Assignment no:-2

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Dop	Doc	remark	sign

Q1) Solve the following with forward chaining or backward chaining or resoution (any one) use predicate logic as language of knowledge representation clearly specify the facts & inference rule used.

Q.1) 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) → godd (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) $\exists y\,[seen(x,y) \rightarrow has(y, pointed\ hat)]$
$\rightarrow \lor \forall y\,[seen(x,y) \rightarrow has(y, black\ hat)]$

c)

sees(x,y)

witch(y) v sees(x,y)
{good v bad/y}

v seen(x,(good) ∧ sees(x,bad)

has(y,z)
{y/good v bad}
{z/black cat v pointed hat)}

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) 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) and 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, ~~b~~ train) or gets (ram, coal)

11) gets (ram, doll) or gets (ram, train) ~~or gets~~

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

5) boy (ram)

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

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

12) ! gets (ram, doll)

13) gets (ram, coal)

6) <a> get (ram, coal)

13) gets (ram, coal)

Hence, bad (ram) is proved

Q2) Differentiate between STRIPS and ADL

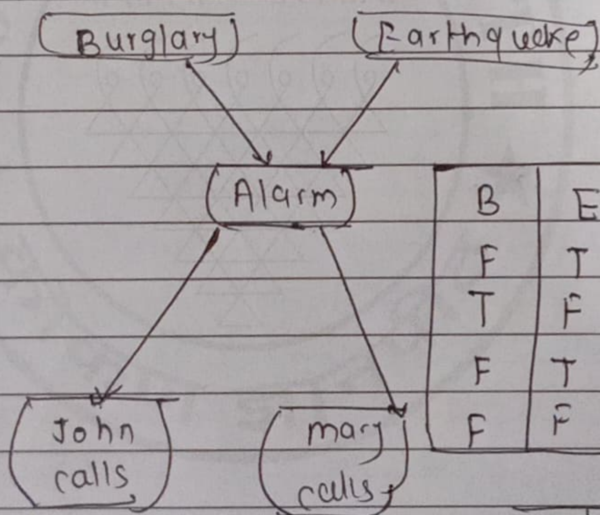
STRIPS language	ADL
1) Only allow positive literals in the states. For eg: A valid sentence is STRIPS is expressed as ⇒ Intelligent ∧ Beautiful	1) Can support both positive & negative literals For eg :- same sentence is expressed as ⇒ Stupid ∧ ¬ugly
2) STRIPS stand for Standard Research Institute problem solver.	2) Stands for Action Description language.
3) makes use of closed world assumption (i.e) 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 e.g :- Intelligent ∧ Beautiful	4) We can find qualified variables in goal For e.g :- ∃x At(P1, x) ∧ At(P2, x) is the goal of having P1 & P2 in the same place in the examples of blocks
5) Goals are conjunctions For e.g :- (Intelligent ∧ Beautiful)	5) Goals may involve conjuctions & disjunctions For eg :- (Intelligent ∧ (Beautiful ∧ Rich))

6) Effects are conjuctions	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 built in
8) Does not have support for types.	8) Support for types for e.g: The variable p: Person

Q4) 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 alarm & 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. 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(J)
T	0.09
F	0.05

A	P(m)
F	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 and marry call depends only on alarm.
- They do not perceive any burglaries directly they do not notice minor earthquake and they do not confer before calling.

2) mary listening the loud music & john confusing phone ringing to sound of alarm can be read from network only implicitly as uncertainty associated to calling at work.

3) The probability actually summarize potentially 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 mary might fail to call and report & alarm because they are out to launch, 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 notes

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

6) All variables are Boolean.

7) In general, a table for a Boolean varianble with k parent contains 2k independently specific probabilities

K.G.C.E.
Karjat - Raigad

Page No. :
Date :

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

9) Every entry in full joint probability distribution can be calculated from information in Bayesian network.

10) 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 $P(x_1 \ldots x_n)$

11) The value of this entry is $P(x_1 \ldots x_n) =$ $\prod i=1, n P(1, parents(xi))\}$, where parents s(xi) denotes the specific values of the variables parents(xi)

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

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

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

$= 0.000628$

12) Bayesian network