

Assignment NO : 2

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Subject :- IS LAB

DOP

DOA

Sign

Mark.

Q1 Solve the following with forward chaining or backward chaining or resolution (any one) use predicate logic as language of knowledge representation clearly. Specify the fact inference rule used.

Eg: 1

Every child sees some witch not witch has both a black cat & a pointed hat

Every witch is good or bad

Every child who sees any good witch get candy

Prove: Every child gets candy

Facts into  $\forall$ al.

i)  $\exists x \forall y (child(x), witch(y) \rightarrow sees(x, y))$

$\sim \exists y (witch(y) \rightarrow has(y, black\ cat) \wedge has(y, pointed\ hat))$

$\exists y (witch(y) \rightarrow good(y) \vee bad(y))$   
 $\exists x (sees(x, y) \rightarrow (witch(y) \rightarrow good(y)) \rightarrow get(x, candy))$

FOL into CNF

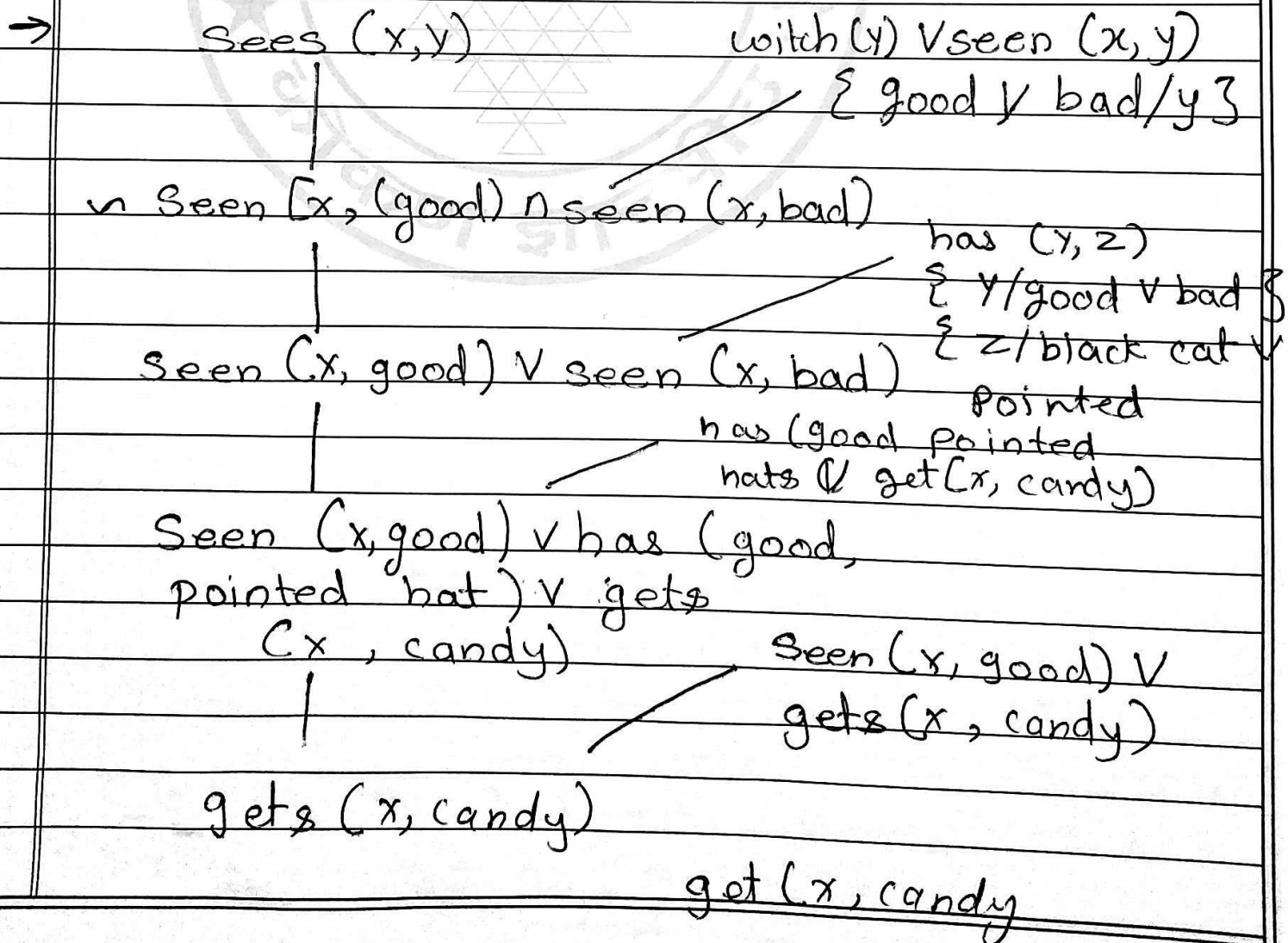
$\neg \exists x \forall y (child(x), witch(y) \rightarrow sees(x,y))$   
 $\rightarrow \neg \exists y, (witch(y) \rightarrow has(y, black\ hat))$   
 $\rightarrow \neg \exists y (witch(y) \rightarrow has(y, Pointed\ hat))$

2)  $\forall y (witch(y) \rightarrow good(y))$

$\forall y (witch(y) \rightarrow bad(y))$

3)  $\exists x [ (sees(x,y) \rightarrow witch(y) \rightarrow good(y))$   
 $\rightarrow gets(x, candy)$

5)  $\exists y [seen(x,y) \rightarrow has(y, pointed\ hat)]$   
 $\neg \forall y [seen(x,y) \rightarrow has(y, black\ hat)]$



## 2) Example 2:

- 1) Every boy or girl is a child
- 2) Every child gets a doll or a train or a lump of coal.
- 3) No boy gets any doll
- 4) Every child ~~no~~ who is bad get any lump of coal
- 5) No child get a train
- 6) Ram gets lump of coal
- 7) Prove Ram is bad.

- 1)  $\forall x (\text{boy}(x) \vee \text{girl}(x) \rightarrow \text{child}(x))$
- 2)  $\forall y (\text{child}(y) \leftrightarrow \text{gets}(y, \text{doll}) \vee \text{gets}(y, \text{train}) \vee \text{gets}(y, \text{coal}))$
- 3)  $\forall w (\text{boy}(w) \rightarrow \neg \text{gets}(w, \text{doll}))$
- 4) for all  $z (\text{child}(z) \wedge \text{bad}(z) \rightarrow \text{gets}(z, \text{coal})) \vee y \text{ child}(y) \rightarrow \neg \text{get}(y, \text{train})$
- 5)  $\text{child}(\text{ram}) \leftrightarrow \text{get}(\text{ram}, \text{coal})$   
To prove  $(\text{child}(\text{ram}) \rightarrow \text{bad}(\text{ram}))$

CNF clauses.

- 1)  $\neg \text{boy}(x) \vee \text{child}(x)$   
 $\neg \text{girl}(x) \vee \text{child}(x)$
- 2)  $\neg \text{child}(y) \vee \text{gets}(y, \text{doll}) \vee \text{get}(y, \text{train}) \vee \text{gets}(y, \text{coal})$
- 3)  $\neg \text{child}(z) \vee \neg \text{bad}(z) \vee \text{gets}(z, \text{coal})$
- 4)  $\neg \text{child}(\text{ram}) \vee \text{get}(\text{ram}, \text{coal})$
- 5)  $\text{bad}(\text{ram})$





The topology of the network indicates that Burglary and earthquake affect the probability.

of the alarms going off.  
Whether John and Mary call depends only on alarm

They do not perceive any burglaries directly  
they do not notice minor earthquakes and  
they do not confer before calling

Mary listening to loud music and John  
confusing phone ringing to sound  
of alarm can be read from network  
only implicitly as uncertainly associated  
to calling at work.

The probability actually summarise potentially  
infinite set of circumstances

The alarm might fail to go off due to high  
humidity, power failure, dead battery  
cut, wires a dead mouse stuck  
inside the bell, etc.

The condition probability tables in n/w  
gives probability for values of random  
variable depending on combination of  
value for the parent nodes

In general a table for a Boolean  
variable with  $k$  parents contain  $2^k$   
independently specific probabilities.

A generic entry in joint distribution is probability of a conjunction of particular assignment to each variable  $P(X_1 = x_1, \dots, X_n = x_n)$  abbreviated as  $P(x_1, \dots, x_n)$

The value of this entry is  $P(x_1, \dots, x_n) = \prod_{i=1}^n p(i, \text{Parents}(x_i))$

$$= P(j|mna \sim b \sim e)$$

$$= P(j|a) P(m|a) P(a|b \sim e) P(b|e) P(e)$$

$$= 0.09 \times 0.07 \times 0.001 \times 0.999 \times 0.998$$

$$= 0.000628$$

## Bayesian Network

