SSN COLLEGE OF ENGINEERING
RECORD SHEET

Sheet No. 1

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Dept : III year CSE-A
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Logic Programming
Assignment - II

1. Given the following statements.

Laxman is wherever Ram is .

Ram is at Ayodhya.

Where is Laxman?

generate answer using logic programming.

Laxman is wherever Ram is.

$\forall x \; At(Ram, x) \rightarrow At(Laxman, x)$

$\neg At(Ram, x) \vee At(Laxman, x)$

① clause : $\{\neg At(Ram, x), At(Laxman, x)\}$.

Ram is at Ayodhya.

$At(Ram, Ayodhya)$

② clause : $\{At(Ram, Ayodhya)\}$.

Goal clause : where is Laxman ? $\Rightarrow At(Laxman, y)$
(negation)

③ clause : $\{\neg At(Laxman, y), Answer(y)\}$

① $\{\neg At(Ram, x), At(Laxman, x)\}$ ③ $\{\neg At(Laxman, y), Answer(y)\}$.

x/y

$\{\neg At(Ram, y), Answer(y)\}$. ② $\{At(Ram, Ayodhya)\}$

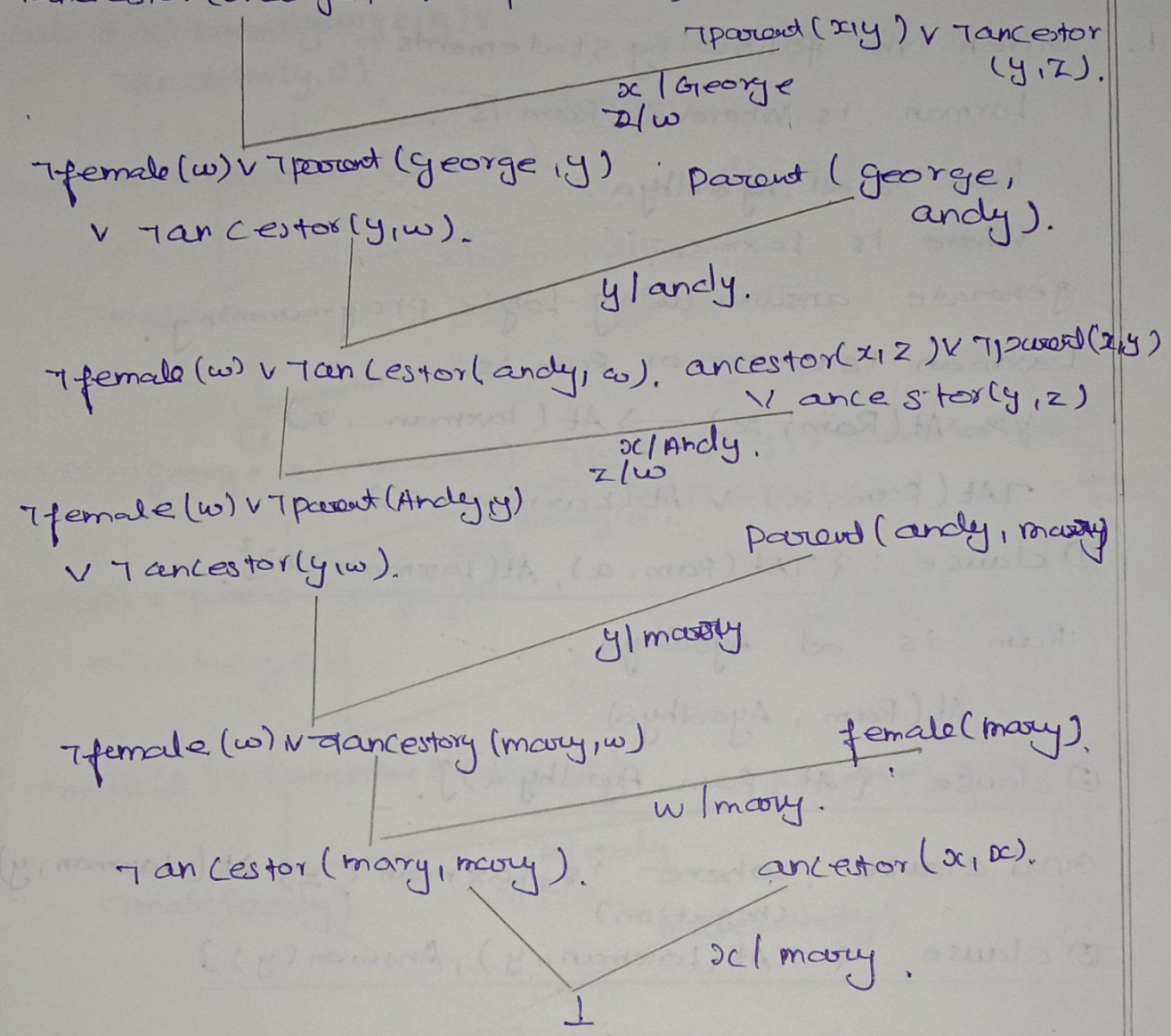
$y/Ayodhya$.

$\{Answer(Ayodhya)\}$: By Answer generation, we find that Laxman is at Ayodhya

Q. i. female ancestor of george.

ancestor(George, w) ∧ female(w)

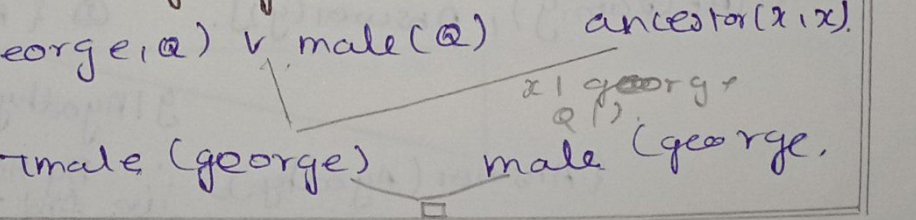
Negation : ¬ancestor(George, w) ∨ ¬female(w).



Answer : w := Mary.

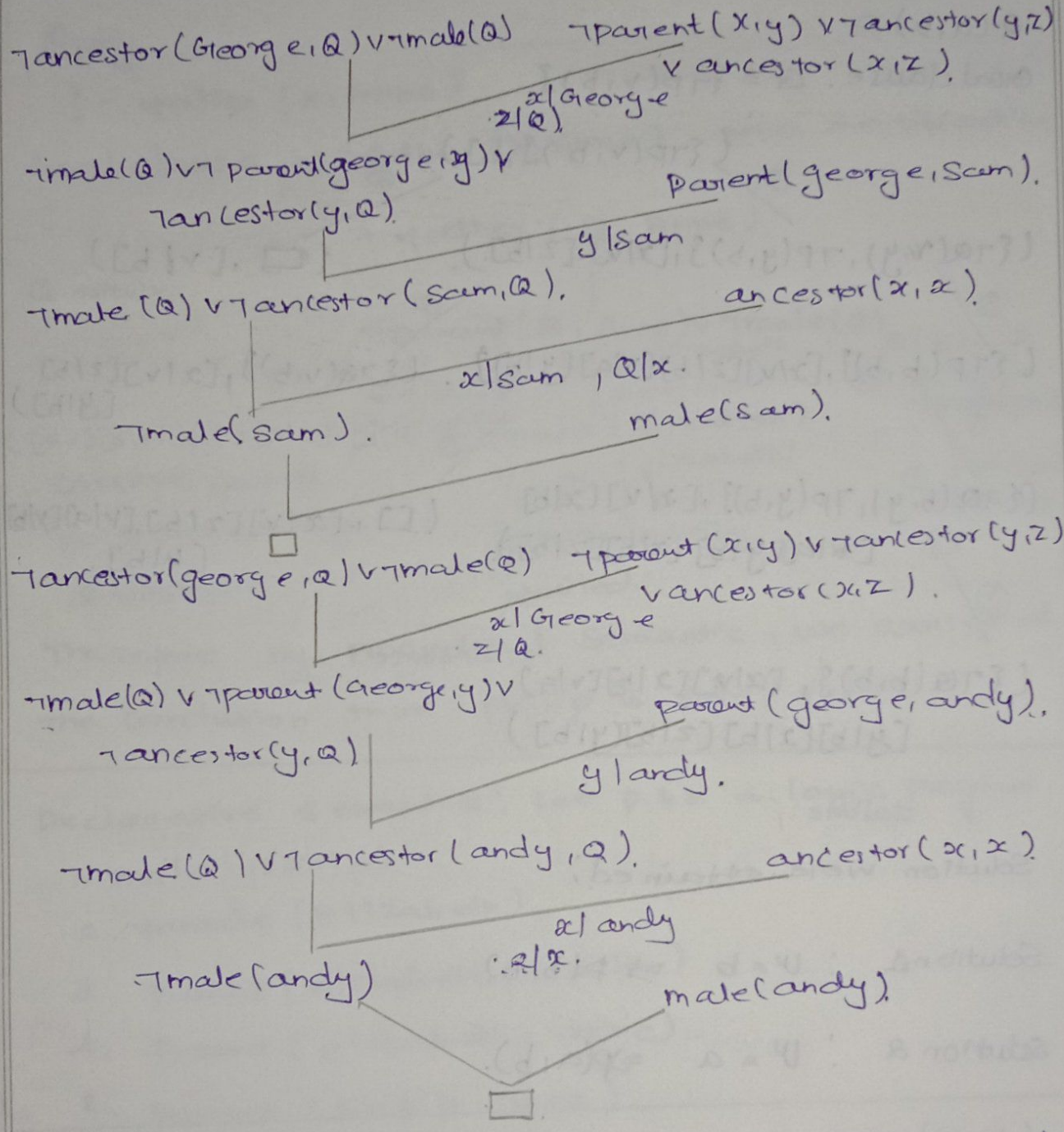
ii. male ancestor of george.

¬ ancestor(george, Q) ∨ male(Q)



'ancestor(george, Q) ∧ male (Q).

Goal clause : ¬ancestor(George, Q) ∨ ¬male (Q).



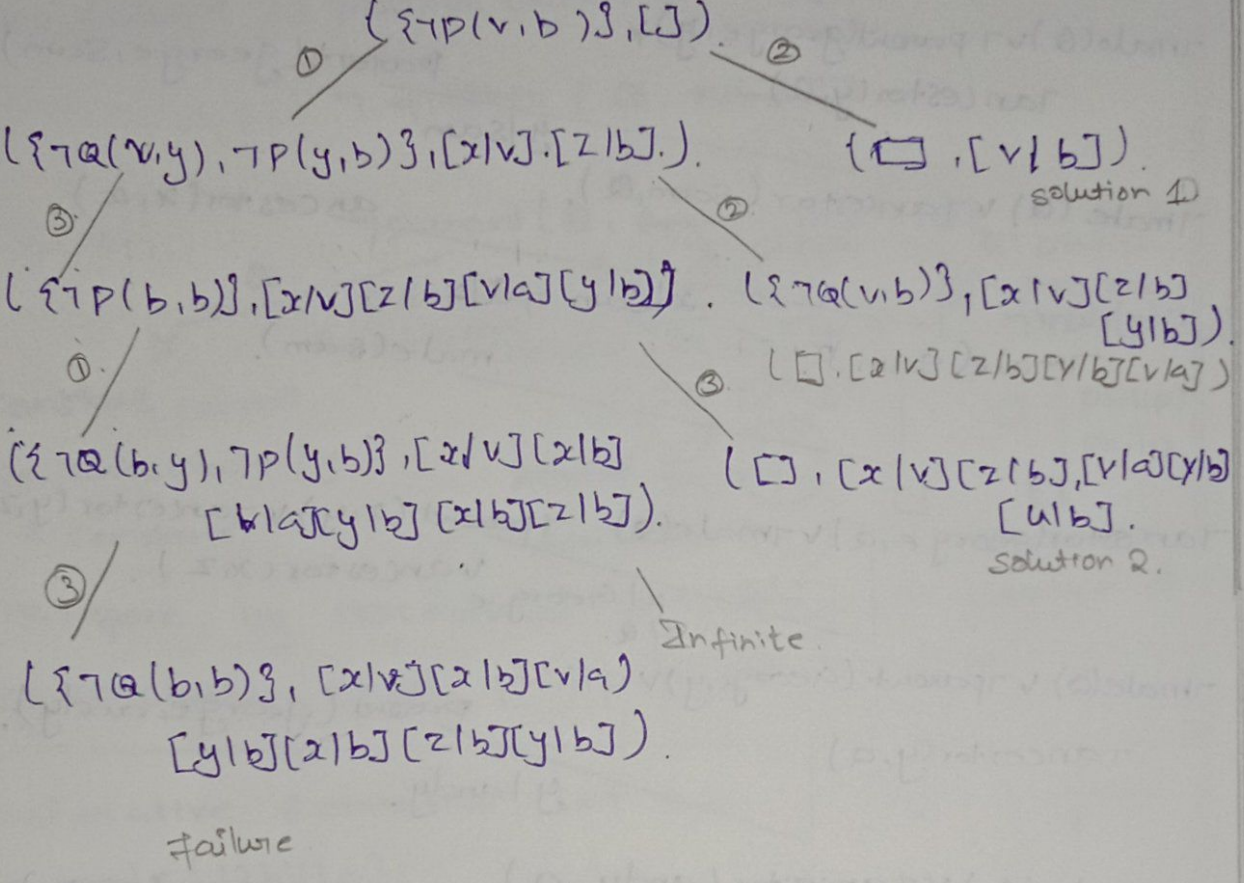
Male ancestors of george are george, sam and andy.

3. $P(x,z) :- Q(x,y), P(y,z)$ ①

$P(u,w)$ ②

$Q(a,b)$ ③

Goal clause: $G = \{\neg P(v,b)\}$.



Solution were obtained;

Solution 1 : $v = b \Rightarrow P(b,b)$

Solution 2 : $v = a \Rightarrow P(a,b)$.

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4. Procedural semantics :-

1. male (philip)
2. female (elizabeth)
3. parent (elizabeth, charles).
4. parent (elizabeth, anne)

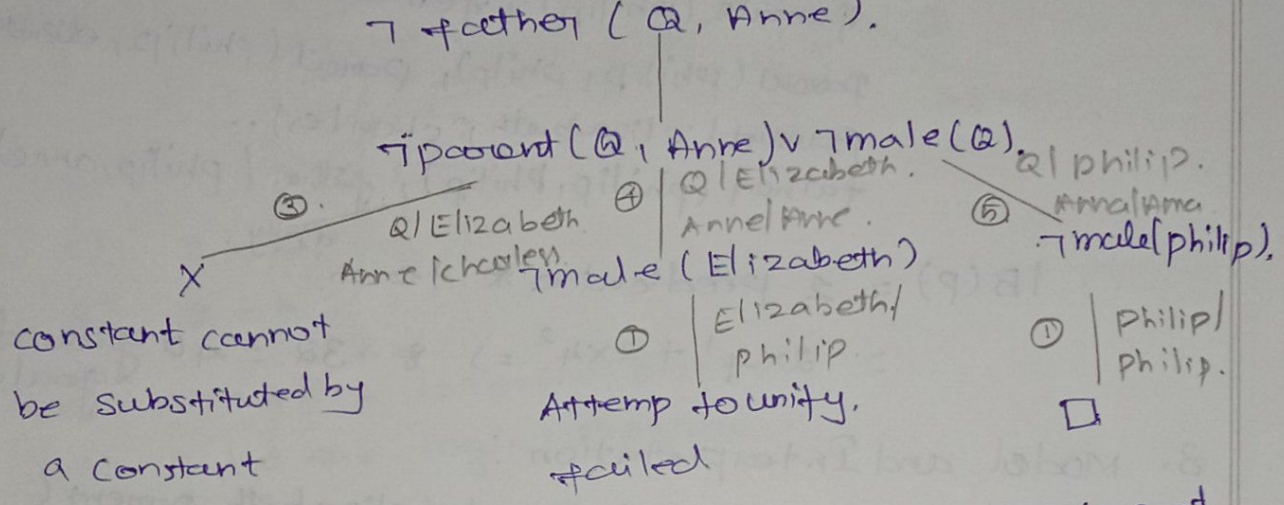
5. parent (philip , anne).

6. father(X,Y) :- parent(X,Y) , male(X).

Query

?- father (X, Anne).

Goal clause => ¬father (X, Anne) After rectification



Therefore by procedural semantic, we arrive at the conclusion that philip is Anne's father

5. Declarative semantics: Let P be a logic program.

1. male (philip)
2. female (Elizabeth)
3. parent (elizabeth, charless)
4. parent (elizabeth, anne).
5. parent (philip, anne).
6. ¬parent (X, Y) v ¬male (X) v father (X, Y)

Model theoretic sematics based on following Principles.

1- Herbrand universe :

$U(P) = \{philip, elizabeth, charles, anna\}$.

$|U(P)| = 4$.

2- Herbrand Base :

$B(P) = \{male(philip), male(elizabeth) \ldots$
$female(philip), female(elizabeth) \ldots$
$parent(philip, philip), parent(philip, elizabeth) \ldots$
$parent(elizabeth, charles) \ldots$
$father(philip, philip), father(philip, anne)\}$.

$|B(P)| = \Sigma$ predicate $*$ term^{arity}.

$= 2 \times 4^1 + 2 \times 4^2 \Rightarrow 8 + 32 = 40$ ground goals.

3. Model and Interpretation :-

$M(P) := \{male(philip), female(elizabeth, parent(elizabeth, charles), parent(elizabeth, anne), parent(philip, anne), father(philip, anne)\}$.

$M(P) \in B(P)$.

$father(philip, anne) \in M(P)$ since each $B_1 B_2 B_3 \ldots$ in $A \leftarrow B_1, B_2, B_3 \ldots$ is in the interpretation.

i.e. $parent(philip, anne), male(philip) \in M(P)$

6. $p(a,a)$ ①

$p(a,b)$ ②

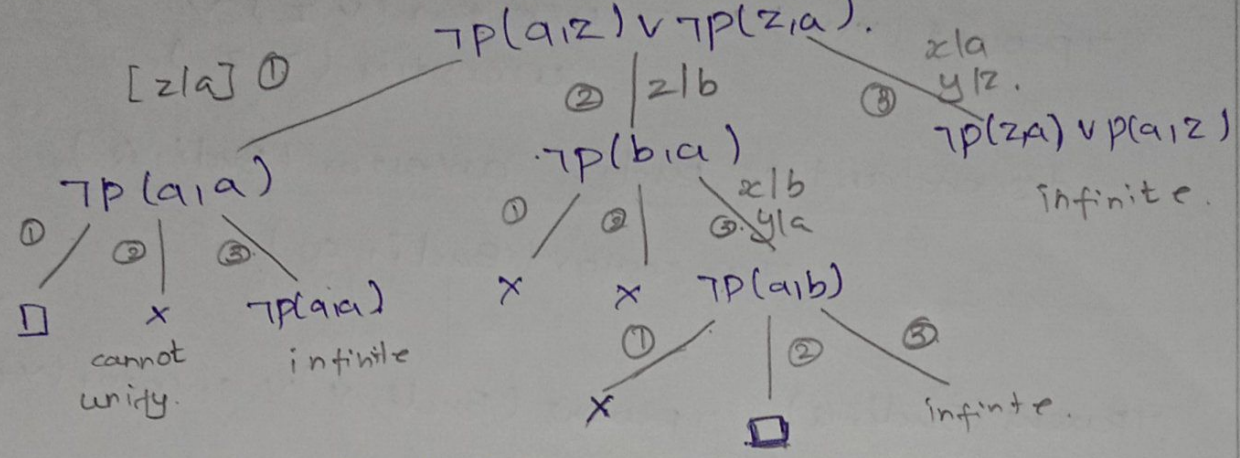
$p(x,y) :- p(y,x)$ ③

$\neg p(y,x) \vee p(x,y)$.

$?- p(a,z), p(z,a)$.

Goal clause : $\neg p(a,z) \vee \neg p(z,a)$

Procedural interpretation :-



Solution obtained :

1) $z = a$

2) $z = b$

Model theoretic interpretation :-

Let P be the logic program.

* $U(P) = \{a, b\}$ $|U(P)| = 2$ ⇒ Herbrand universe.

* $B(P) = \{p(a,a), p(a,b), p(b,a), p(b,b)\}$ ⇒ Herbrand Base.

$|B(P)| = 1 \times 2^2 = 4.$

* Model $M(P) = \{p(a,a), p(a,b), p(b,a)\}$.

$p(a,b)$ is in the model.

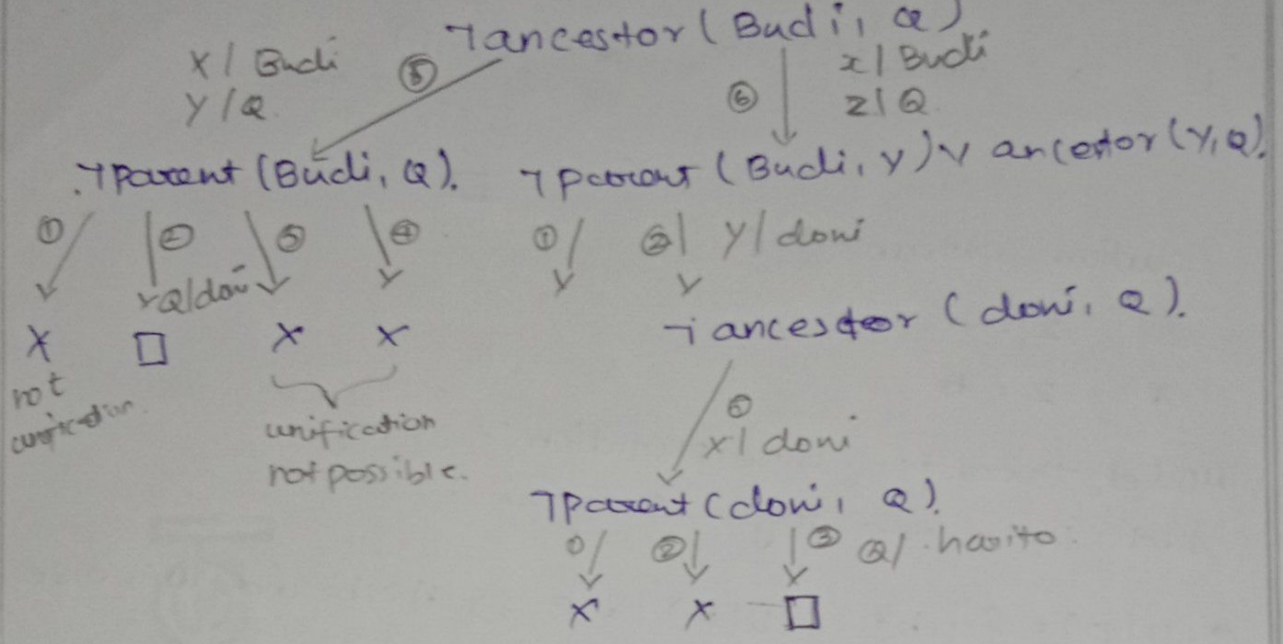
7. Logic program P.

1. parent(tukul, budi).
2. parent(budi, doni).
3. parent(doni, harto).
4. parent(harto, tomi).
5. ancestor(X,Y) :- parent(X,Y)
   ancestor(X,Y) :- parent(X,Z), ancestor(Z,Y)

6. ancestor(x,z) :- parent(x,y), ancestor(y,z)

¬parent(x,y) ∨ ¬ancestor(y,z) ∨ ancestor(x,z)

descendant of Budi - ancestor(Budi, Q)



Answer : first 2 descendants of Budi during DFS Traversal are.

1) doni.
2) harto.