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ASSIGNMEN NO-02

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subject - IS Lab.

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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 facts & interference rule used.

→ 1. Example-

1. every child sees some witch with no witch has both blackcat & 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. ∃y (witch(y), → good(y) ∨bad(y)))
3. ∈x ((sees(x,y) → (witch (y) → godd(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. $\exists x \forall y$ (child (x), witch (y) $\rightarrow$ sees (x, y))

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

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

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

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

3. $\in x$ [(sees (x, y) $\rightarrow$ witch (y) $\rightarrow$ good (y)] $\rightarrow$ gets (x, Candy)

$\rightarrow \in x$ [sees (x, good (y) $\rightarrow$ gets (x, Candy)]

4. $\in y$ [bad (y) $\rightarrow$ has (y, black, hats)]

5. $\in y$ [seen (x, y) $\rightarrow$ has (y, pointed hat)]

$\rightarrow \sim \forall y$ [seen (x, y) $\rightarrow$ has (y, black hat)]

c)

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 gets (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. $\forall x$ (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 gets (z, coal)
6. bad ram
7. ! child (ram) or gets (ram, coal)
   substituiting z by ram
1. (0) ! boy (x) or child (x)
   boy (ram)
8. child ram [substituting x by ram)
~~7. ! child ram (substituting x~~
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, 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)

Hence, bad (ram) is proved.

Q.2. Differentiate between STRIPS and ADL.

STRIPS	ADL
1. STRIPS stands for standard Research Institute Problem Solver.	ADL stands for Action Description Language.
2. Only allows positive literals in thestate.	Can support both positive & negative literals.
3. It makes use of closed world assumption (i.e) unmentioned literals are false.	It makes use of open world assumption. i.e. unmentioned literals are unknown.
4. Goal are conjuctions ~~for eg~~ - intellegent ^ Beautiful	Goals may involve conjuctions & disconjunctions. E.g. (Intelligent ^ (Beautiful ^ Rich))
5. We can only find ground literals in goals.	We can find qualified variables in goal.
6. Does not support equality.	Equality predicate (x = y) is builtin.

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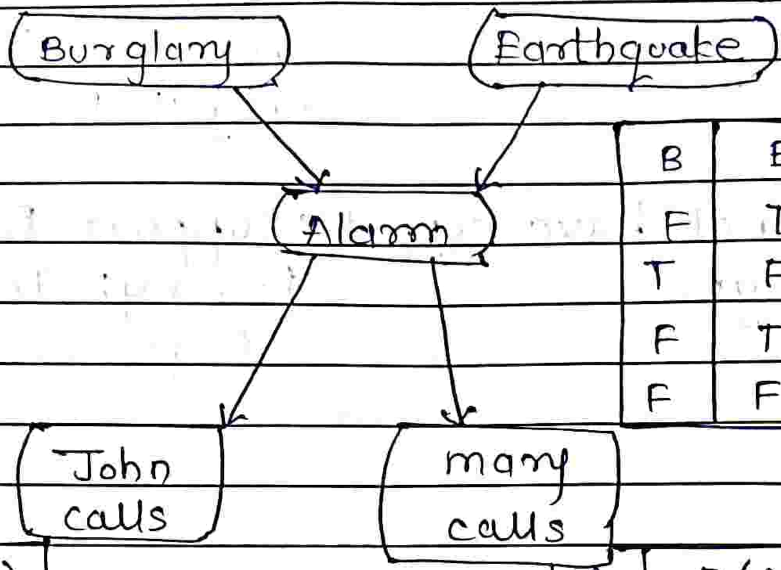
7.	Effects are conjunctions.	Conditional effects are allowed: when P:E means E is an effect only if P is satisfied.
8.	Does not have support for types.	• support for types for eg: The variable p: person.

Q.4.

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(T)
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.
- 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.

② Mary listening to loud music & John confusing phone ringing to sound of alarm can be read from network only implicitly as uncertainly associated to calling at work.

(3) The probability actually summarize potentially infinite sets of circumstances.

- 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 became they are out to lunch, an vacation, temperarily deaf, passing helicopter, etc.

(4) The condition probability tables in network 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 exhaustic set of cases for variables

(6) All variables are boolean.

(7) In general, a table for a boolean variable with k parents contains 2^k independently

(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 conjuction of particular assignments to each variable $P(X1 = x_1 \wedge \dots \wedge X_n = x_n)$ abbrevated as $P(x_1, \dots, x_n)$.

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

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

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

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

$= 0.000628$

(12) Boyesian Network