Assignment No-2

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Class :- BE/IT

Sub :- IS lab

DOP	DOC	Marks	Sign.

Assignment No - 2

1] Solve the following with forward chaining or backward chaining or resolution. use predicate logic as the language of knowledge representation. clearly specify the facts and interference rule used.

Example 1 :

1] Every child see some witch. no witch has both a black cat and a pointed hat.

2] Every witch is good or bad.

3] Every child who sees any good witch gets candy.

4] Every witch that is bad has a black cat.

5] Every witch that is seen by any child has a pointed hat.

6] Prove : Every child gets candy.

→ A] Facts into FOL

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

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

2] $\exists y$ (witch (y) $\rightarrow$ good (y) v bad (y))

3] $\forall x$ ((sees (x, y) $\rightarrow$ (witch (y) $\rightarrow$ good (y)) $\rightarrow$ get (x, candy).

4] $\forall y$ ((witch (y) $\rightarrow$ bad (y)) $\rightarrow$ has (y $\rightarrow$ black hat))

5] $\forall y$ (sees (x, y) $\rightarrow$ has (y, pointed hat)

B] FOL into CNF

1] ∃ x ∀y (child (x) , witch (y) -> sees (x,y))

-> ∼ ∃y , (witch (y) -> has (y , black hat)

-> ∼ ∃y (witch (y) -> has (y , pointed hat)

2] ∀y (witch (y) -> good (y))

∀y (witch (y) -> bad (y))

3] Ex [(sees (x,y) -> witch (y) -> good (y)) -> gets (x, candy).

-> Ex [(sees (x, good (y) -> gets (x, candy)]

4] Ey [bad (y) -> has (y , black hats)]

5] Ey [seen (x,y) -> has (y, pointed hat)]

-> ∼ ∀y [seen (x,y) -> has (y , black hat)]

i]

sees (x,y)

witch (y) v sees (x,y)
{good v bad (y}

∼ seen (x, (good) ∩ sees (x, bad)

has (y,z)
{y / good v bad}
{z / black cat v pointed hat)}

seen (x, good) v seen (x, bad)

has (good, pointed hats v get (x, candy) seen (x, good) ∨ has (good, pointed hat) ∨ gets (x, candy)

seen (x, good) ∨ gets (x, candy)

gets (x, candy)

gets (x, candy)

Example 2:

1] Every boy or girl is a child

2] Every child gets a doll or train or a lump of coal.

3] No boy gets any doll.

4] Every child who is bad gets any lumb of coal.

5] No child gets a train.

6] Ram gets lumb of coal.

7] Prove : Ram is bad

→ 1] $\forall x$ (boy (x) or girl (x) → child (x))

2] $\forall y$ (child (y) → gets (y, doll) or gets (y, train) or gets (y, coal))

3] $\forall w$ (boy (w) → ! gets (w, doll))

4] for all z (child (z) and bad (z)) → gets (z, coal))

$\forall y$ child (y) → ! gets (y, train)

5] child (ram) → gets (ram, coal)

To prove (child (ram) → bad (ram)).

CNF clauses

1] ! boy (x) or child (x)
! girl (x) or child (x)

2] ! child (y) or gets (y, doll) or
gets (y, train) or gets (y, ~~doll~~ coal)

3] ! boy (w) or ! gets (w, doll)

4] ! child (z) or ! bad (z) or gets (z, coal)

5] ! child (ram) -> gets (ram, coal)

6] bad (ram)

Resolution

4] ! child (z) or ! bad (z) or get (z, coal)

6] bad (ram)

7] ! child (ram) or gets (ram, coal)
substituting z by ram

1] (a) ! boy (x) or child (x)
boy (ram)

8] child ram / substituting x by ram)

7] ! child (ram) or gets (ram, coal)

8] child (ram)

9] gets (ram, coal)

2] ! child (y) (or gets (y, doll) or gets (y, train)
or gets (y, coal)

8] child (ram)

10] gets (ram, doll) or gets (ram, train) or
gets (ram, coal).
(substituting y by ram).

9] gets (ram, coal).

10] gets (ram, doll) or gets (ram, train) or
gets (ram, coal)
(substituting y by ram)
9] gets (ram, coal)
10] gets (ram, doll) or gets (ram train) or gets
(ram, coal)
11] gets (ram, doll) or gets (ram, coal)
2] ! boy (w) or ! gets (w, doll)
5] boy (ram)
12] ! get (ram, doll) substituting w by ram)
11] gets (ram, doll) or gets (ram, train)
12] ! gets (ram, doll)
13] gets (ram, coal)
6] <a> get (ram, coal)
13] gets (ram, coal)
Hence, bad (ram) is proved.

2] Differentiate betn STRIPS and ADL.

STRIPS	ADL
1] only allow positive literate in the states for eg : A valid sentence is ~~ST~~ STRIPS is expressed as => Intelligent ^ Beautiful.	1] can support both positive and negative literals for eg :-> same sentence is expressed as => Stupid ^ - ugly

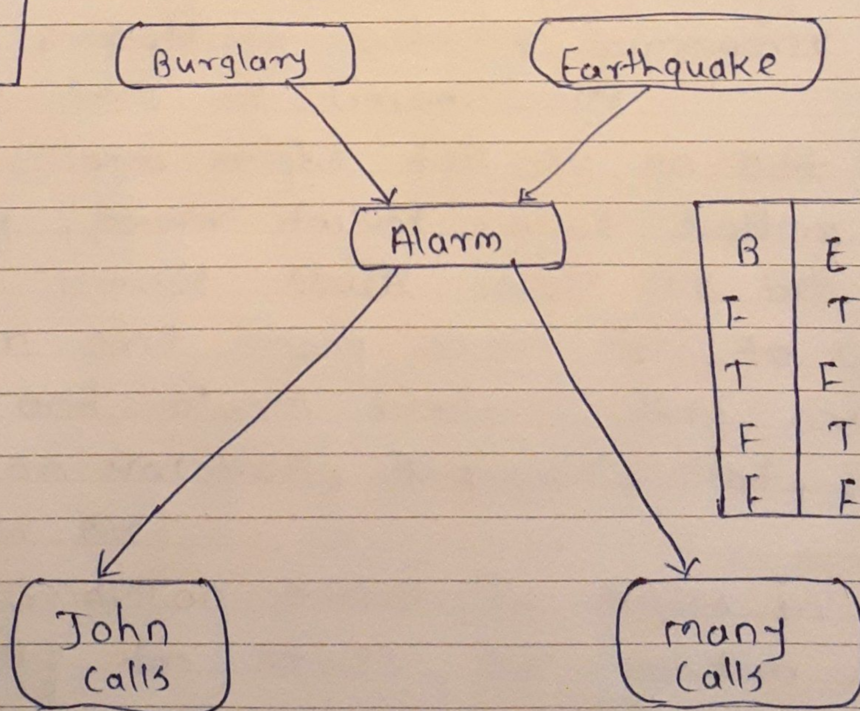
1] STRIPS stand for Standard Reasearch Institute problem Solver.	2] stands for Action Description Language.
3] makes use of closed world assumption (i.e) un mentioned literals are false.	3] makes use of open world Assumption (i.e) unmentioned literals are unknown.
4] We only can find ground literals in goals for eg:- Intelligent $\wedge$ ~~Beata~~ Beautiful.	4] we can find qualified variables in goal. for eg: $\exists x\, At(P_1, x) \wedge At(P_2, x)$ is the goal of having P_1 and P_2 in the same place in the example of blocks.
5] Goals are conjunctions for eg:- (Intelligent $\wedge$ Beautiful).	5] Goals may involve conjuactions and disjunctions for eg:- (Intelligent $\wedge$ (Beautiful $\wedge$ Rich))
6] Effects are Conjunctions	6] Conditional effects are allowed : when P:E means E is an effect only if P is satisfied.

4] You hare two neighbour J and m, who hare promised to call you at work when they hear the alarm. J always calls when he hears the alarm, but sometimes confused telephone ringing with alarm, and calls then too. m likes loud music and sometimes misses the alarm altogther. Given the evidence of who has or has not called. we would like to estimate the probability of burglary. Draw a Bayesian network for this domain with suitable probability table.

→

P(B)
0.001

P(E)
0.002



B	E	P(A
T	T	0.95
T	F	0.94
F	T	0.29
F	F	0.001

A	P(J)
T	0.09
F	0.05

A	P(m)
T	0.70
F	0.01

① The topology of the network indicates that
- Burglary and earthquake affect the probability of the alarms going off.
- Wheather 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
② mary listening to laud music and John confusing phone ringing to sound of alarm can be read from network only implicity as uncertainty associated to calling at work.
③ The probability actually summarize potentially infinite sets of cirumstances.
- The alarm might full to go off due to high humidity, power failure, dead battery, cut wires, a dead mouse stuck inside the bell etc.
- John and mary might fail to call and report and alarm beacause they are out to lunch, an vacation, temporarily deaf, passing helicopter etc.
④ The condition probability tables in n/w gives probability for values of random variables depending, an combination of values for the parent nodes.
⑤ Each row must be sum to 1, beacause entire represent exhaustive set of cases for variable.
⑥ All variables are Boolean.

⑦ In general, a table for Boolean variable with k parents contains 2^k independently specific probabilities.

⑧ A variable with no parents has only one row representing prior probalities of each possible value of the variable.

⑨ Every entry in full joint probalility distribution can be calculated from information in Bayessian network.

⑩ A generic entry in joint distribution is probability of a conjuction of particular assignments to each variable $P(X_1 = x_1 \cap \dots \cap \dots X_n = x_n)$ abbreviated as $P(x_1, \dots, x_n)$.

⑪ The value of this entry is $P(x_1, \dots, x_n) = \prod_{i=1,n} P(x_i \mid parents(x_i))$, where parents s(xi) denotes the specific values of the variables parents (xi)

$- P(J \cap m \cap a \cap \neg b \cap \neg e)$

$= P(j|a)\, P(m|a)\, P(a|\neg b \cap \neg e)\, P(\neg b)\, P(\neg e)$

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

$= 0.000628$

⑫ Bayesian network.