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CLASS:- B TECH 3RD YEAR,
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AIML
Tutorial 11

Ans 1:

1. {p(f(a), g(y)) and p(X, X)}

$\psi_1 = p(f(a), g(y))$
$\psi_2 = p(X, X)$

$\theta = \{f(a) / X\}$
S1 ⇒ $\psi_1 = p(f(a), g(y))$
$\psi_2 = p(f(a), f(a))$

$\theta = \{f(a) / g(y)\}$, Unification failed

2: $\psi_1 = p(b, X, f(g(z)))$
$\psi_2 = p(z, f(y), f(y))$
$\theta = \{b/z\}$
S1 ⇒ $\psi_1 = p(b, X, f(g(z)))$ $\psi_2 = p(b, f(y), f(z))$
$\theta = \{f(y)/X\}$ $\{f(y)/z\}$
S2 ⇒ $\psi_1 = p(b, f(y), f(g(z)))$ $\psi_2 = p(b, f(y), f(y))$
$\theta = \{g(b)/y\}$
S3 ⇒ p(b, f(g(b)), f(g(b))); p(b, f(g(b)), f(g(b)))

Unifier = {b/z, f(y)/X, g(b)/y}

3. $\{p(X,X), p(Z,f(Z))\}$

$\theta = \{X/Z\}$

$S1 \Rightarrow \{p(Z,Z), p(Z,f(Z))\}$

$\theta = \{f(Z)/Z\}$, Unification failed.

4. $S0 = p_1\{prime(11)\}\ p_2(prime(y))$

$\theta = \{11/y\}$

$S_1 = p_1(prime(11)),\ p_2(prime(11))$

Hence, Unifier $= \{11/y\}$

5. $S_0 = p(a, g(x,y), f(y))$
$p(a, g(bf(b), a), x)$

$\theta = \{f(b)/x\}$

$S_1 = \{Q(a, g(f(b), a), f(y)); Q(a, g(f(b), a), f(b)\}$

$\theta = \{b/y\}$

$S_2 = \{Q(a, g(f(b), a), f(b)); Q(a, g(f(b), a)), f(b)\}$

Hence, Unifier $= \{f(b)/x, b/y, a/a\}$

6. $S_0 = \{knows(Richard, X), knows(Richard, John)\}$

$\theta = \{John/X\}$

$S_1 = \{knows(Richard, John), knows(Richard/John)\}$

Hence, unifier $= \{John/X\}$

Ans 2:-

a) ~~John likes all kinds of food.~~

i) $\forall x : food(x) \rightarrow likes(John, x)$

ii) $\forall x \rightarrow food(x) \vee likes(John, x)$

~~iii)~~

a) John likes all kinds of food
b) Apple and vegetable are food
c) Anything anyone eats and not killed is food.
d) Anil eats peanut and is alive.
e) Harry eats everything that Anil eats

Prove that:-

f) John likes peanuts.

Step 1:-

a) $\forall x : food(x) \rightarrow likes(John, x)$
b) $food(Apple) \wedge food(Vegetable)$
c) $\forall x \forall y : eats(x,y) \wedge \sim killed(x) \rightarrow food(y)$
d) $eats(Anil, Peanuts) \rightarrow alive(Anil)$
e) $\forall x : eats(Anil, x) \rightarrow eats(Harry, x)$

f) $\forall x : \sim killed(x) \rightarrow alive(x)$ } added predicates
g) $\forall x : alive(x) \rightarrow \sim(killed(x))$ }

h) $likes(John, peanuts)$

Step 2:-

Remove Implications:-

a) $\forall x$ food(x) $\vee$ likes(John, x)

b) food(Apple) $\wedge$ food(Vegetable)

c) $\forall x \forall y \rightarrow [eats(x,y) \wedge \sim killed(x)] \vee food(y)$

d) eats(Anil, Peanuts) $\wedge$ Alive(Anil)

e) $\forall x \rightarrow \forall x \sim eats(Anil, x) \vee eats(Harry, x)$

f) $\forall x \sim(\sim(killed(x)) \vee alive(x)$

g) $\forall x \sim alive(x) \vee \sim(killed(x))$

h) likes(John, peanuts)

Move negation inwards:-

a) $\forall x \sim food(x) \vee likes(John, x)$

b) food(Apple) $\wedge$ food(vegetables)

c) $\forall x, \forall y \sim eats(x,y) \vee killed(x) \vee food(y)$

d) eats(Anil, Peanuts) $\wedge$ Alive(Anil)

e) $\forall w \sim eats(Anil, w) \vee eats(Harry, w)$

f) $\forall g \sim killed(g) \vee alive(g)$

g) $\forall k \sim alive(k) \vee \sim(killed(k))$

h) likes(John, Peanuts)

Drop universal quantifiers:-

a) $\sim food(x) \vee likes(John, x)$

b) food(Apple)

c) food(vegetable)

d) $\sim eats(y,z) \vee killed(y) \vee food(z)$

e) eats(Anil, peanuts)

f) alive(Anil)

g) $\sim eats(Anil, w) \vee eats(Harry, w)$

h) killed(g) $\vee$ alive(g)

i) $\sim alive(k) \vee \sim killed(k)$

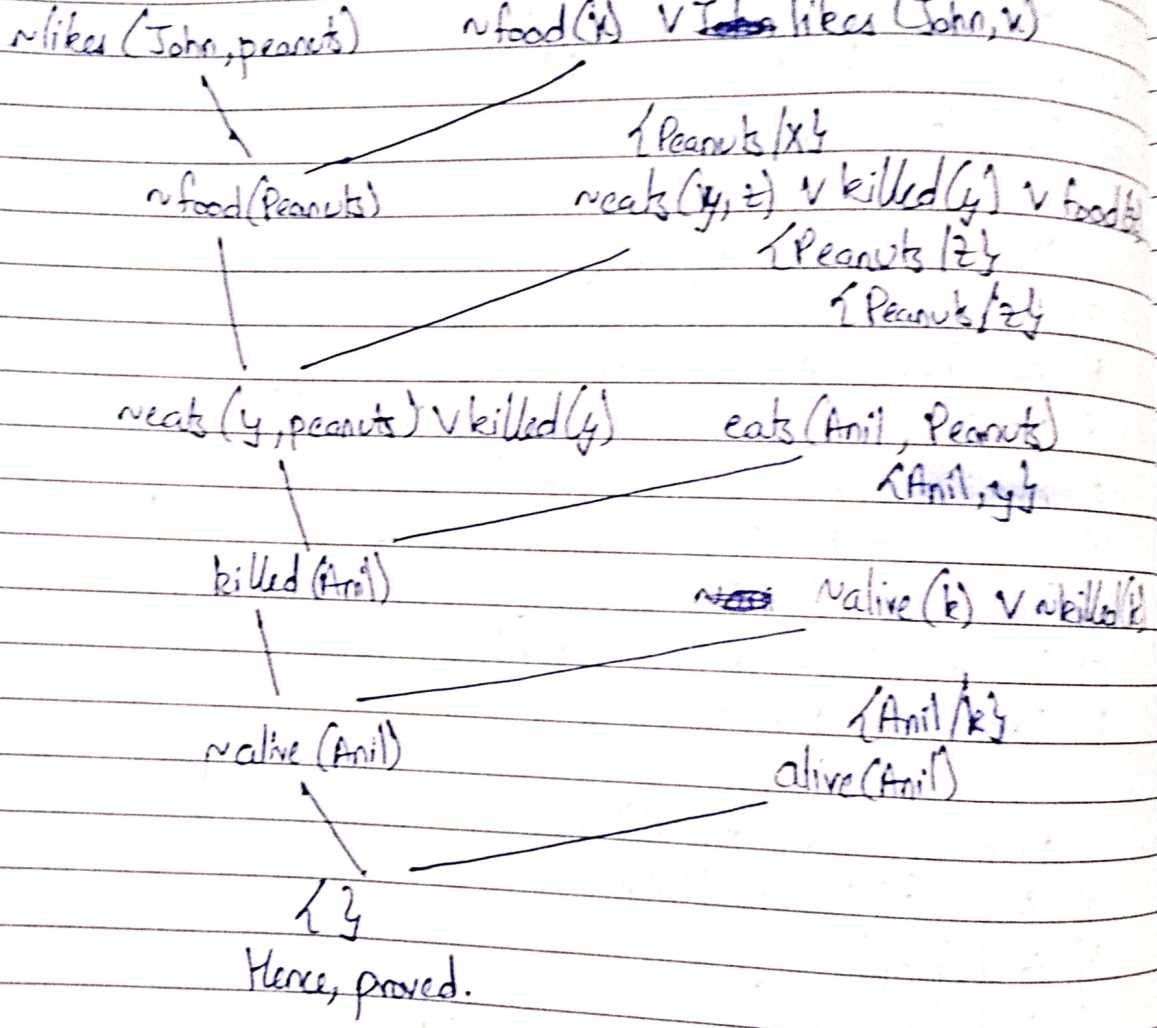
j) likes(John, peanuts)

Step 3: Negate the ~~prove~~ statement to be proved.

Hence,

g) ¬likes(John, peanuts)

Step 5:- Draw Resolution Graph



Hence, proved.