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Name :- Darshan Sanjay Jadhav

Roll No :- 23

class :- BE - I.T

sem :- VII

sub :- Is lab.

DOP	DOL	marks	sign

K.G.C.E.
Karjat - Raigad

Assignment No :- 02

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Q.1] Solve the following with forward chaining or backword chaining or resolution (any one) use predicate logic as language of knowledge representation clearly specify the facts and inference rum used.

Q-1) Example :

1) Every child spes some witch No which has both a black cut and a pointed hot.
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 cut.
5) Every witch that is seen by any child has a pointed hat.
6) Prove : Every child gets candy

→ A) Facts into FOL

1) $\exists x \forall y (child(x), witch(y) \rightarrow sees(x,y))$
   $\sim \exists y (witch(y) \rightarrow has(y, black cat) \wedge has(y, pointed hat))$

2) $\exists y (witch(y) \rightarrow good(y) \vee bad(y))$

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

4) $\exists y ((witch(y) \rightarrow bad(y)) \rightarrow has(y \rightarrow black hat))$

5) $\exists y (sees(x,y) \rightarrow has(y, pointed hat)$

B) FOL into CNF

1) $\exists x \forall y (child(x), witch(y) \rightarrow sees(x,y))$
   $\rightarrow \sim \exists y, (witch(y) \rightarrow has(y, black hat)$
   $\rightarrow \sim \exists y (witch(y) \rightarrow has(y, pointed hat)$

1) $\forall y \ (witch(y) \rightarrow good(y))$

   $\exists y \ [witch(y) \rightarrow bad(y)]$

3) $\exists x \ (sees(x,y) \rightarrow witch(y) \rightarrow good(y)) \rightarrow gets[x, candy]$

   $\rightarrow \exists x \ [(sees(x,y) \rightarrow witch(y) \rightarrow good(y)) \rightarrow (x \ candy)]$

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

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

6) $\Rightarrow \neg \forall x \ [seen(x,y) \rightarrow has(y, black \ hat)]$

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 cat ∨
          │                              pointed hat}
  seen(x,good) ∨ seen(x,bad)
          │                          has(good, pointed
          │                           hat ∨ get(x,candy)
          │
  seen(x,good) ∨ has(good,
  pointed hat) ∨ gets                      seen(x,good) ∨
      (x, candy)                           gets(x, candy)
          │                                      │
          │                                      │
          │
    gets(x, candy)                       gets(x, candy)
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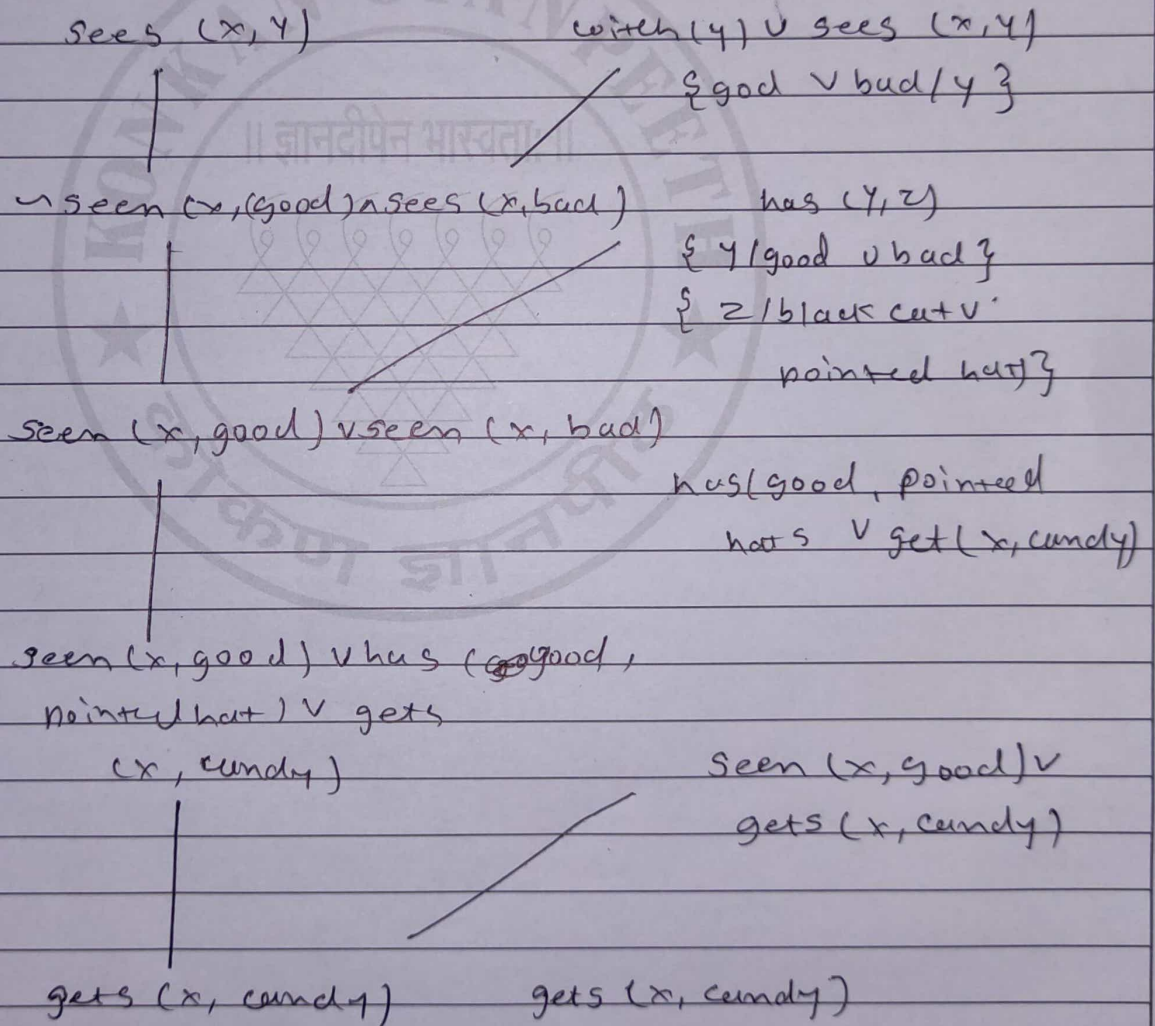
2) 3) Example 2 :-

1) Every boy or girl 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 gets lump of coal.

7) Prove Ram is bad.

→ 1) $\forall x (boy(x)$ or $girl(x)) \rightarrow child(x)$

2) $\forall y (child(y)) \rightarrow gets(y, doll)$ 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($child(ram)$ and 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 ! bud (z) or get (z, coal)

6) bud (rum)

7) ! child (rum) or gets (rum, coal)
        substituting z by rum

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

8) child rum (substituting x by rum)

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

8) child (rum)

9) gets (rum, coal)

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

8) child (rum)

10) gets (rum, doll) or gets (rum, train) or gets
        (rum, coal)
        (substituting y by rum)

9) gets (rum, coal)

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

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

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

5) boy (rum)

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

11) gets (rum, doll)

13) gets (rum, coal)

5) (a) get (rum, coal)

13) gets (rum, coal)
        Hence, bud (rum) is proved.

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Q.2) Differentiate between STRIPs and ADL

| STRIPs language	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 and negative literals. for eg :- same sentence is expressed as ⇒ Stupid ∧ ~Ugly
2) STRIPs stand for Standard Research Institute Problem Solver	2) stands for Action Description Language
3) makes use of closed world assumption (i.e) Un mentioned 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 also find qualified variables in goal. for eg :- ∃x At(P1,x) ∧ At(P2,x) is the goal of having P1 and P2 in the example of blocks.
5) Goals are conjuctions for eg :- (Intelligent ∧ Beautiful)	5) Goals may Binvolve conjunctions & disjunctions for eg :- (Intelligent ∧ (Beautiful ∧ Rich))

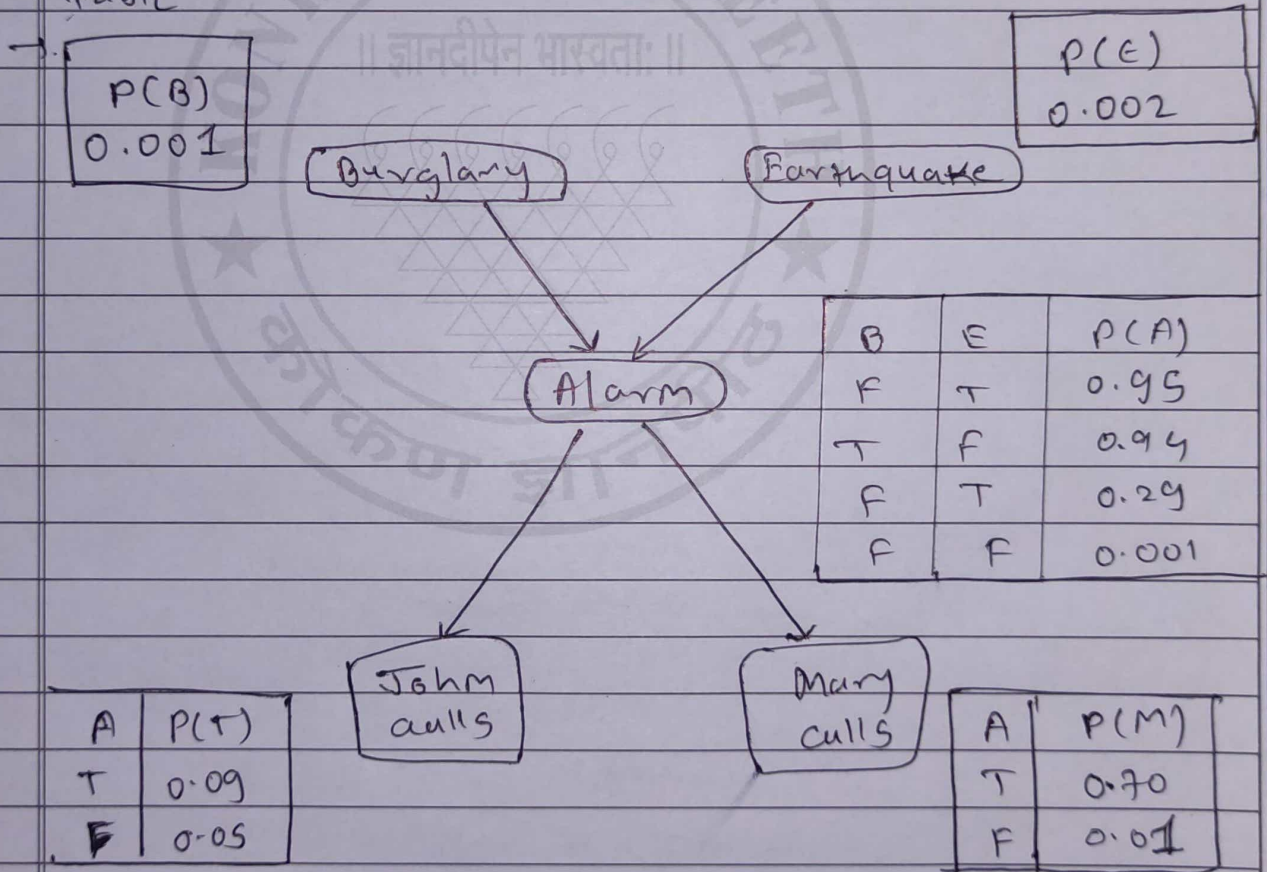| | | 6) Effects are conjunctions | 6) conditional effects are allowed : when P,e means e is an effect only if p is satisfied |
| | | 7) Does not support equality | 7) Equality Predicate $(x=y)$ is build in |
| | | 8) Does not have support for types | 8) Support for types for eg: The Variable P: Person. |
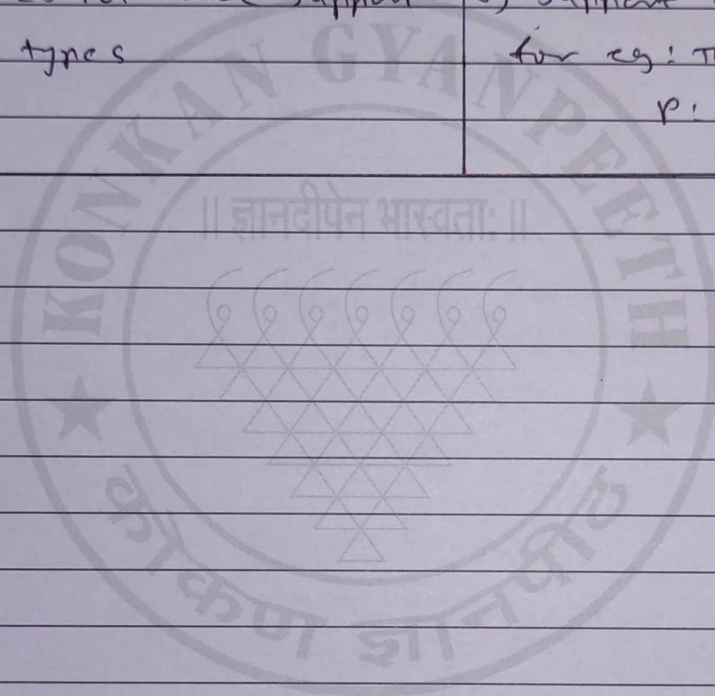
Q4) You have two neighbors I and m, who have promised to can you at work when they here the alarm J always culls when he hears the alarm, but sometimes confused telephone ringing with alarms and culls then too. m likes loud with music and sometimes misses the alarm together given the evidence of who has or has not culled we would like to estimate the probability of burglary Draw a Bayesich network 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	0.29
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 and John confusing phone ringing to sound of alarm can be read from network only implicitly an uncertainty associated to calling at work.

3) In probability actually summarize patently intinite sets 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 mary might fail to call and report and alarm because they are out to lunch, on vacation temporarily dead passing helicopter etc.

4) The condition probability tables 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 general a table for a Boolean variable with k parents contain 2^k independently specific probabilities.

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 a conjuction of particular assignments to each variable $P(x_1 = x_1 \cap \ldots \cap \ldots x_n = x_n)$ abbreviated as $P(x_1, \ldots, x_n)$ 0.

11) The value of this entry is $P(x_1, \ldots x_n)$
$= \Pi_i - 1$, $np(1, parents(x_i))$, where Parents $s(x_i)$ denotes the specific values of the variables Parents (x_i)

$- P(j \cap m \cap a \cap \neg b \cap \neg e)$

$= p(j|a) \, p(m|a) \, p(a|\neg b \cap \neg e) \, p(\neg b) e(\neg e)$

$\Rightarrow 0.09 \times 0.04 \times 0.001 \times 0.999 \times 0.998$

$\Rightarrow 0.000628$

12) Bayesian Network