Assignment No: 2

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Sem: VII

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DOP	DOC	Remark	sign

Q.1. Solve the following with forward chaining or backword Chaining or resolution (any one) use predicate logic as language of knowledge representation clearly specify the facts & inference rule used.

Q.1. Example 1:

① Every child sees some witch No witch has both a black cat & 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 ∃ x A y (child (x), witch (y) → sees (x, y))
∾∃ y (witch (y) → has (y, black cat) ∧ has (y, pointed hat))

② ∃ y [witch (y) → good (y) ∨ bad (y))

③ E x ((sees (x, y) → (witch (y) → good (y)) → get (x, candy)

④ E y ((witch (y) → bad (y)) → has (y → black hat))

⑤ E y (sees (x, y) → has (y, pointed hat)

(B) FOL into CNF

① ∃ x A 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 [(see(x,y) → witch (y) → good (y))~~

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

4) Ey [bad (y) → has (y, black hats)]

5) Ey [seen (x,y) → has (y, black hat)]

c)

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) v has (good, pointed hat) v gets (x, candy) | seen (x, good) v gets (x, candy)

gets (x, candy) | gets (x, candy)

(2) Example 2:

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

→ (1) $\forall x$ (boy (x) or girl (x) $\rightarrow$ child (x))
(2) $\forall y$ (child (y) $\rightarrow$ gets (y, doll) or gets (y, train) or gets (y, coal))
(3) $\forall w$ (boy (w) $\rightarrow$! gets (w, doll))
(4) for all z (child (z) and bad (z)) $\rightarrow$ gets (z, coal))
$\forall y$ child (y) $\rightarrow$! gets (y, train)
(5) child (ram) $\rightarrow$ gets (ram, coal)
To prove (child (ram) $\rightarrow$ 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, coal)
(3) ! boy (w) or ! gets (w, doll)
(4) ! child (z) or ! bad (z) or gets (z, coal)
(5) ! child (ram) $\rightarrow$ 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)

(2) 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)

(11) gets (ram, doll) or gets (ram, train) or coal)

(3) ! boy (u) 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.

Q.2 Diffrentiate between STRIPS and ADL

STRIPS language	ADL
① Only allow positive literals in the states for eg: A valid sentence is STRIPS is expressed as => Inteligent ∧ Beautiful	① can support both positive & negative literals for eg :- same sentence is expressed as => stupid ∧ ¬ ugly
② STRIPS stand For standard Research Institute Problem solvers	② Stands for Action Description language.
③ Makes use of closed world assumption (i.e) unmentioned 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 ∧ Beautiful	④ we can find qualified variables in goal for eg: ∃x At(P1, x) ∧ At (P2, x) is the goal of having P1 & P2 in the same place in the eg of blocks
⑤ Goals are conjuction for eg: (Intelligent ∧ Beautiful)	⑤ Goals may involve conjuctions & disjuction for eg :- (Intelligent ∧ (Beautiful ∧ Rich))

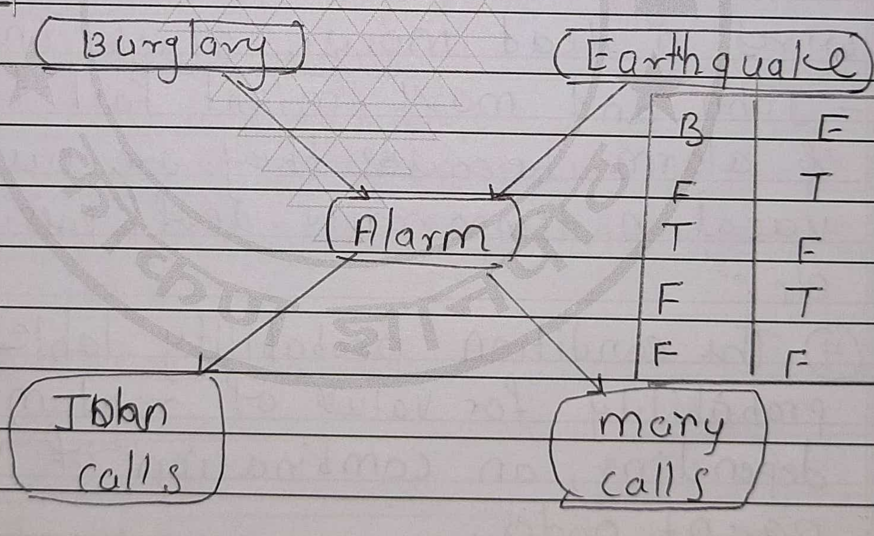
6) Effects are conjuctions	6) conditional effects are allowed : when P: E means E is an effect only if P is ~~sta~~ satisfied.
7) Does not support equality	7) Equality predicate $(x=y)$ is build in
8) Does not have support for types	8) Support for types for eg : The variable P : person

Q.4 You haave two neighbors J and M, who have promised to call you at work when the here the alarm. J always calls when he heors the alarm, but sometimes confused telephone ringing with alarms & calls then too M likes loud music and sometimes misses the alarm together 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)
F	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
- Burglory and earthquake affect the probility 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 end they do not confer befor calling

(2) Mary listening to load music & John confusing phone ringing to sound of alarm can be read forom ~~m~~ network only implicitly as uncertainty associated to calling at work.

(3) The probability acatually summarize potentialy infinite sets of circumstance
- 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 & alarm becauses they are out to launch on 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, because entries represent exhaustive set of causes for variable

(6) All variables are Boolean

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

(8) A variable with no parents has only one row, representing prior probabilities of each possible value of the variable.

(9) Every entry in full joint probability 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 $P(x_1 = x_1 \wedge \ldots \wedge x_n = x_n)$ abbreviated as $P(x_1, \ldots, x_n)$

(11) The value of this entry is $P(x_1, \ldots, x_n) = \pi_{i=1,n} P(1, \text{parents}(x_i))$, where parents (x_i) denotes the specific values of the variable parents (x_i)

$- P(j \wedge m \wedge a \wedge \sim b \wedge \sim e)$

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

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

$= 0.000628$

(12) Bayesian Network