Lab-8 First Order Logic Unification

Unifying $\{Q(a, g(x,a), f(y)), Q(a, g(f(b),a), x)\}$

A:

$\Psi_1 = Q(a, g(x,a), f(y))$
$\Psi_2 = Q(a, g(f(b),a), x)$

Substitution set $\theta = \{\}$

add ~~θ~~ $f(b)/x$ to θ

$\Psi_1 = Q(a, g(f(b),a), f(y))$
$\Psi_2 = Q(a, g(f(b),a), f(b))$
$\theta = \{f(b)/x\}$

adding b/y to θ

$\Psi_1 = Q(a, g(f(b),a), f(b))$
$\Psi_2 = Q(a, g(f(b),a), f(b))$
$\theta = \{b/y, f(b)/x\}$

$\Psi_1 = \Psi_2$, therefore returning substitution

∴ ~~MGU~~ most general unifier
$= \{Q(\cancel{f}a, g(f(b),a), f(b))\}$
$\theta = \{f(b)/x, b/y\}$

∴ Unification Successful.

Unifying the following sentences:

1. John likes all food
2. Apple and vegetable are food
3. Anything anyone eats and not killed is food
4. Anil eats peanuts and lives

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Converting to FOL

1. $\forall x$: food (x) $\rightarrow$ likes (John, x)
2. ~~$\forall x$~~ food (Apple) $\wedge$ food (vegetable)
3. $\forall x, y$ eats (x,y) $\wedge \neg$ killed (x) $\rightarrow$ food (y)
4. eats (Anil, Peanut) $\wedge \neg$ killed (Anil)

Convert to atomic sentences

1. $\forall x$: food (x) $\rightarrow$ likes (John, x)
2. food (Apple)
3. food (Vegetable)
4. $\forall x, y$ (eats (x, y) $\wedge \neg$ killed (x)) $\rightarrow$ food (y)
5. eats (Anil, peanut)
6. $\neg$ killed (Anil)

~~Unifying 1 and~~ 5, 6 = 7

eats (Anil, peanut) $\wedge \neg$ killed (Anil) - 7

Unifying 4, 7

ψ_1 = eats (x, y) $\wedge \neg$ killed (x) $\rightarrow$ food (y)

ψ_2 = eats (Anil, peanut) $\wedge \neg$ killed (Anil)

Substituting ~~x~~ Anil / x

ψ_1 = eats (Anil, y) $\wedge \neg$ killed (Anil) $\rightarrow$ food (y)

ψ_2 = eats (Anil, peanut) $\wedge \neg$ killed (Anil)

Substituting peanut / y

$\therefore$ ψ_1 = eats (Anil, peanut) $\wedge \neg$ killed (Anil) $\rightarrow$ food (Peanut)

ψ_2 = eats (Anil, peanut) $\wedge \neg$ killed (Anil)

θ = {Anil/x, peanut/y}

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Using rule
~~P, Q~~ P, $P \rightarrow Q \vDash Q$ (Modus Ponens)
$P = \varphi_2$ $Q = \varphi_1$
$\therefore$ φ_1 = True
$\therefore$ food (peanuts) — ⑧

Unifying ① and ⑧
φ_1 = food (x) $\rightarrow$ likes (~~peanuts~~ John, x)
φ_2 = food (peanuts)
Substituting peanuts / x
φ_1 = food (peanuts) $\rightarrow$ likes (John, ~~x~~ peanuts)
φ_2 = food (peanuts)
θ = {peanuts / x}

Using
P, $P \rightarrow Q \vDash Q$ (Modus Ponens)
P = φ_2, ~~Q = φ_1~~
$\therefore$ ~~φ_1 = True~~ Q is True
$\therefore$ likes (John, peanuts) is True

Proceed

Code Output:
Substitutions: { ~~x / Peanuts~~ x: Ajay, y: Peanuts }

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