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CSE-B

LP Assignment - 2.

①

Ram is at Ayodhya - at (Ram, Ayodhya)

Laxman is wherever Ram is

- at (Ram, x)  $\rightarrow$  at (Laxman, x)

Query: "Where is Laxman?" - {at (Laxman, y),  
ANSWER(y)}

ANSWER GENERATION:

{at (Laxman, y), ANSWER(y)} {at (Ram, x),  
at (Laxman, x)}

Unification  
[y/x]

{at (Ram, x), ANSWER(x)}

at (Ram, Ayodhya)

Unification

ANSWER (AYODHYA)

$\Rightarrow$  Laxman

and Input Resolution.

②

1) ancestor( $x, x$ )

2) ancestor( $x, z$ ) :- parent( $x, y$ ), ancestor( $y, z$ )

$\rightarrow$  parent( $x, y$ )  $\wedge$  ancestor( $y, z$ )  $\rightarrow$  ancestor( $x, z$ )

3) parent( $\text{george}, \text{Sam}$ )

$\Rightarrow \neg \text{parent}(x, y)$

4) parent( $\text{george}, \text{andy}$ )

$\neg \text{ancestor}(y, z)$

5) parent( $\text{andy}, \text{mary}$ )

$\vee \text{ancestor}(x, z)$

6) male( $\text{george}$ )

7) male( $\text{andy}$ )

8) male( $\text{Sam}$ )

9) female( $\text{mary}$ )

10) Query: female ancestor of George:

ancestor( $\text{george}, a$ )  $\wedge$  female( $a$ )

Clauses:  $\{ \neg \text{ancestor}(\text{George}, a), \neg \text{Female}(a) \}$

②

$z = a$

$x = \text{George}$

$\neg \text{ancestor}(y, a) \vee \neg \text{parent}(\text{George}, y) \vee$

$\neg \text{Female}(a)$

④



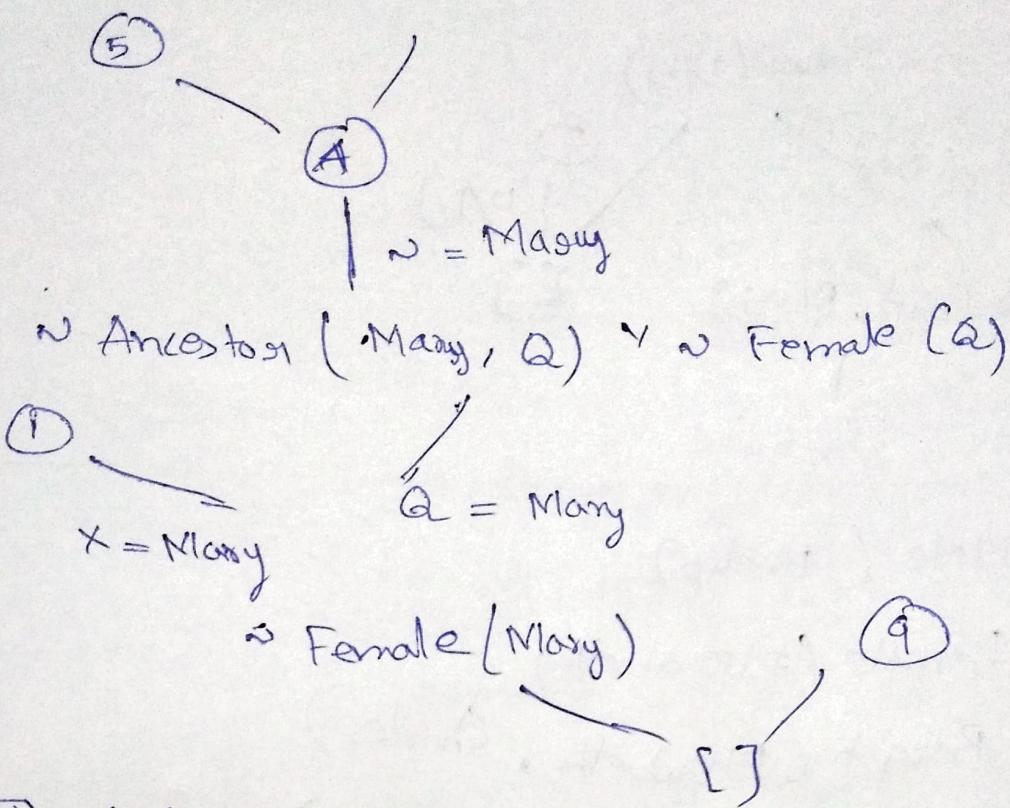
$y = \text{andy}$

$\neg \text{ancestor}(\text{andy}, a) \vee \neg \text{Female}(a)$

②

$/ x = \text{andy}, z = a$

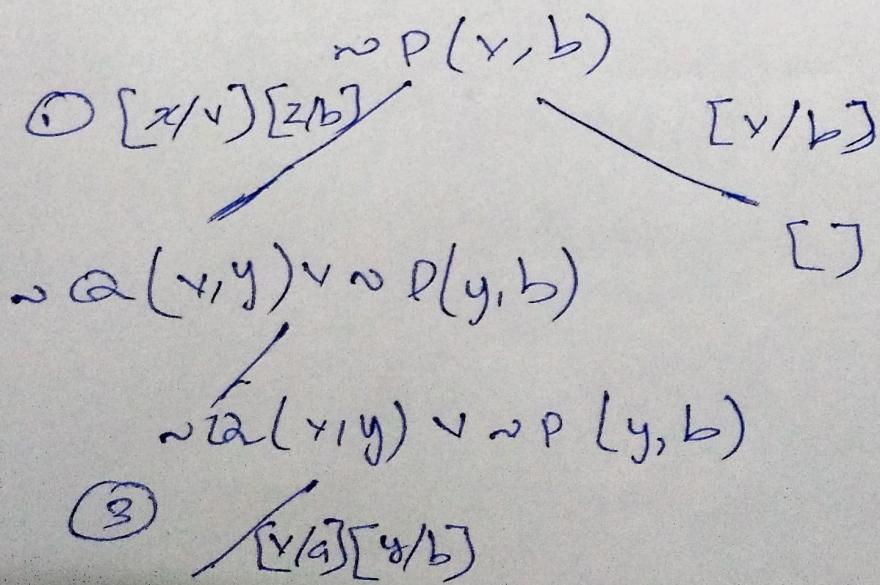
$\neg \text{parent}(\text{andy}, y) \vee \neg \text{ancestor}(y, a) \vee \neg \text{Female}(a)$

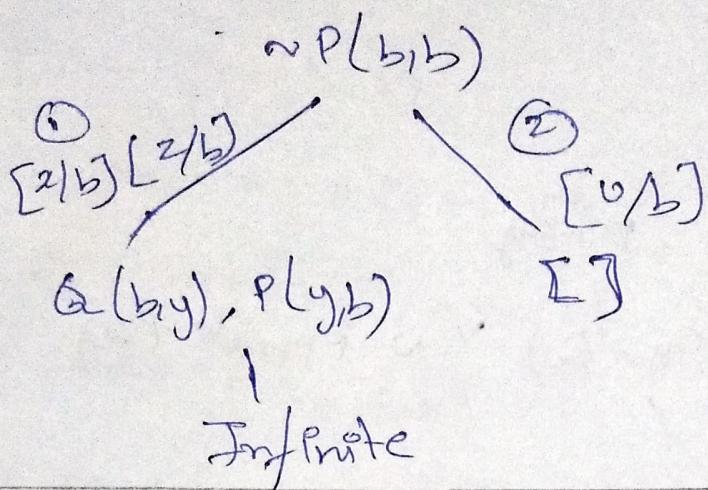


The last substitution of  $\approx \text{ Mary}$   
 $\Rightarrow$  Female ancestor of George is Mary.

- (3)
- 1)  $P(x, z) :- Q(x, y), P(y, z)$
  - 2)  $P(u, u)$ .
  - 3)  $Q(a, b)$

$$G = \{ \sim P(v, b) \}$$





- (4)
- 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 (\*, Anne)
- Goal Clause -  $\sim \text{Father} (Q, \text{anne})$

$\sim$  father (Q, anne)

$$| \quad x = Q, y = anne \quad (6)$$

$\rightarrow$  parent (Q, anne)  $\vee \sim$  male (Q)

Q = elizabeth

Anne = charles

\*

elizabeth

$\sim$  male (elizabeth)

| ① elizabeth

= philip

\*

Q = philip

|  
 $\sim$  male / philip

| ①  
[]

(5)

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)

$\Rightarrow$  parent (x, y)  $\wedge$  male (x)  $\rightarrow$  Father (x, y)

$\Rightarrow$   $\sim$  parent (x, y)  $\vee$   $\sim$  male (x)  $\vee$  Father (x, y)

Hosibrand Universe

$$U(P) = \{ Philip, Elizabeth, Charles, Anne \}$$

Hedibrand base

$$B(P) = \{ \text{Male}(Philip), \text{Male}(Elizabeth), \dots$$

Female(Philip), Female(Elizabeth), \dots

Parent(Elizabeth, Charles),

Parent(Philip, Anne) \dots

Father(Philip, Anne), Father(Philip, Charles)

|B(P)| = predicate \* term arity.

$$= 4 \times 4^2 = 64.$$

M(P) = { Male(Philip), Female(Elizabeth),

Parent(Elizabeth, Charles),

Parent(Elizabeth, Anne), Parent(Philip, Anne)

Father(Philip, Anne) }

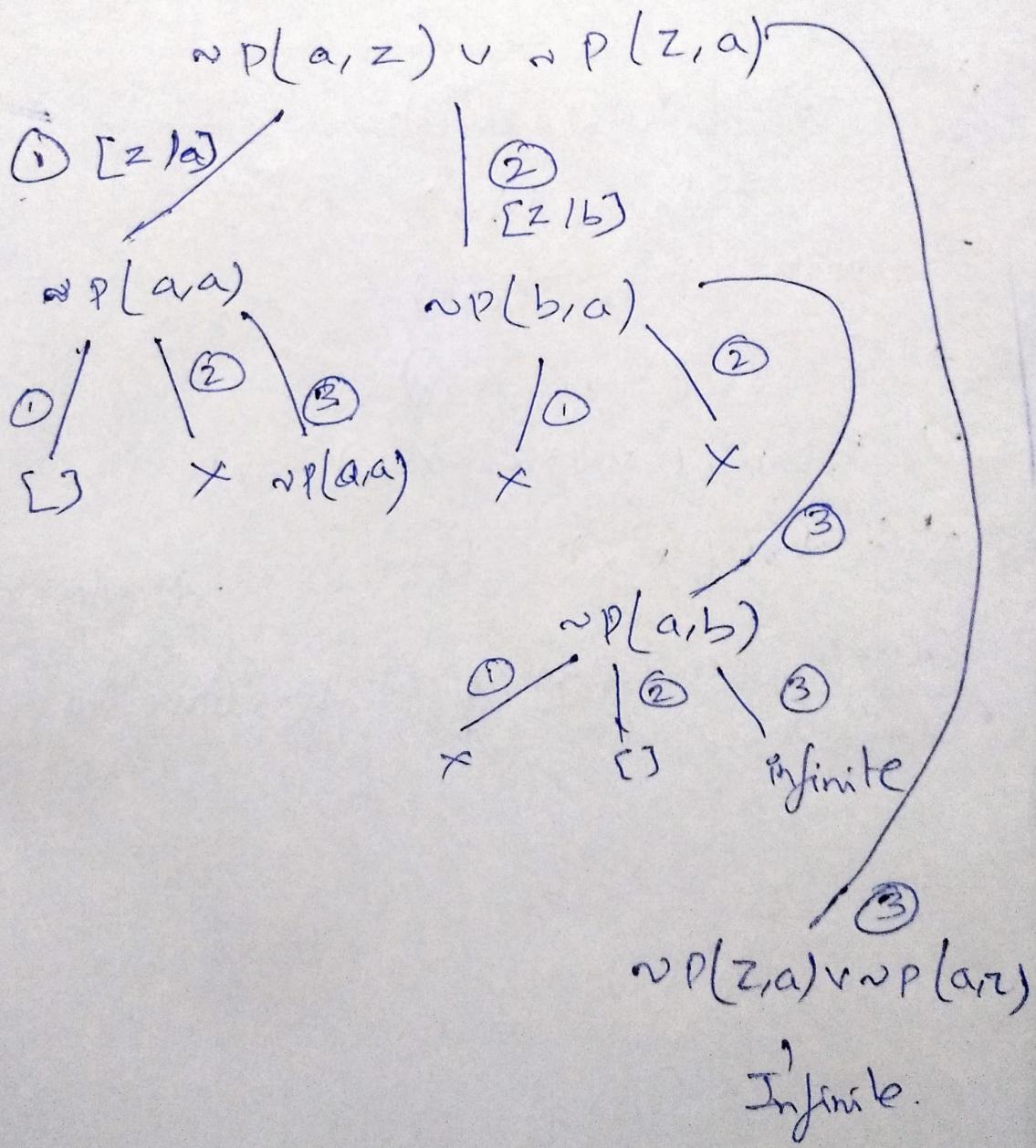
Father(Philip, Anne) is in the model as

Parent(Philip, Anne) and male(Philip)

are there in the modal.

- ⑥
- 1)  $p(a, a)$
  - 2)  $p(a, b)$
  - 3)  $p(x, y) :- p(y, x)$   
 $\Rightarrow p(y, y) \rightarrow p(x, y) \rightarrow \neg p(y, x) \vee p(x, y)$
- Goal clause:  $\neg p(a, z) \vee \neg p(z, a)$

### Procedural interpretation:



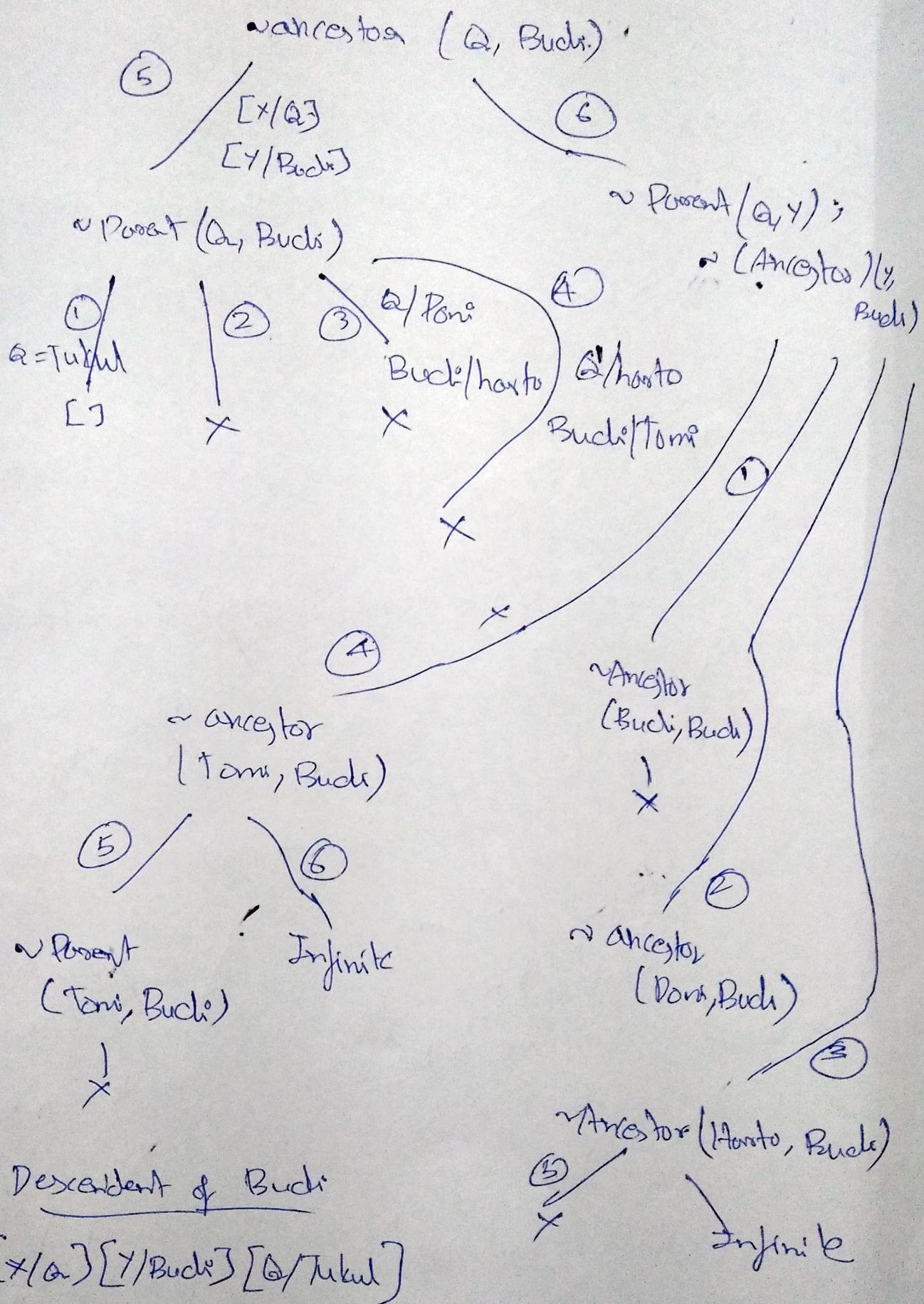
MODEL	THEORETIC	INTERPRETATION:
$V(P) = \{a, b\}$		
$B(P) = \{P(a a), P(a b), P(b b), P(b a)\}$		
$ B(P)  = 1 \times 2^2 = 4$		

Minimal Model =  $M(P) = \{P(a,a), P(a,b), P(b,a)\}$   
 $P(a,z), P(z,a)$  is in the model.

(7)

- 1) Parent (Tukul, budi<sup>o</sup>)
- 2) Parent (Budi<sup>o</sup>, Doni<sup>o</sup>)
- 3) Parent (Domi, Hasto)
- 4) Parent (Hasto, Tomi)
- 5) Ancestor (x,y) :- Parent (x,y)
- 6) Ancestor (x,z) :- Parent (x,y), ancestor (y,z)

Query: descendant of Budi<sup>o</sup> - Ancestor (a,Budi<sup>o</sup>)



(2) (ii) Query: Mak ancestor of George

ancestor(George, a)  $\sim$  Nate(a)

Goal clauses:  $\sim$  ancestor(George, a)  $\vee \sim$  Mak(a);

$\sim$  ancestor(George, a)  $\vee \sim$  Nate(a) ②

