Assignment NO: 2

Name:- Dhanashri Devendra Shinde

Roll NO: 62

Class: B.E - IT

Sem: VII

Subject: IS LAB

DOP	DOC	marks	sign

Q. I) 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 & inference rule used.

Q. I) Example 1:

1) Every child sees some witch no witch has both a black cat & 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) → good (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) ∃ x∀y (child (x), witch (y) → sees (x, y))
→ ∼∃y. (witch (y) → has (y, black hat)
→ ∼∃y (witch (y) → has (y, pointed hat)

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

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

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

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

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

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

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

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 hats ∨ get (x, candy))

seen (x, good) ∨ has (good, pointed hat) ∨ gets (x, candy) — seen (x, good) ∨ gets (x, candy)

gets (x, candy) — gets (x, candy)

2) 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) ∀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) & bad(z)) → gets(z, coal))
∀y child(y) → ! gets(y, train)
5) Child(ram) → gets(ram, coal)
to prove (child & (ram) → 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) → gets(ram, coal)
6) bad(ram)

Resolution:

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)
8) 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)
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~~ w by ram)
11) gets (ram, doll) or gets (ram, train)
12) ! gets (ram, doll)
13) gets (ram, coal)
6) g <a> get (ram, coal)
13) gets (ram, coal)
Hence, bad (ram) is proved.

Q. 2] Differentiate between STRIPS and ADL.

STRIPS language	ADL
1) Only allow positive literals in the states. for eg. A valid sentence in STRIPS is expressed as → Intelligent ^ Beautiful.	1) Can support both positive & negative literals. for.eg: Same sentence is expressed as → Stupid ^ ¬ ugly
2) STRIPS stands for Standard Research Institutes 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 grounded literals in goals. for eg: Intelliget ^ Beautiful.	4) we can find qualified variables in goal. for eg : $\exists x At(P_1, x) \wedge At(P_2, x)$ is the goal of having P_1 & P_2 in the same place in ex. of blocks.
5) Goals are conjuctions for eg: (Intelligent ^ Beautiful)	5) goals may involve conjuctions & disjuctions for eg: (Intelligent ^ (Beautiful ^ Rich))
6) Effects are conjuctions.	6) conditional effects are allowed: when P:E means E is an affect only if P is satisfied.

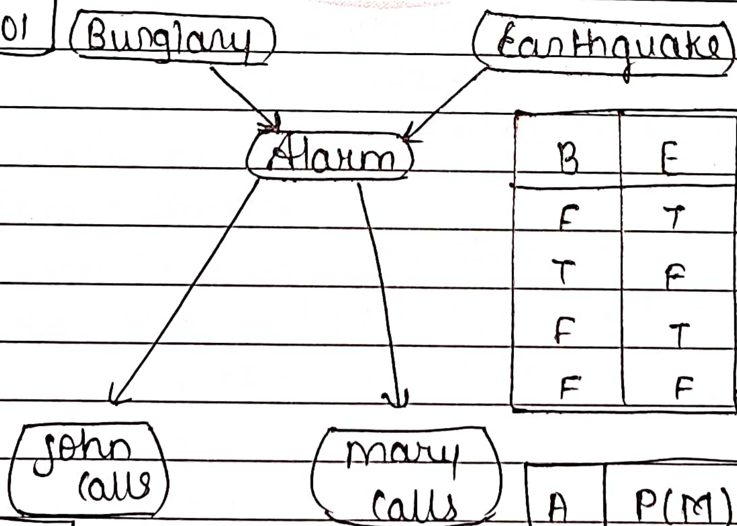
7) Does not support equality.	7) Equality predicate (x = y) is build in.
8) Does not have support for types.	8) Support for types: for eg. the variable P: person.

Q: 4) You have two neighbors 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 alarms & calls then too. M likes loud music & sometimes misses the alarm together. Given the evidence of who has or has not called we would like to estimate the probability of burglary. Draw a Bayesian 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 & earthquake affect the probability of the alarms going off.
- wheather John & 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 & to john confusing phone ringing to sound of alarm can be read from network only implicity as uncertainly associated to calling at work.

3) the probability actually summarize potentially infinite 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.
- to john & mary might fail to call & report e alarm because they are out to lunch on vacation, temporarily deaf, 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 entire represent exhaustive set of cases for variable.

6) All variables are boolean.

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

K.G.C.E.
Karjat - Raigad

Page No. :
Date :

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 to each variable $P(X_1 = x_1 \wedge \dots \wedge \dots$ $X_n = x_n)$ abbreviated as $P(x_1, \dots, x_n) = \prod i - 1, nP$ $(1, \text{parents}(xi))$, where parents s(xi) denotes the specific values of the variables parents (xi)

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

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

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

$= 0.000628$

12) Bayesian Network