Assignment no 2

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Q1 Solve the following with forward chaining or backward chaining or resolution use predicate logic as language of knowledge representation clearly specify the facts & inference rule used.

Q1) 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∀y (child (x), witch(y) → sees (x, y))
∧ ∃y (witch (y) → has (y black cat) ∧ has (y - pointed hat)
2) ~~Every wit~~ ∃ y (witch (y) → good (y) ∨ bad (y))
3) ∀x ((sees (x, y) → (witch (y) get(x, candy)
4) ∀y ((witch (y → bad (y)) → has (y → black hat)
5) ∀y (sees (x, y) → 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) ∃x [(sees (x, y) → witch (y) → good (y)) →
gets (x, candy)
→ ∃x [(sees (x, good (y) → gets (x, candy)]
4) ∃y [bad (y) → has (y, black hats)]
5) ∃y [seen (x, y) → has (y, pointed hat)]
→ ~∀y [seen (x, y) → has (y, black hat)]

c)

sees (x, y)

witch (y) ∨ sees (x, y)
{good ∨ bad / y}

∧ seen (x, (good) ∧ sees (x, bad)

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

seen (x, good) ∨ seen (x, bad)

has (good, pointed hat) ∨ get (x, candy)

seen (x, good) ∨ had (good, pointed hat) ∨ gets (x, candy)

seen (x, good) ∨ gets (x, candy)

gets (x, candy)

gets (x, candy)

2) Example 2:
1) ~~Every boy or girl is a child~~

Ans)
1) ∀x (boy (x) or girl (x) → child (x))
2) ∀y (child (y) → gets (y, doll) or gets (y, train) or gets (y, coal))
3) ∀w (boy (w) → ! gets (w, doll))
4) for all z (child (z) and bad (z)) → gets (z, coal)
∀y child (y) → ! gets (y, train)
5) child (ram) → gets (ram, coal)
to prove ! child (ram → bad (ram))

CNF clause
1) ! boy (x) or child (x)
! girl (x) or child (x)
2) ! child (y) or gets (y, ~~bo~~ 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) → gets (ram, coal)
6) bad (ram)

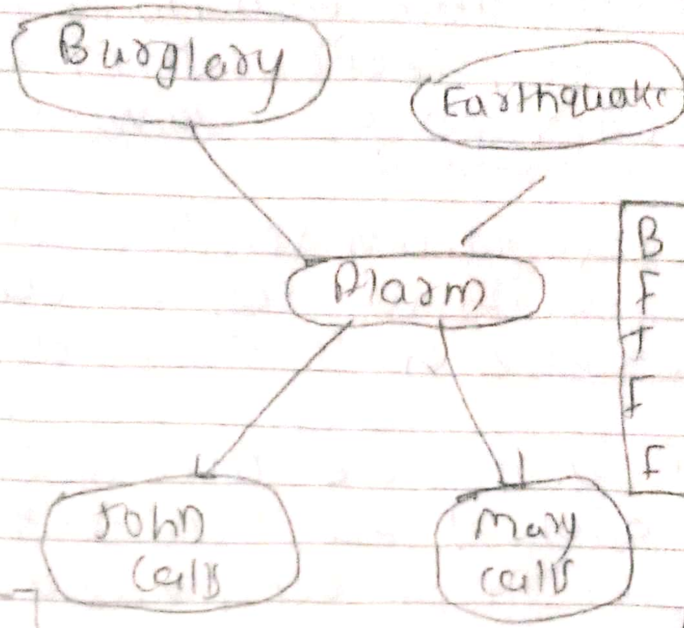
Resolution:
4) !child (z) or !bad (z) or get (z, coal)
6) bad (ram)
7) !child (ram) or gets (ram, coal)
Substituting z by ram
1) (a) !boy (x) or child (x)
boy (ram)
2) child ram (substituting x by ram)
7) ! child (ram) or gets (ram, coal)
8) child (ram)
9) gets (ram, coal)
2) !child (y) (or gets (y, doll) or gets
8) child (ram)
9) gets (ram, coal)
2) gets (ram, doll) or gets (ram, coal)
3) !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)
nine !bad (ram ? proved)

Q2) Difference between STRIPS and ADL

STRIPS language	ADL
1) only allow positive literals in the state for eg. A valid sentence is STRIPS is expressed as	1) can support both positive & negative literals for eg :- some sentence is expressed as stupid ∧ ¬ugly
2) STRIPS stand for Stanford Research Institute problem solver.	2) stands for Action Description language
3) makes use of closed world assumption (i.e) unmentioned literal are false	3) make use of open world assumption (i.e) unmentioned literals are unknown
4) goals are conjunctions for eg :- (Intelligent ∧ Beautiful)	4) Goals may involve conjunctions & disjunctions for eg. (Intelligent ∧ (Beautiful ∨ Rich))
5) Does not support equality	5) Equality predicate (x = y) is built in
6) Does not have support for types	6) Support for types for eg the variable p: Person

A4)

P(B)
0.001



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

A	P(J)
T	0.90
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 probability of alarms going off
- Whether John and Mary call depends only on alarm

2) Mary listening to loud music, John confusing phone ringing to sound of alarm can be read from network only implicitly as uncertainty associated to calling of work

3) The condition probability table in n/w gives probability for value of random variable depending on combination of values of parent node

4) A variable with no parent has only one row, representing prior probabilities of each possible value of the variable.

5) Every entry in full joint probability distribution can be calculated from information in Bayesian network.

6) A generic entry in joint distribution probability of conjunction of particular assignment to each variable $P(x_1 = x_1, \ldots, x_n = x_n)$ abbreviated as $P(x_1, \ldots, x_n)$.

7) Value of this entry is $P(x_1, \ldots, x_n) = \prod_i P(x_i \mid parents(x_i))$, where parents$(x_i)$ denotes the specific value of the variables parents (x_i)

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

$= P(j \mid a)\, P(m \mid a)\, P(a \mid \neg b \wedge \neg e)\, P(\neg b)\, P(\neg e)$

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

$= 0.000\ 628$

12) Bayesian network