Knowledge Representation & Reasoning

(CSCA-203)

Lecture Week 4/2: Forward & Backward Chaining

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Example knowledge base

It is a crime for an American to sell weapons to hostile nations:

$\text{American}(x) \land \text{Weapon}(y) \land \text{Sells}(x,y,z) \land \text{Hostile}(z) \Rightarrow \text{Criminal}(x)$

Nono has some missiles

$\exists x\ \text{Owns}(\text{Nono},x) \land \text{Missile}(x)$

$\text{Owns}(\text{Nono},M_1) \land \text{Missile}(M_1)$

All of its missiles were sold to it by Colonel West

$\text{Missile}(x) \land \text{Owns}(\text{Nono},x) \Rightarrow \text{Sells}(\text{West},x,\text{Nono})$

Missiles are weapons:

$\text{Missile}(x) \Rightarrow \text{Weapon}(x)$

An enemy of America counts as “hostile”:

$\text{Enemy}(x,\text{America}) \Rightarrow \text{Hostile}(x)$

West is American

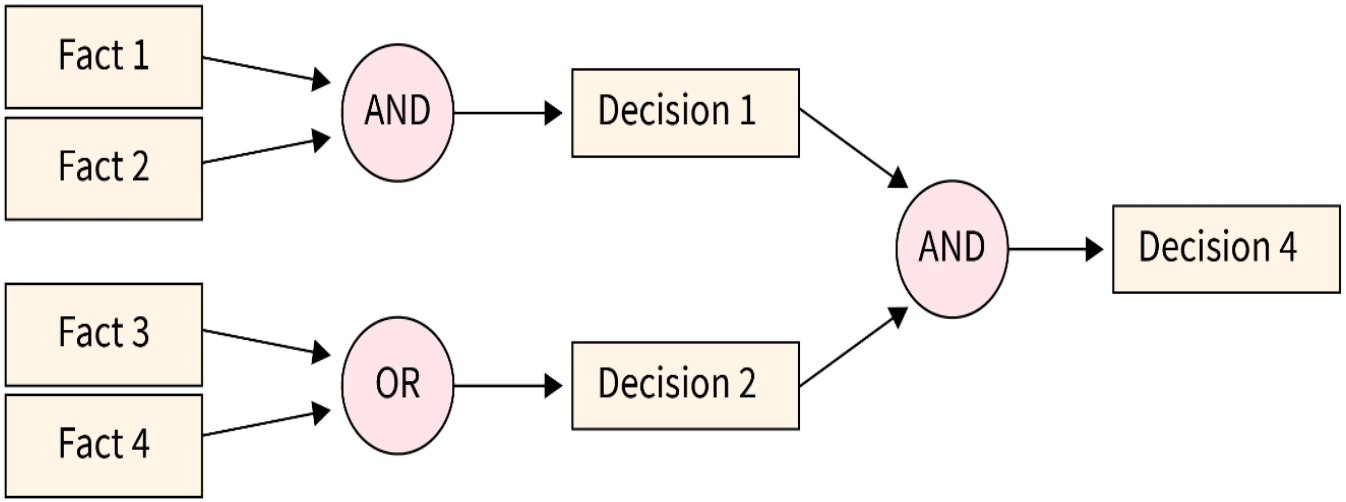
$\text{American}(\text{West})$

The country Nono is an enemy of America

$\text{Enemy}(\text{Nono},\text{America})$

Forward Chaining

Forward chaining is a type of reasoning in which atomic clauses in a knowledge base are used to retrieve more data in the forward path using inference principles (Modus Ponens).



Forward chaining proof

American(x) $\wedge$ Weapon(y) $\wedge$ Sells(x,y,z) $\wedge$ Hostile(z) $\Rightarrow$ Criminal(x)

Owns(Nono,M_1) $\wedge$ Missile(M_1)

Missile(x) $\wedge$ Owns(Nono,x) $\Rightarrow$ Sells(West,x,Nono)

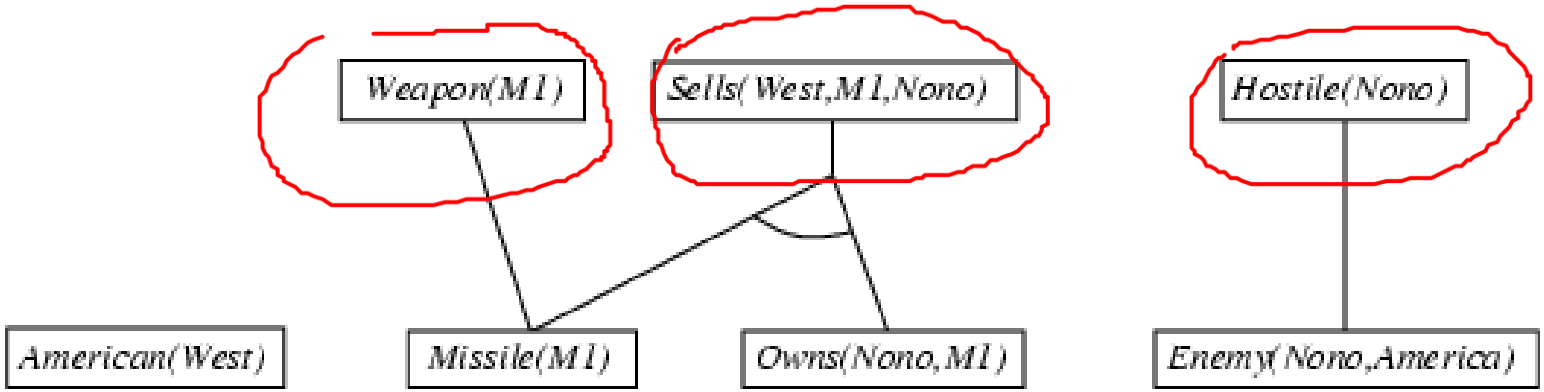
Missile(x) $\Rightarrow$ Weapon(x)

American(West)

Enemy(x,America) $\Rightarrow$ Hostile(x)

Enemy(Nono,America)

Forward chaining proof



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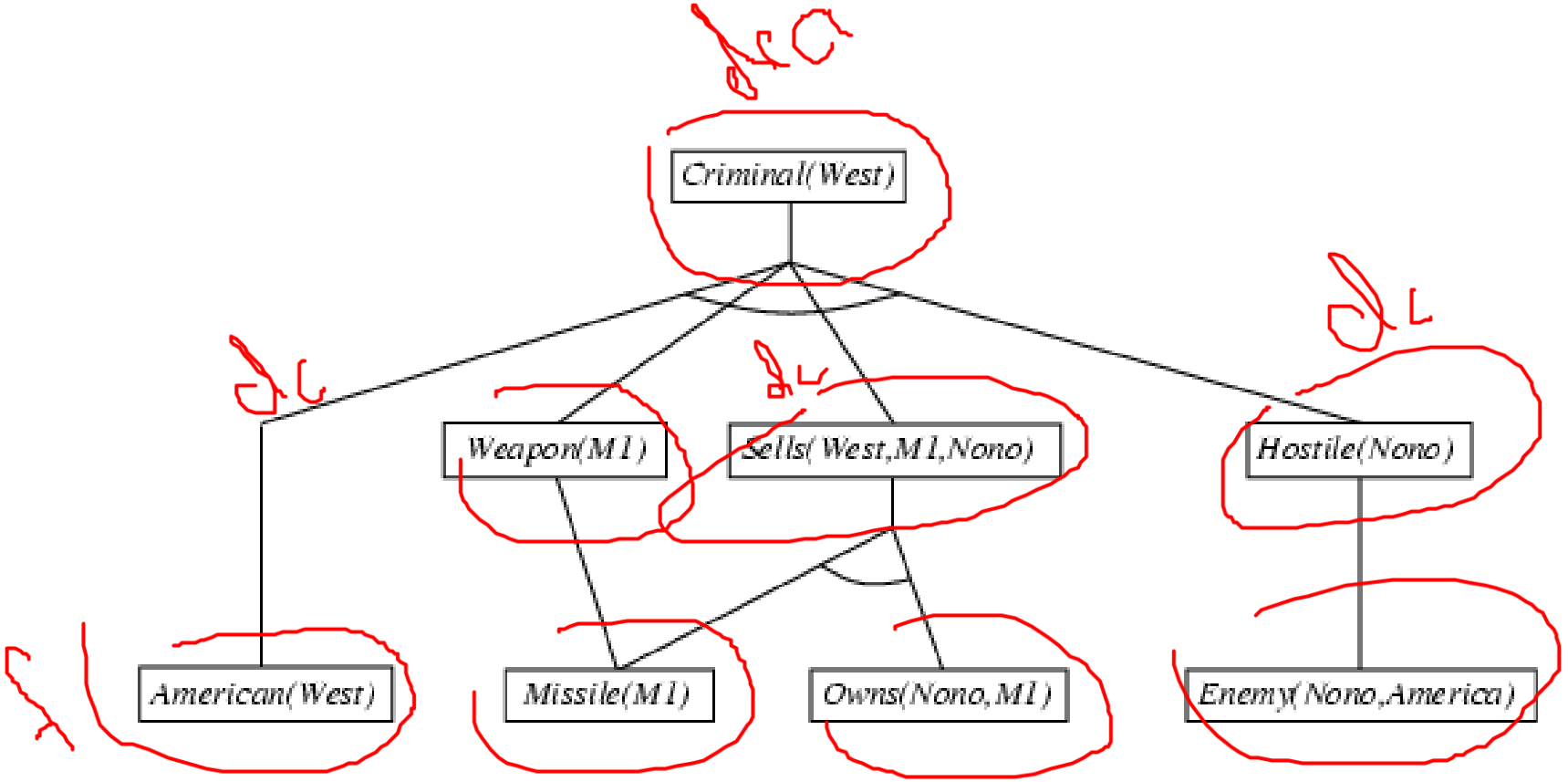

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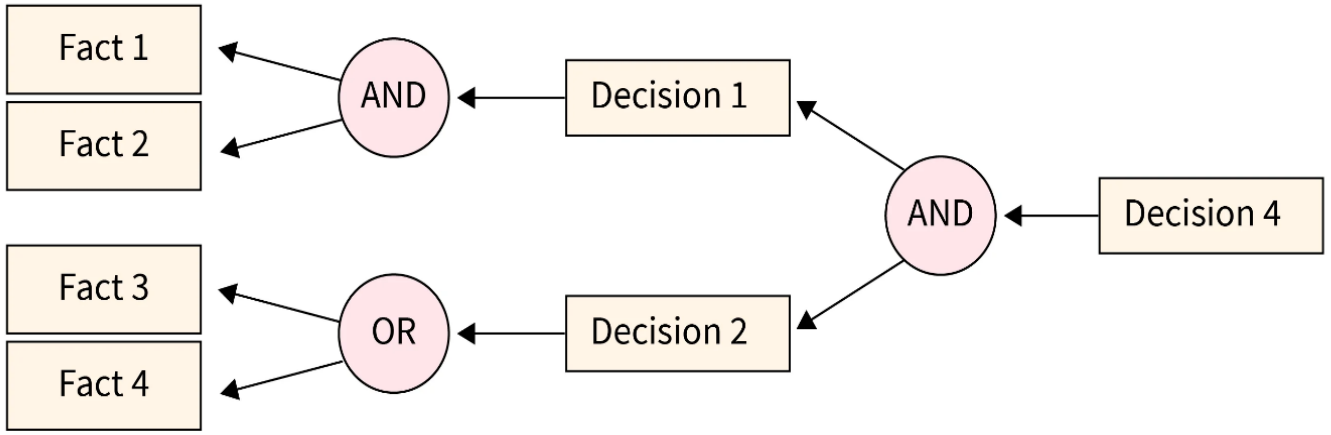
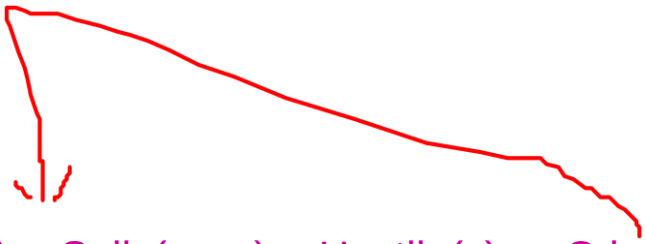
Backward Chaining

Backward Chaining, also known as backward reasoning, is an inference engine reasoning method that begins with an imagined objective. It employs backtracking to discover the most optimum method for dispute resolution or to achieve the target state, in which the search begins from the outcome and travels back to comprehend the circumstances from which it came



Backward chaining example



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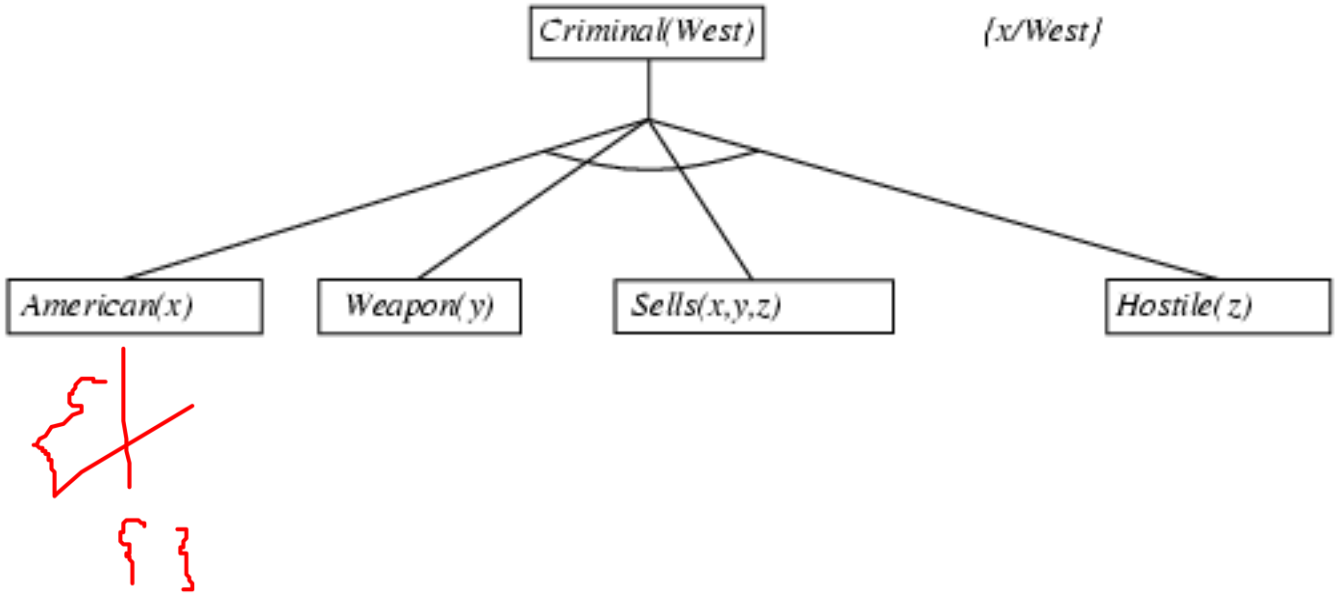

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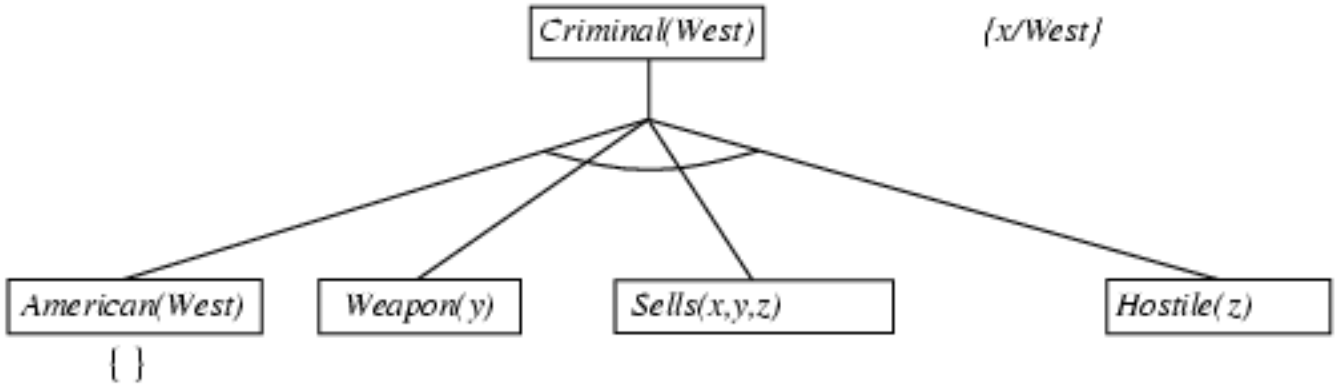

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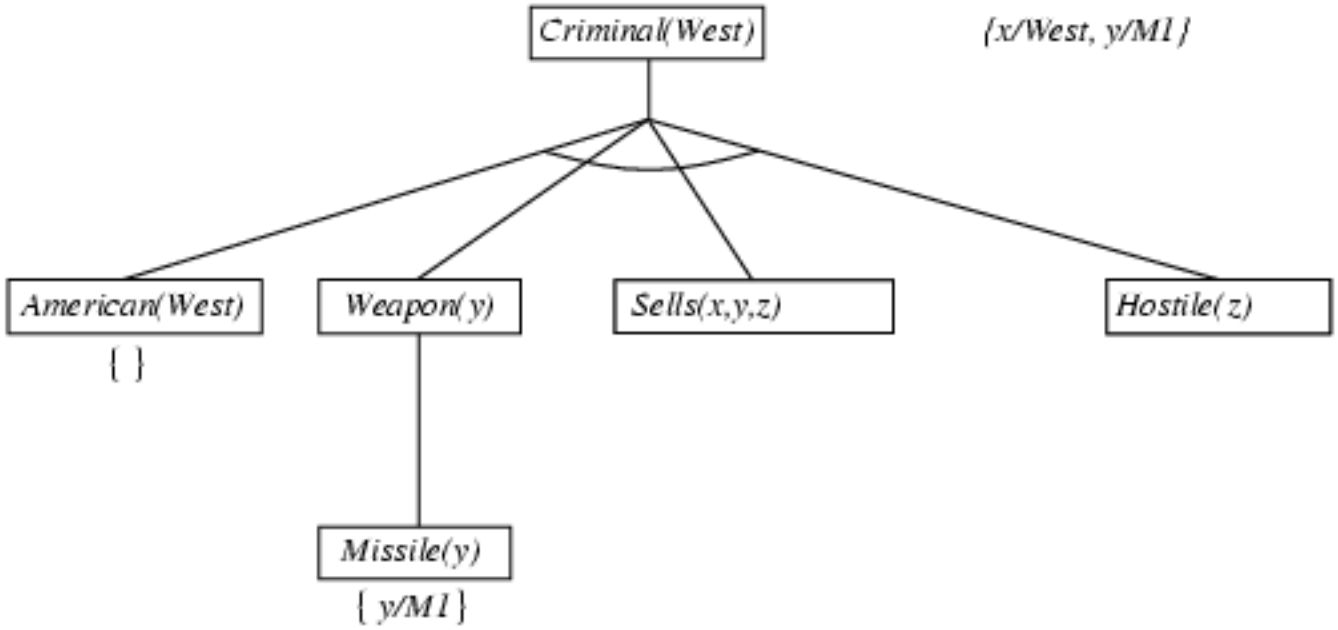

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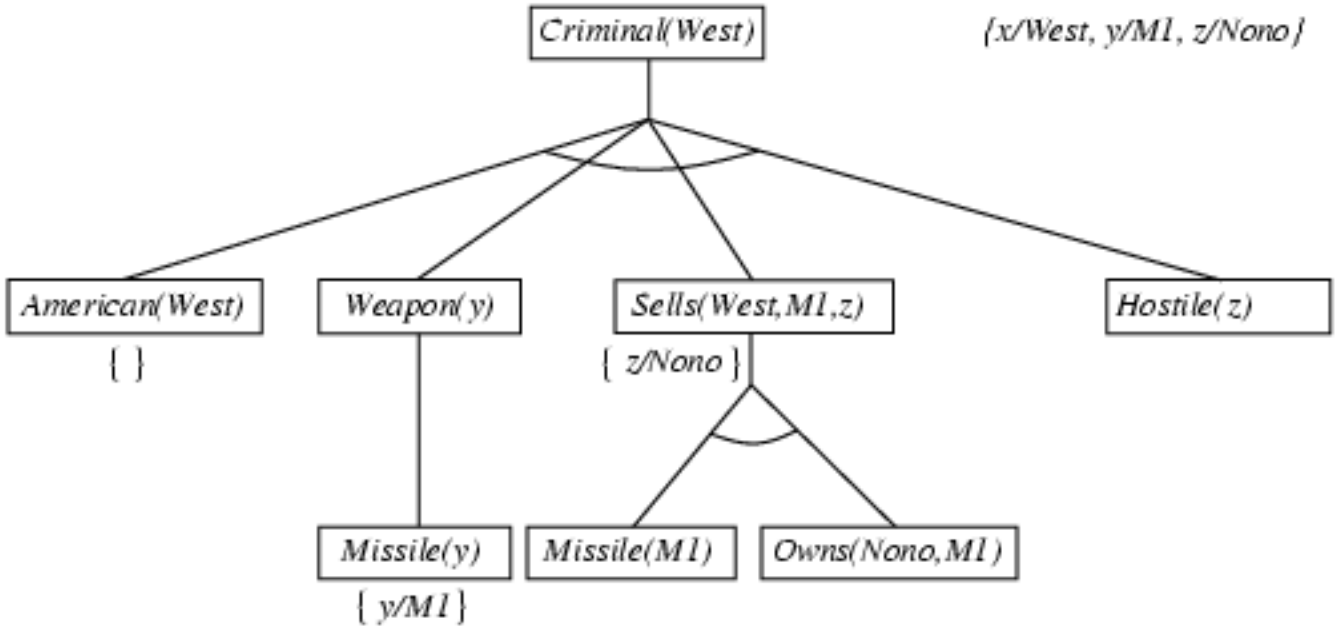

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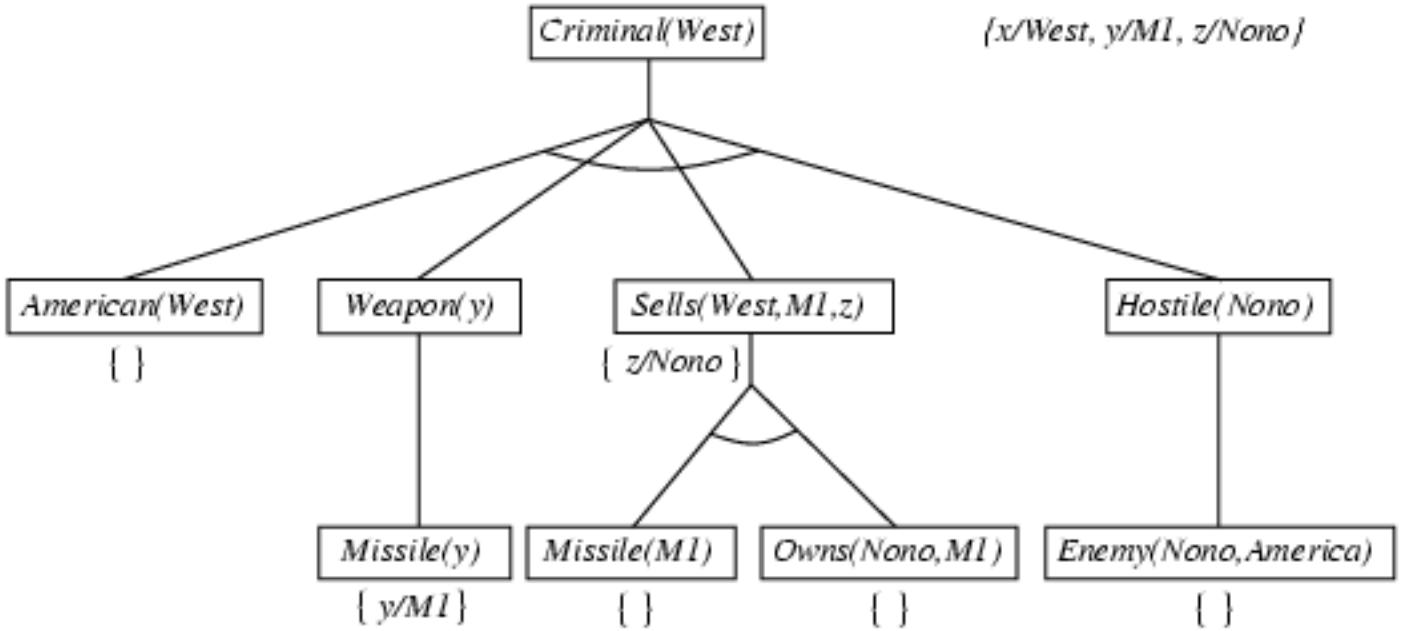

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