Artificial Intelligence

Assignment 9

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GROUP HOLLERITH - SOLUTION

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1. Solution:

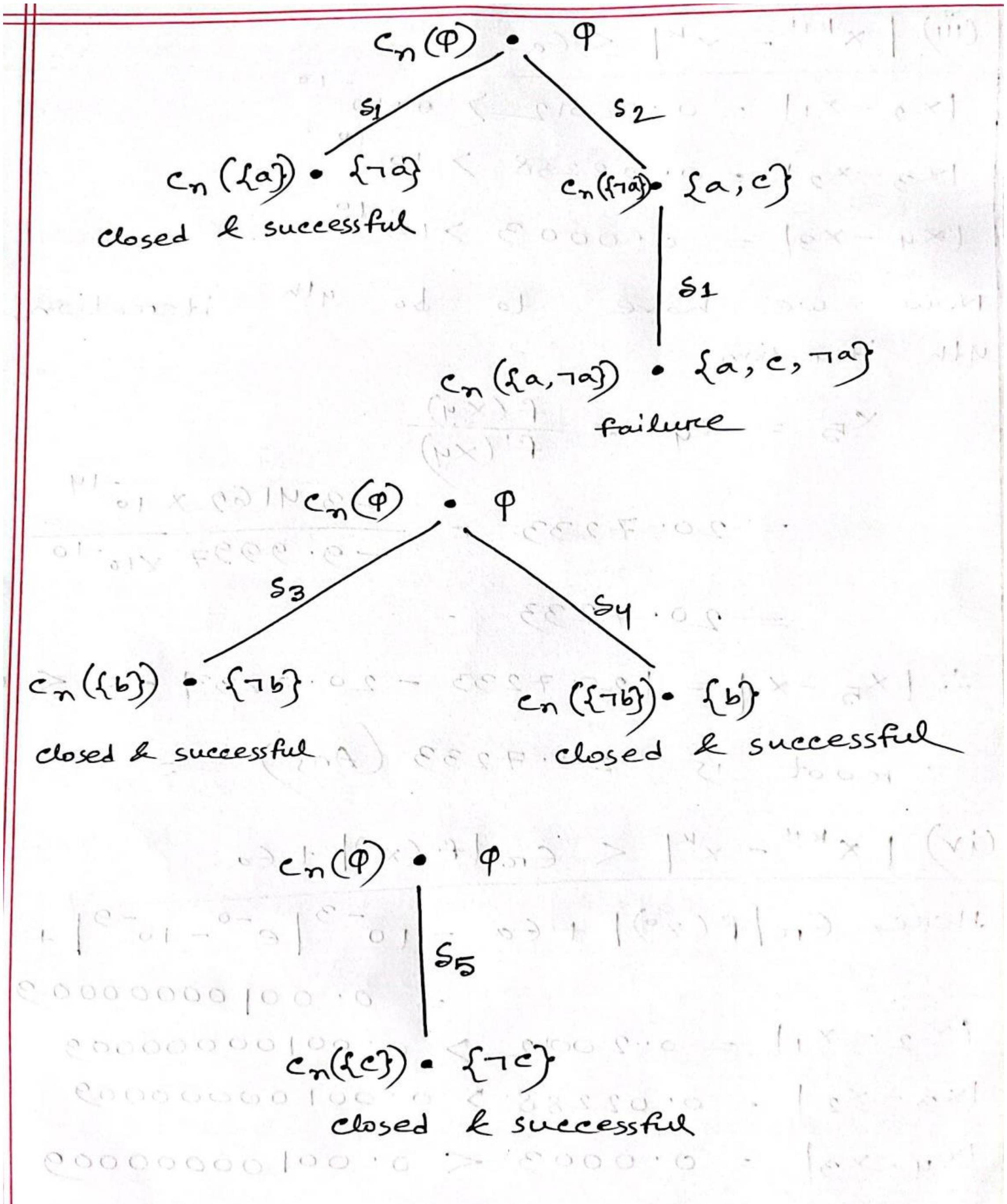


fig: process tree

All extensions for the default theory T are:

$E_1 = C_n(\{a\})$

$E_2 = C_n(\{\neg a\})$

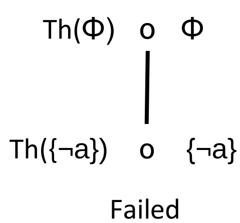
$E_3 = C_n(\{b\})$

$E_4 = C_n(\{\neg b\})$

$E_5 = C_n(\{c\})$

2. (1) Solution:

Let T = (W,D) with W = Φ and D = {true : a/¬a}. The process tree in the following Figure shows that T has no extensions. Here, the default can be applied because there is no hindrance from assuming a. After applying the default, the negation of a is added to the current knowledge base, so the default validates its own application because both the “In” and the “Out”-set contain “¬a”. This example delineates that there may not always be an extension of a default theory.



Reference: https://www.csd.uoc.gr/~hy467/resources/p337-antoniou.pdf

2. (2) Solution:

Let T = (W, Δ) be a default theory with W = Φ and Δ = {δ_1, δ_2, δ_3} with

$\delta_1 = \frac{p:q}{q}$, $\delta_2 = \frac{p:\neg q}{\neg q}$, $\delta_3 = \frac{\neg p:r}{r}$

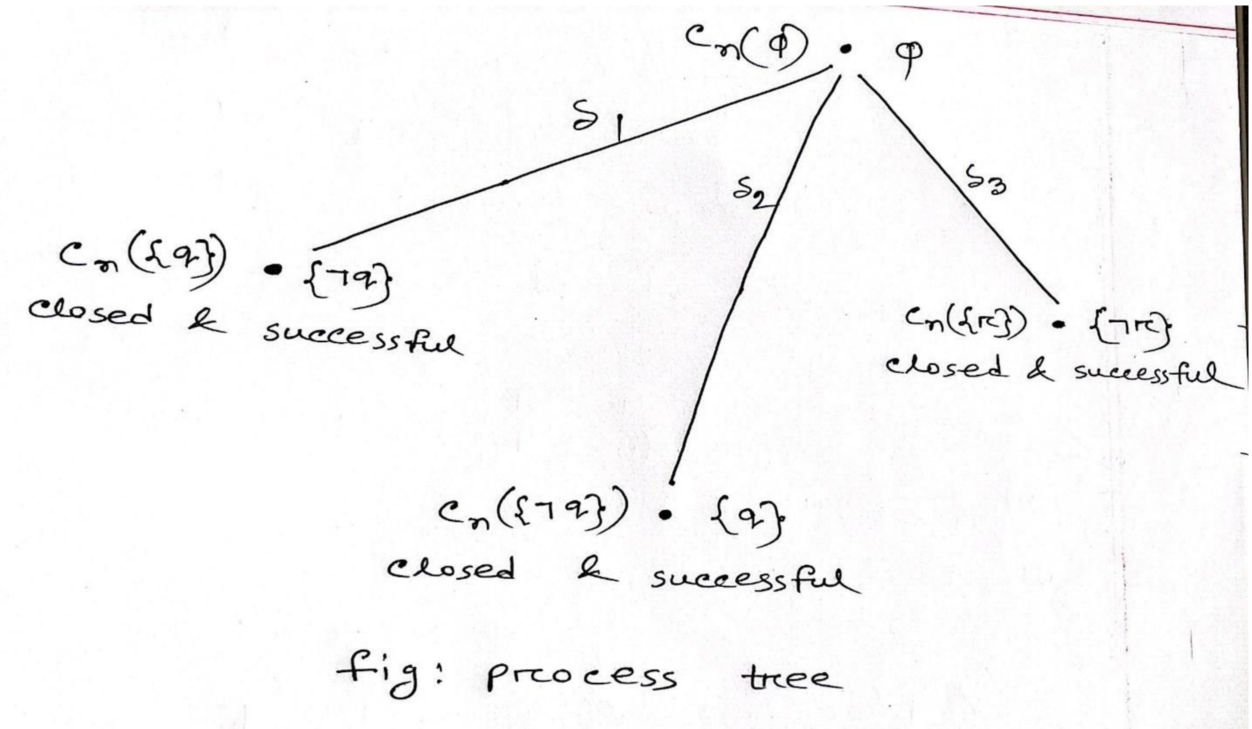


fig: process tree

All three extensions are:

$E_1 = C_n(\{q\})$

$E_2 = C_n(\{\neg q\})$

$E_3 = C_n(\{r\})$

3. SOLUTION:

Let α, β1, β2, γ be propositional logic formulae. Have to show that $\delta 1 = \frac{\alpha : \beta 1, \beta 2}{\gamma}$ and $\delta 2 = \frac{\alpha : \beta 1 \wedge \beta 2}{\gamma}$ are not equivalent. Here are two default theories T_1 = (W, {δ'_1}) and T2 = (W, {δ'_2}) which do not have the same extensions (with δ'_i a default of the form of δ_i).

We know, a default is a semi-normal default, if it has the form like this:

$$\frac{\varphi : \psi \wedge \chi}{\psi}$$

Normal default theories are well-behaved, but are too restrictive for modeling. Semi-normal defaults can "implement" priorities between defaults.

$$\delta = \frac{\varphi : \psi 1, \ldots, \psi n}{\chi}$$

From default theory, If ϕ is known and $\psi_1, \ldots, \psi_n$ can be consistently assumed, then conclude χ.

Here, extension E:

- ϕ is known iff ϕ ∈ E;
- ψ1, . . . , ψn can be consistently assumed iff ¬ψi ∉ E, 1 ≤ i ≤ n.

An extension E ⊆ L(Σ, V) is characterized by the following properties:

- E contains all facts: W ⊆ E
- E is deductively closed: Cn(E) = E
- E is closed under default application, i. e. if $\delta = \frac{\varphi : \psi 1, \ldots, \psi n}{\chi} \in \Delta$ is applicable in E then χ ∈ E where:

  δ is applicable in E iff ϕ ∈ E and ¬ψ1 ∉ E, . . . , ¬ψn ∉ E

Again, as per semi monotonicity, if T = (W, D) and T' = (W, D') be normal default theories s.t. D ⊆ D'. Then each extension of T is contained in an extension of T'. A default theory T = (W, D) is semi-normal, if all defaults in D are semi-normal. So, two default theories T_1 = (W, {δ'_1}) and T2 = (W, {δ'_2}) do not have the same extensions.