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Assignment No. 2

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Q. 1

1) Example 1

→ A] facts into foll.

1) $\exists x \forall y$ (child (x), witch (y) → sees (x, y))
 $\sim \exists y$ (witch (y) → has (y, black cat) ∧ has (y, pointed hat)
2) $\exists y$ (witch (y) → good (y) ∨ bad (y))
3) $\in x$ ((sees (x, y) → (witch (y) → good (y)) → get (x, (andy)) }
4) $\in y$ (witch (y) → bad (y)) → has (y → black hat))
5) $\in y$ (sees (x, y) → has (y, pointed hat)

B] FOL into CNF

1) $\exists x \forall y$ (child (x), witch (y) → sees (x, y))
→ $\sim \exists y$, (witch (y) → has (y, black hat)
→ $\sim \exists y$ (witch (y) → has (y, pointed hat)
2) $\forall y$ (witch (y) → good (y))
 $\forall y$ (witch (y) → bad (y))
3) $\in x$ [(sees (x, y) → witch (y) → (good (y)] → gets (x, andy)
⟹ $\in x$ [(sees (x, good (y) → gets (x, (andy)]
4) $\in y$ [bad (y) → has (y, black hats)]
5) $\in y$ [seen (x, y) → has (y, pointed hat)]
⟹ $\sim \forall y$ [seen (x, y) → has (y, black hat)]

C]

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

$\sim$seen (x, (good) ∧ sees (x, bad) has (y, z)
 {y/good ∨ bad }
 {z/black cat ∨
 pointed hat) }

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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) ∀x (boy (x) or girl (x) → child (x))
2) ∀x (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 (sam) → gets (sam, coal)
To prove (child (sam) → bad (sam))

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 (sam) → gets (sam, coal)
6) bad (sam)

Resolution

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

6) bad (sam)

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

substituting z by sam

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

boy (sam)

8) child sam (substituting x by sam)

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

8) child (sam)

9) gets (sam, coal)

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

8) child (sam)

10) gets (sam, doll) or gets (sam, train) or gets (sam, coal)

(substituting y by sam)

9) gets (sam, coal)

10) gets (sam, doll) or gets (sam, coal) or gets (sam, train)

11) gets (sam, doll) or gets (sam, coal)

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

5) boy (sam)

12) !get (sam, doll) (substituting w by sam)

11) gets (sam, doll) or gets (sam, train)

12) !gets (sam, doll)

13) gets (sam, coal)

6) <a> get (sam, coal)

Hence, bad (sam) is proved.

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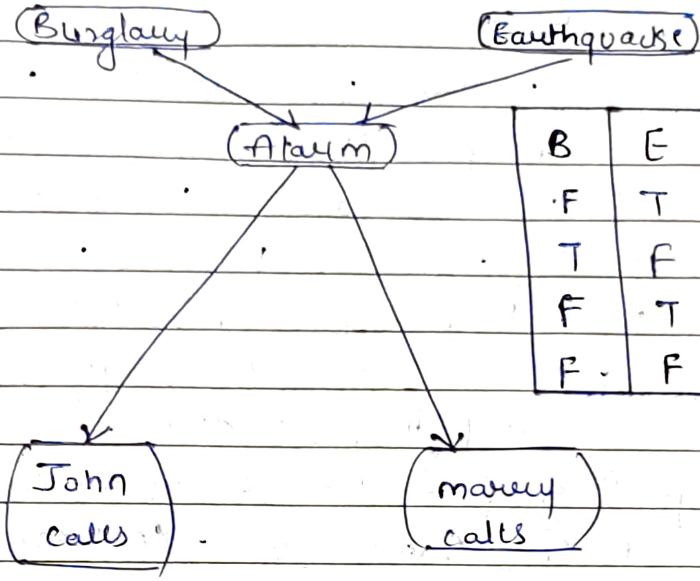
Q.2 Differentiate between STRIPS and ADL

STRIPS	ADL
(1) Only allow positive literals in the states For eg: A valid sentence is STRIPS is expressed as ⟹ Intelligent ∧ Beautiful	(1) Can support both positive & negative literal For eg: - same sentence is expressed as ⟹ stupid ∧ ugly
(2) STRIPS stand for std. Reascarch Institute Problm solver	(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 variable in goals For eg: $\exists x At(P_1, x) \wedge At(P_2, x)$ is the goal of having P_1 & P_2 in the eg of blocks
(5) Goals are conjunctions For eg: (Intelligent ∧ Beautiful)	(5) Goal may involve conjunctions & disjunctions for eg: (Intelligent ∧ (Beautiful ∧ Rich))
(6) Effects are conjutions	(6) Condit^n effects are allowed when P:E means E is an effect only if P is 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

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.
- wheather John and Mary call depends only on alarm
- They do not perceive any burglaries directly they do not notice minor earthquakes & 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 associat to calling at work.

③ The condition probability tables in n/w gives probability for values of random variables. depending on combination of values for the parent nodes.

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(4) Each row must be sum to 1, because entries represent exhaustive set of cases of variable.

(5) All variables are Boolean.

(6) In general a table for a Boolean variable with parents contains 2^k "independently specific probabilities

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

(8) Every entry in full joint probability distribution can be calculated from information in Bayesian networks

(9) A generic entry in joint distribution is probability of a conjunction of particular assignments to each variable $P(X_1 = x_1 \wedge \ldots \wedge \ldots X_n = x_n)$ abbreviated as $(P(x_1 \ldots x_n))$

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

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

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

$= 0.000628$

(11) Baysian Networks