ASSIGNMENT No.:- 02

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Date

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 and inference rule used.

① Example 1:

1> Every child sees same witch, no witch has both 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 ~~anyone~~ child has pointed hat.
6> Prove: Every child gets candy.

→

A) fact into ~~fat~~ FOL

1) ∃x Ay (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) → good(y)) → get(x, candy))
4) ∈x ((witch(y) → bad(y)) → has(y - black ~~cat~~ cat))
5) ∈y (sees(x,y) → has(y, ~~black~~ pointed hat))

B) FOL into CNF.

1> ∃x Ay (child(x), witch(y) → sees(x,y))
→ ~ ∃y, (witch(y) → has(y, black hat)
→ ~ ∃y, (witch(y) → has(y, pointed hat)

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

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

3) $Ex\,((sees(x,y) \rightarrow witch(y) \rightarrow good(y)) \rightarrow jets(x, candy))$

4) $Ey\,(bad(y) \rightarrow has(y, black\ hats))$

5) $Ey\,(seen(x,y) \rightarrow has(y, pom\text{-}tless\ hat))$

$\rightarrow \sim Ay\,(seen(x,y) \rightarrow has(y, black\ hat))$

1) sees (x, y)

witch (y) V seen (x, y)

{good v bad ly}

~ seen (x, I good, A sees (x, bad)

has (y, z)

{y/good U bad} {z/black hat U pointed hat}

seen (x, good) V seen (x, bad)

has(good), pointed hats

V jets(x, candy)

seen (x, good) V has good, pointed hat) V gets (x, candy)

seen (x, good) V gets

get (x, candy)

jets (x, candy)

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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 who is bad gets any lump of coal.
5) No child gets a train.
6) Ram get lump of coal.
7) Prove Ram is bad.

→

1) $\forall x$ (boy (x) or girl (x) $\rightarrow$ child (x))
2) $\forall y$ (child (y) $\rightarrow$ get (y, doll) or get (y, train) or get (y, coal))
3) $\forall w$ (boy (w) $\rightarrow$! gets (w, doll))
4) for all z (child (z) and bad (z)) $\rightarrow$ get (z, coal)
$\forall y$ child (y)
5) child (ram) $\rightarrow$ get (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 get (y, doll) or get (y, train) or get (y, coal)
3) ! boy (w) or ! get (w, doll)
4) ! child (z) or ! bad (z) or get (z, coal)
5) ! child (ram) $\rightarrow$ gets (ram, coal)
6) ~~bad (fram~~ bad (ram)
Resolution
5) ! child (z) or ! bad (z) or get (z, coal)
6) bad (ram)

7) !child (rum) or get (rum, coal)
substitution z by rum

1) ~~ad~~ (a) ! boy (x) or child (x) boy (rum)

8) child rum | substitutions x by rum

7) ! child (rum) or gets (rum, coal)

8) child (ram)

9) gets (rum, coal)

2) ! child (y) (or, gets (y, doll) or gets (y, trash) or get (y, coal)

8) child

10) gets (rum, doll) or get (rum, trash) or get (rum, coal)
~~from~~

(substitution. y by rum)

9) gets (rum, coal)

10) gets (rum, doll) or get (rum, trash) or gets (rum, coal)

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

3) ! boy (w) or ! get (w, doll)

5) boy (ram)

12) ! get (ram, doll) (substitution w by rum)

11) ! gets (ram, doll) or gets (ram, trash)

12) gets (ram, coal)

13) gets (ram, doll)

6) (a) get (ram, ~~doll~~ coal)

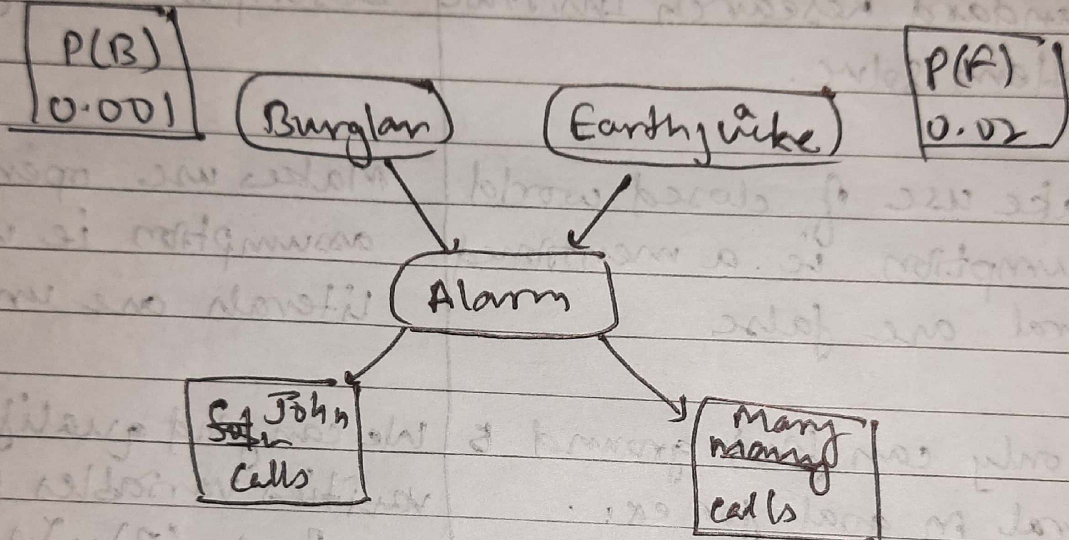
13) gets (ram, coal)

Hence bad (ram) is proved.

Q(2) Differentiate between STRIPs & ADL.

STRIPs language	ADL
1) Only allow positive literal in the states for ex. A valid sentance is STRIPs is expressed as Intelligent. Beautiful.	Can support both positive & negative literal. for eg: Some sentances is expressed as ⇒ stupid $\wedge$ - ugly.
2) STRIPs stands for Standard Research Institute Problem solve.	ADL stands for Action Description Language.
3) Make use of closed world assumption ie a mentioned literal are false	Makes use open world assumption ie unmentioned literals are unknown.
4) We only can find ground & literal in goal for ex: Intelligent A x beautiful.	We can find qualified ~~varities~~ variables in good e.g: $\exists x At(P)x) \wedge At(P_2, x)$ is the goal of having P_1 & P_2 in the same place in example of P blocks.
5) Goals are conjunction eg: Intelligent $\wedge$ Beautiful.	Goal may interact involve conjunction and disconjunction eg Intelligent $\wedge$ (Beautiful A Rich).
6) Does not support equality.	Equality Predicate: $(x = y)$ is build in.

Q④ You have two neighbours J & M who have promised to call you at work when they here the alarm J always call when he hear the alarm but sometimes confused telephone ringing with alarm & call them 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 burglar. Draw a Bayersian network for this domain with suitable probability table.



B	E	P(A)
F	T	0.95
T	F	0.94
F	T	0.29
F	P	0.01

A	P(T)
T	0.09
F	0.05

A	P(M)
T	0.70
F	0.01

(8)1) The topology of the network indicates that
→ Burglar & earthquake affect. The probabilities of the alarm point off
- wheather John & Mary call only on alarm.
→ They do not precive any ~~to~~ burglarics directly they do not notice minor earthquake and do not counter before calling.

2) → Mary listens to loud music & John confusing ~~continuing~~ phone ringings to sound of alarm can ready from network.

3) The probability actual summarizes potentially infinite set of circumstance:
- The alarm might fail to go be to high humidity, power failure etc.
- John and mary might fail to call and report & alarm because they are out to lunch on valtion, temporarily lef. passing, helicopter etc.

4) The condition probability table in n/w gives probability for values for the parent node.

5) Each row must be sum to because entries represents exhaustion set of call for variables.

6) All variables are Boolean.

7) In general, a table for a Boolean variable with K, parent contain 2^k independently specific probabilities.

8) A variable with no parent has only one row representing prior probabilities at each possible value of variable.

9) Every entry in full join probability distribution can be calculated from information in Bayessian network.

10) A general entry in joint distribution is probability of a conjunction at particular assignment to each other.
$P(x_1 = x_1 \wedge \dots \wedge \dots X_n = x_n)$ abbreviated as $P(x_1, \dots x_n)$.

11) The value of this entry is $P(X_1, \dots X_n) = \pi_{i-1}$.
The specific values of the variable parent
s(xi) denotes the specific values of the variable parent (xi)

$-\{P(j \wedge m \wedge a \wedge \sim b \wedge \sim e)$
$= P(J/a) P(m|a) P(a|\sim b \wedge \sim e) P(\sim b) e(\sim e)$
$= 0.09 \times 0.07 \times 0.001 \times 0.999 \times 0.998$
≈ 0.0006828

12) Bayesian Network.