K.G.C.E.
Karjat - Raigad

Assignment No. 2

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Class :- BE

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Assignment no 2.

1) Solve the following with forward chain or backward chaining or resolution (any one) use representation clearly specify that facts and inference rule used.

→ Example!-

1) Every child spes some witch No witch has both a black cat and a pointed hat.
2) Every witch is good or bad.
3) Every child who sees any good witch get candy.
4) Every witch that is bad has a blatk 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) $\exists x \forall y$ (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) → god (y) ∨ bad (y))

3) $\exists x$ ((sees (x, y) → (witch (y) → good (y)) → get (x, candy)

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) ∀y (witch (y) → good (y))
   ∀y (witch (y) → bad (y))
3) ∃x [∀ (sees (x, y) → witch (y) → good (y)) → gets (x, candy)
→ ~~∃y [bad (y) → has (y, black hats)]~~
4) ∃x ((sees (x, good (y) → gets (x, candy)]
5) ∃y [bad (y) → has (y, black hats)]
6) ∃y [seen (x, y) → has (y, pointed hat)]
→ ~∀y [seen (x, y) → has (y, block hat)]

6) 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 cat ∨ pointed hat)}

Seen (x, good) ∨ has (good pointed hat) ∨ gets (x, candy)

seen (x, good) ∨ gets (x, candy)

gets (x, candy)

get (x, candy)

2) Example 2:-

1) Every boy or girls 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 get lump of coal.
7) prove Ram is bad.

→ 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)) → get(z, coal)
5) ∀ 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, doll) or gets(y, train) or get(x and
3) ! boy(w) or ! gets(w, doll)
4) ! child(z) or ! bad(z) or gets(z, coal)
5) ! child(ram) → gets(room coal)
6) bad(ram)

Resolation

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)

3) 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)

7) 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) ~~ge~~! boy (w) or ! gets (w, doll)

3) boy (ram)

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

13) gets (ram, doll) or gets (ram, train)

12) ! gets (ram, doll)

(3) gets (ram, coal)

6) <a> get (ram, coal)

13) gets (ram, coal)

Hence, bad (ram) is proved.

2) Differentiate between STRIPS and ADL

STRIPS language	ADL
i) only allow positive literals in the states	i) can support both positive & negative literals.
ii) STRIPS stand for standard Research Institute problem Solver.	ii) ADL stand For Action Description language.
iii) makes use of closed word assumption (i.e.) un mentioned literals are False.	iii) makes use of open world Assumption (ie.) Unmentioned literals are Unknown.
iv) We only can find ground literals in goals e.g:- Intelligent ∧ Beautiful.	iv) we can find qualified variable in goal: e.g:- ∃x At(P1,x) ∧ At(P2,x) is the goal having P1 & P2 in the same place in the eg. of blocks
v) Goals are conjuction For e.g. :- (Inteligent ∧ Beautiful)	v) Goal may involve conjuction & disjunction for e.g. (Intelligent ∧ (Beautiful ∧ Rich)

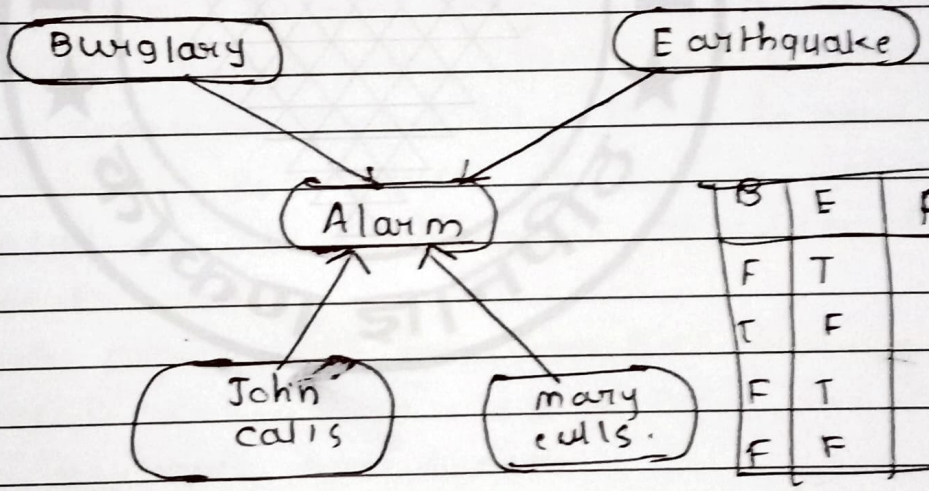
6) Effect are conjuctive	6) Conditional effect are allowed: when P:E mean, E is an effect only if p is statisfied.
7) Does not support equality	7) Equality predicate (X=Y) is build in
8) Does not have support for types.	8) Support for types. E for eg. the variable P:person.

4) You have two neighbour J and M, who have promised to call you at work when they here the alarm J always calls when he hears the alarm, but sometimes confused telephone ringing with alarm and 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. B Draw a Bayesian networks 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	0.029
F	F	0.001

1) The topology of the network indicates that Burglary and earthquake affect the probability of the alarm going.
2) wheather John and Mary call depends only on alarm.
3) They do not perceive any burglaries directly

they do not notice minor earthquake and they do not confer before calling.

2) Many listening to loud music and John confusing phone ringing to sound alarm can be read from network only implicitly as uncertainty associated to calling at work.

3) The probability actually summarize potentiality infinite set of circumstances.

- The alarm might fail to go off due to high humidity, power failure, dead battery, cut wires, a dead mouse stuck inside the bell etc.
- John and many might fail to call and report and alarm because they are out lunch on vacation, temporarily deaf, pasing helicopter. etc.

4) The condition probability table in n/w gives probability for values of random variables depending on combination of values for the parent nodes

5) Each row must be sum to 1 because entries represent exhaustive set of cases for variable.

6) All variables are Boolean

7) In genral, a table for a Boolean variable with k parents contain 2^k independtly specific probabilities.

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

9) Every entry in full joint probability distribution can be calculated from information in Bayessian n/w

10) A generic entry in joint distribution is probability of a conjuction of particular assignments to each variable $P(X_i = x_1 \wedge \cdots \wedge X_n = x_n)$ abbreviated as $P(x_1, \ldots, x_n)$

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

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

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

$= 0.89 \times 0.07 \times 0.001 \times 0.999 \times 0.998$

$= 0.000628$

12) Bayesian Network