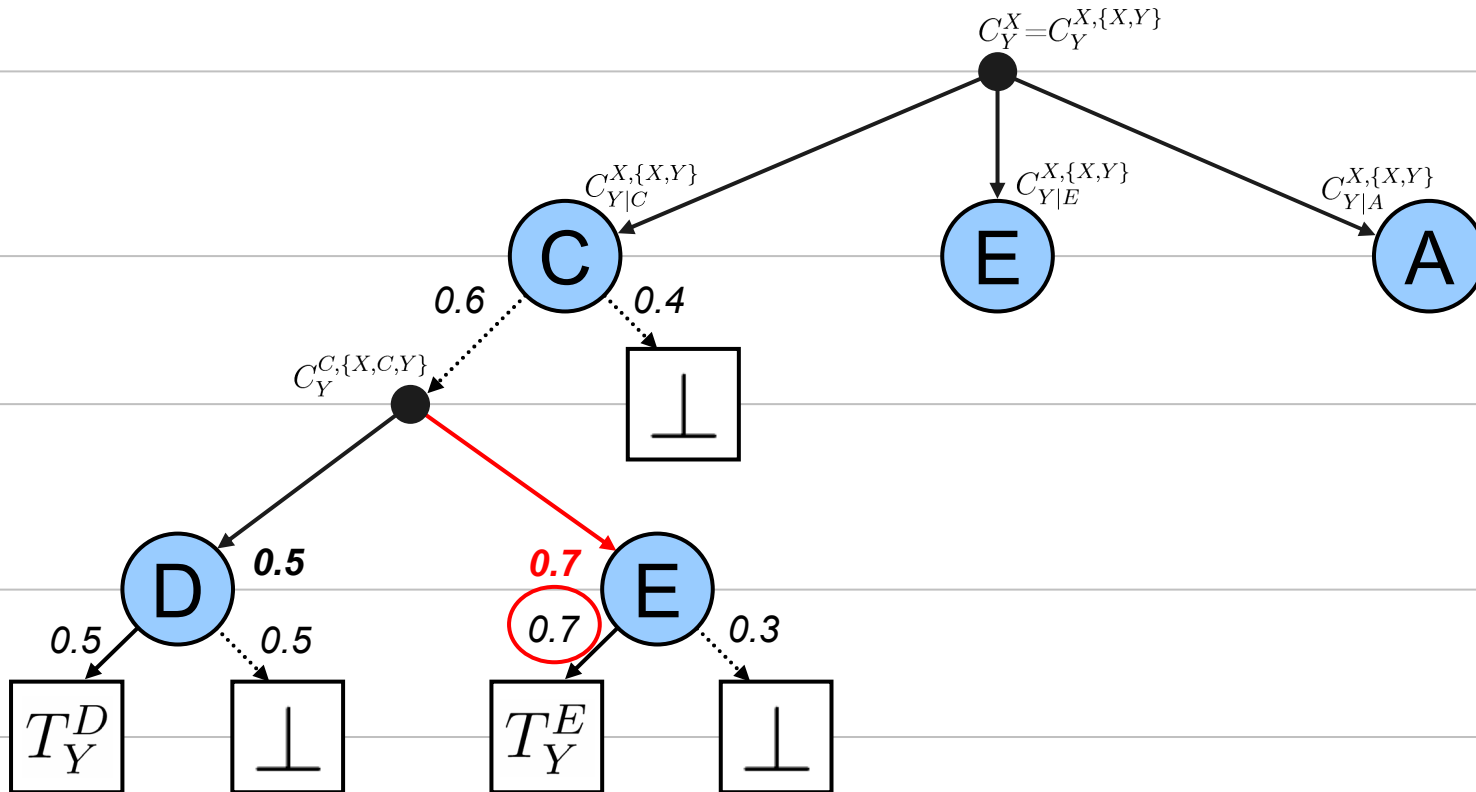
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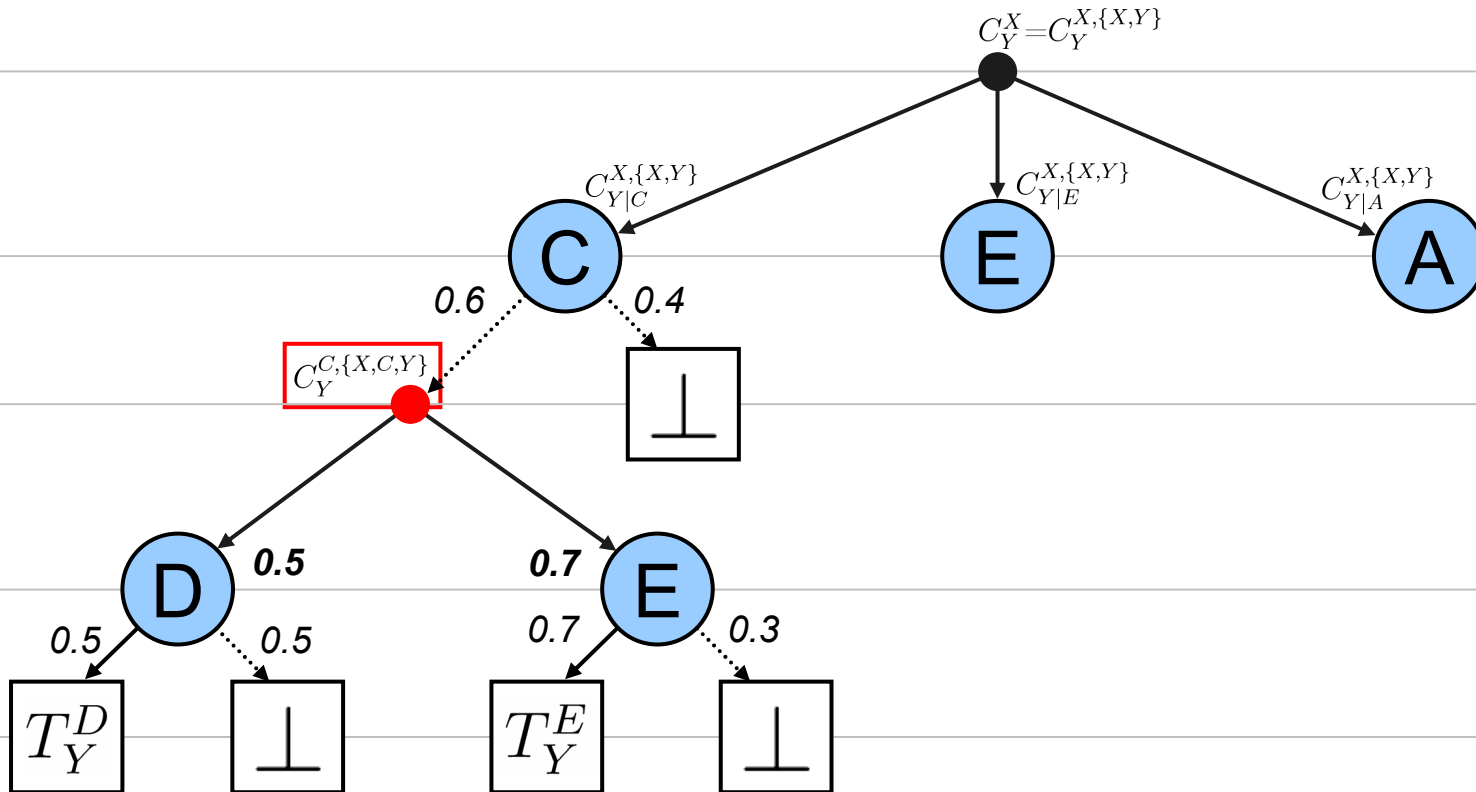
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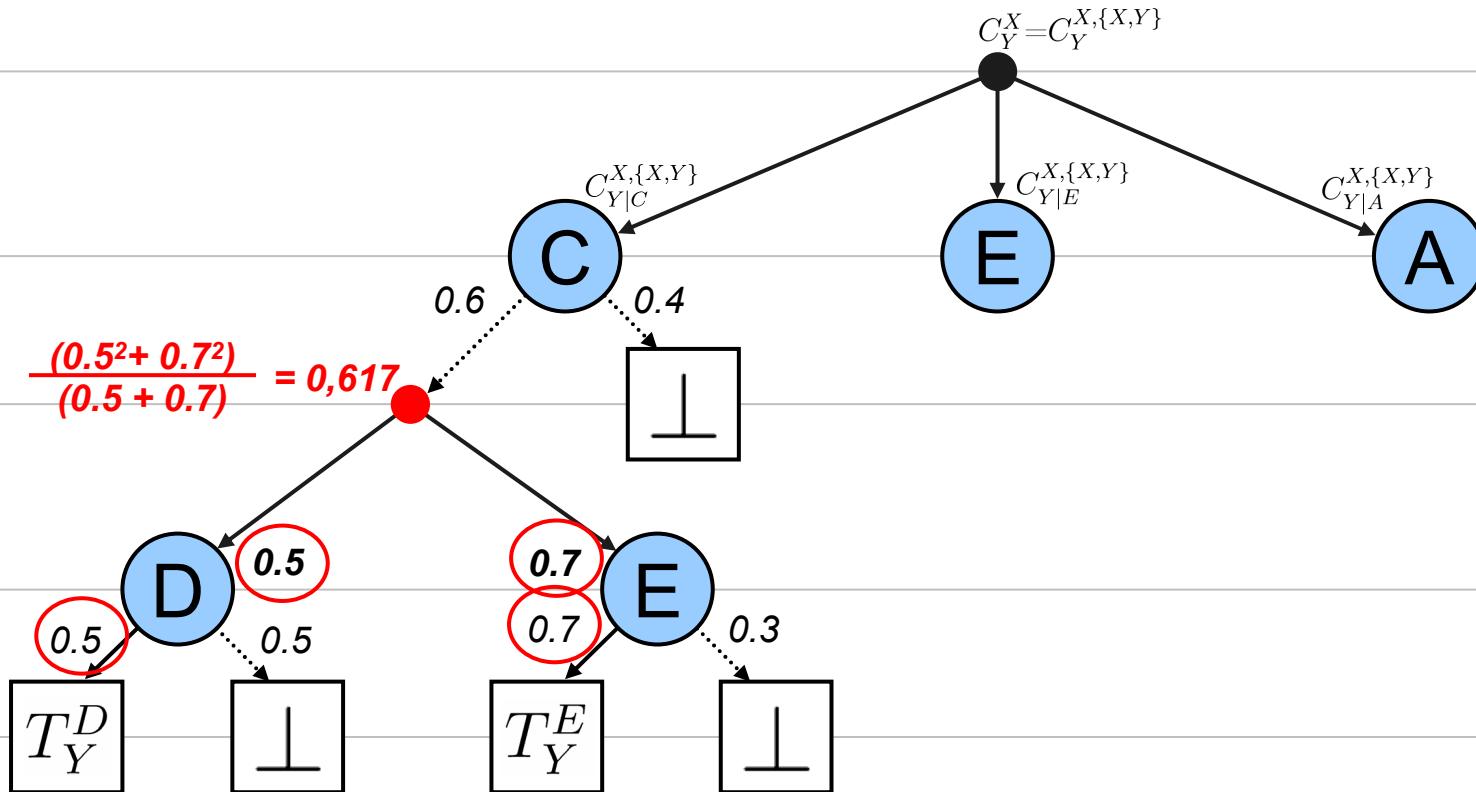


Weighs of the Edges

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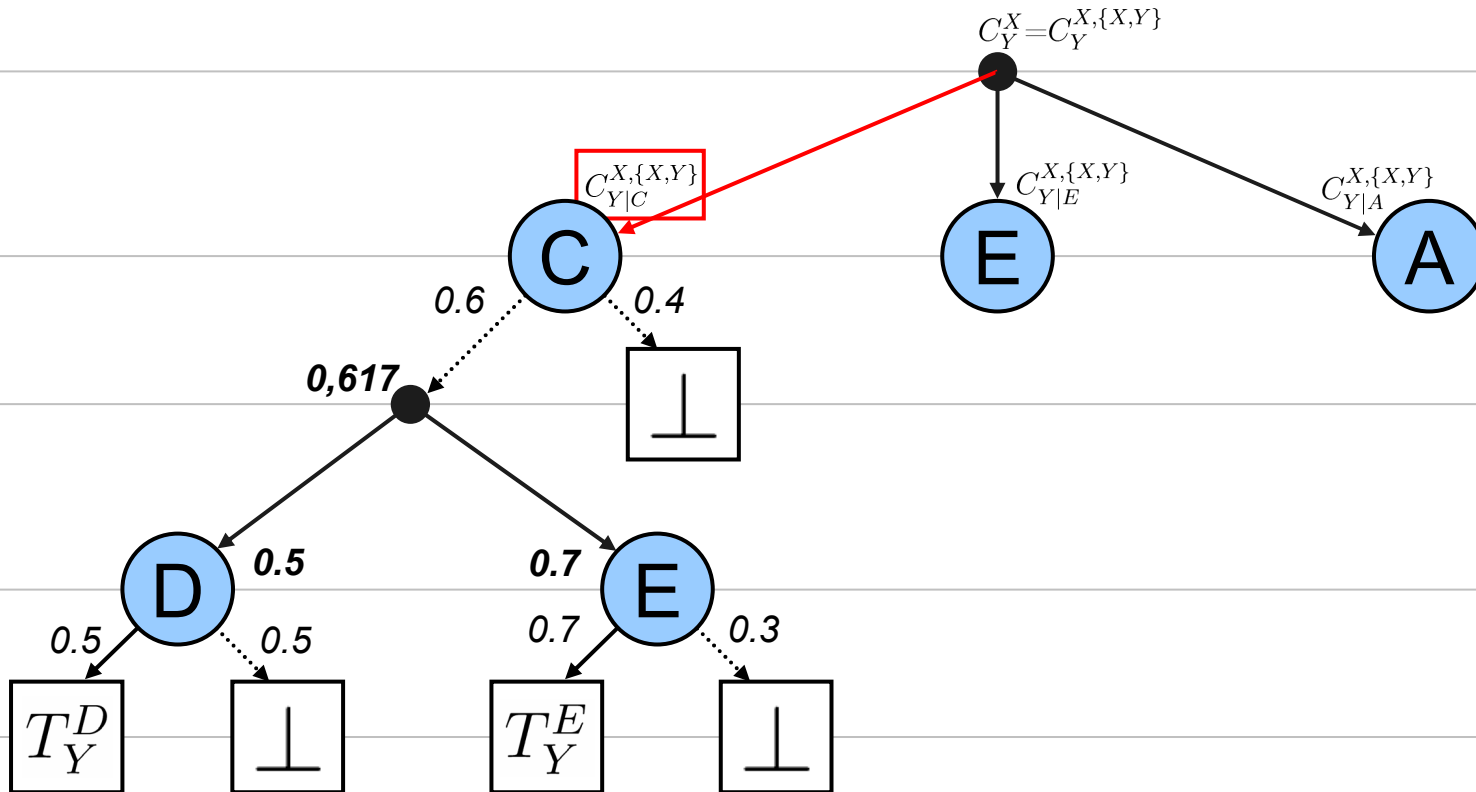


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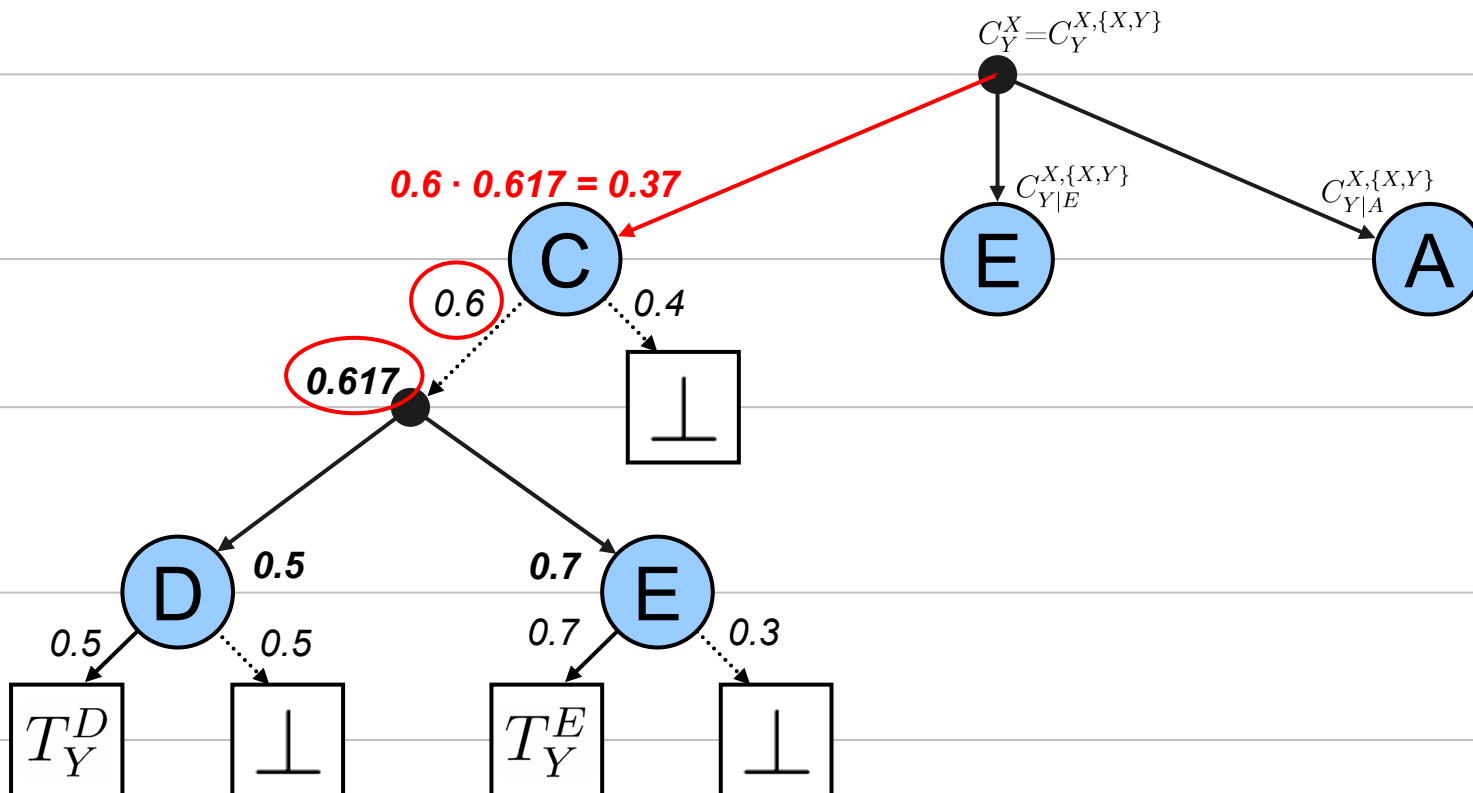
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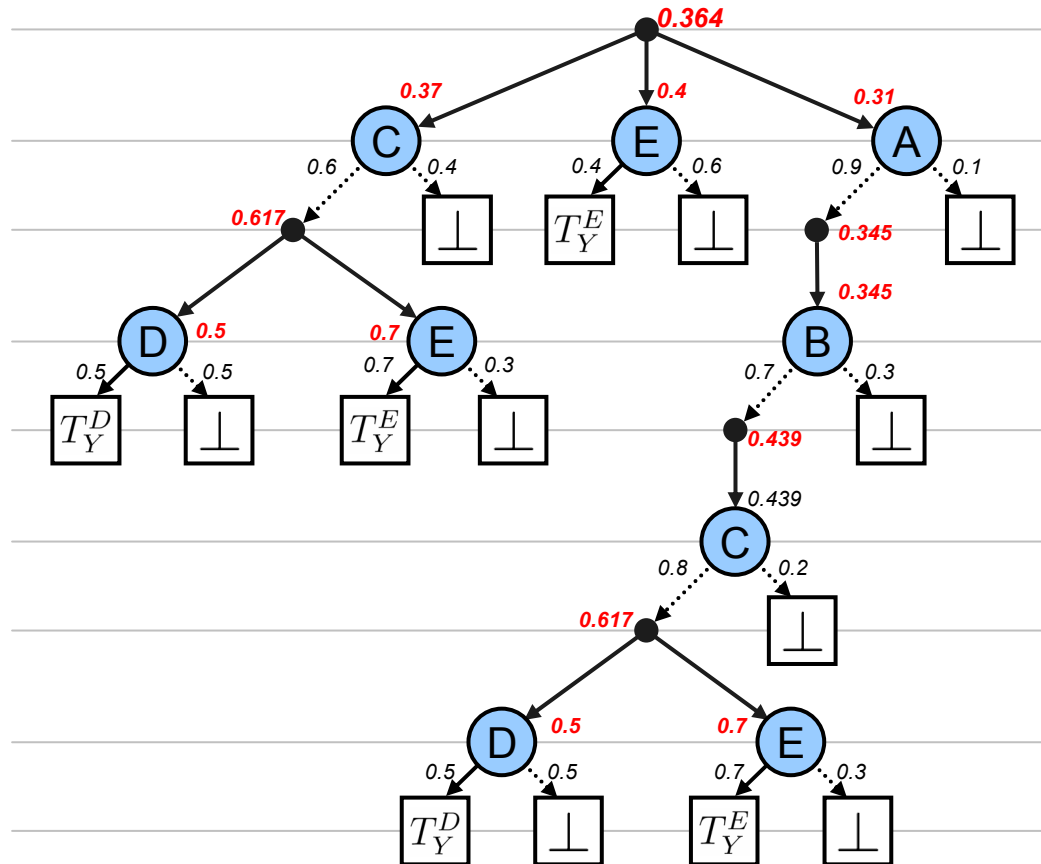


Weighs of the Edges

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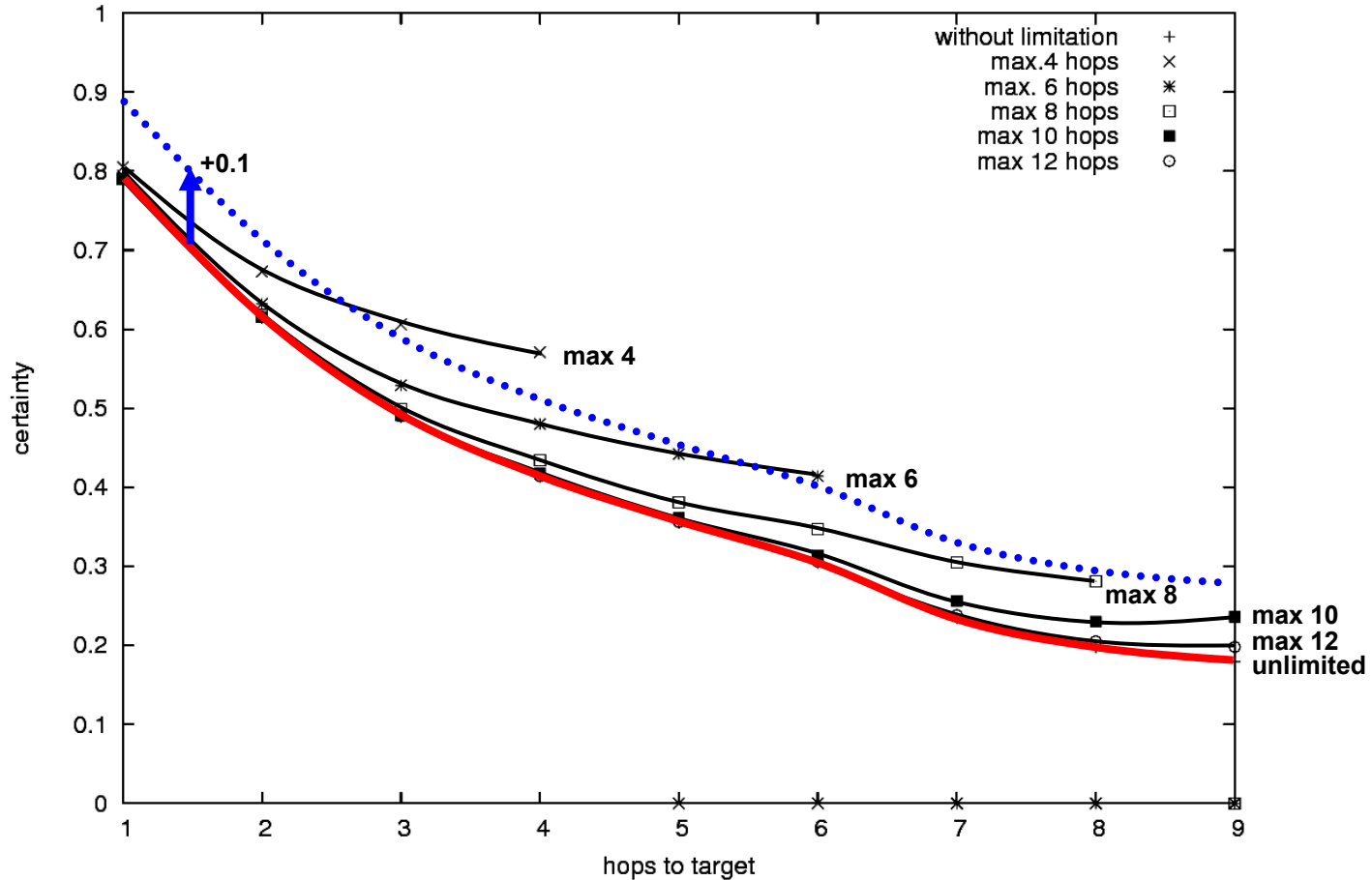
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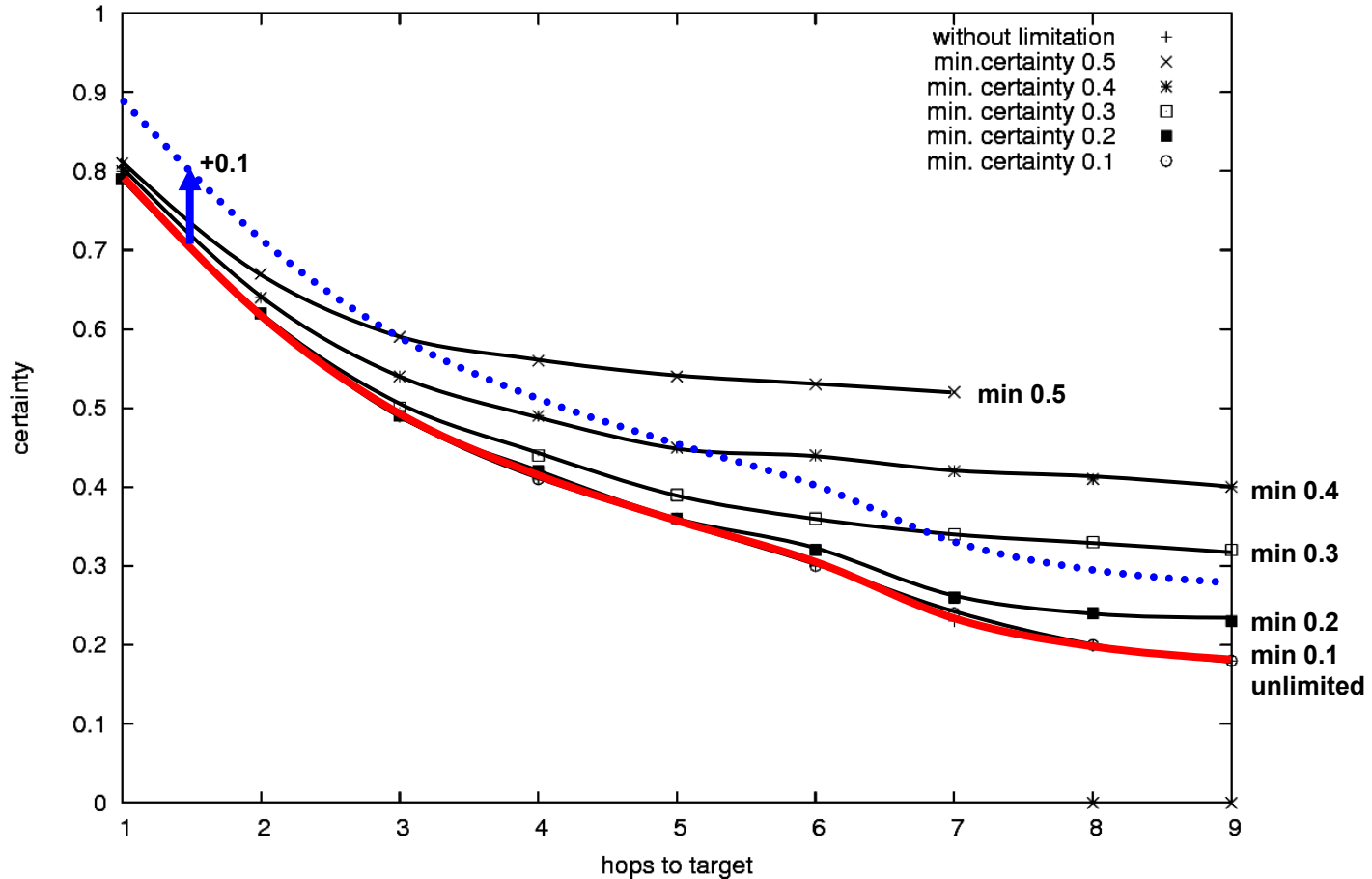
Results So Far

- **Simulation** with networks of 20 nodes with reliability 50% - 100% shows
 - 3 hops: certainty $< 50\%$
 - 7 hops: certainty $< 25\%$
- The building of a decision-tree has **exponential complexity**
- Two trials to reduce its complexity:
 - **Restricting hops** to destination
 - **Limiting the minimal certainty** of a sub-tree

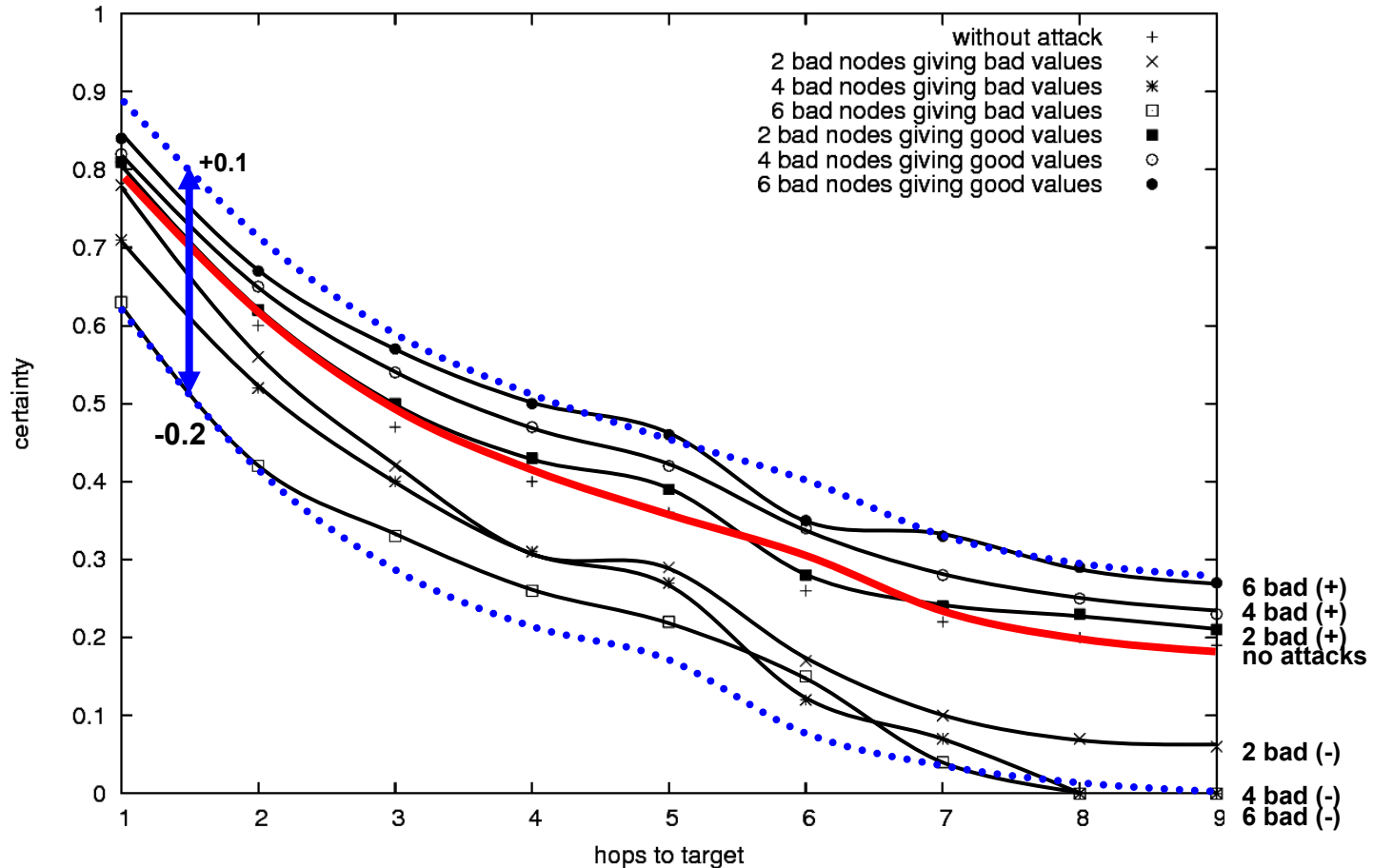
Simulation with Hop-Restriction



Simulation with Certainty-Restriction



Influence of Malicious Participants



Results

- **Influence of malicious participant** lies in the percentage-magnitude like the percentage of malicious participants
- **Limiting the tree** to 6-8 hops or 0.3-0.4 minimal certainty gives **acceptable results** compared to the unrestricted values (up to 107x faster)
- **Hop-restriction** is more **effective** than certainty-restriction (up to 3,1x faster)
- Still **exponential** complexity in **worst case**
- Decision on the base of recommended trust-information of distance > 8 hops are getting **unreasonable**

How Certain is Recommended Trust-Information?

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