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DOP	DOA	Remark	sign
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Q1. Solve the following with forward chaining or backward chaining or resolution we predicate logic as language of knowledge representation clearly specify the facts and inference rote used.

Example 1 :

1) Every child spes some which no which 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) ∃xAY (child(x), witch(y) → sees(x,Y))

~∃y (witch(y) → has (y, black cat) ∧ has (y, pointed hat)

2) ∃y (witch(y) → good(y) v bad (y))

3) Ex ((sees(x,y) → (witch(y) v bad (y)) get (x, candy)

4) Ey ((witch(y) → bad(y)) → has (y → black hat)

5) Ey (sees (Y,Y) → has (y, pointed hat)

B) FOL into CNF

1) ∃xAY (child(x), witch(y) → sees(x,Y))

2) → ~∃y, (widh(y) → has (y, black cat)

→ ~∃y (witch(y) → has (y, pointed hat)

2) ∀y (witch(y) → good(y))

∀y (witch(y) → bad(y))

3) Ex [(sees(x,y) → witch(y) → good(y)) → gets (x, andy)

→ Ex [(sees (x, good (y) → gets (x, candy)]

4) Ey [bad(y) → has (y, black hats)]

5) Ey [seen (x, y) → has (y, pointed hat]

→ ~∀y [seen (x, y) → has (y, black hat)]

c) sees (x, y)   witch (y) v sees (x, y)

{good v bad / y}

~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)

Example 2:

1) Every boy or girl is a ~~a~~ child.

2) Every child gets a doll or a train or a lump of 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) ∀ ω (boy (ω) → ! gets (ω, 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) ! chld (y) or gets (y, doll) or gets (y, train) or gets (y, cool)
3) ! cboy (ω) or ! gets (ω, doll)
4) ! child (z) or ! bad (z) or gets (z, coal)
5) ! child (ram) → gets (ram, coal)
6) bad (ram)

Resolation
4) ! child (z) or ! bad (z) or get (z, goal)
6) bad (ram)

7) ! child (from) 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)
10) ! 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)
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 (ω) or ! gets (ω, doll)
5) boy (ram)
12) ! get (ram, doll) substituting ω by ram)
11) gets (ram, doll) or gets (ram, train)
13) ! gets (ram, doll)
12) gets (ram, coal)
6) (a) get (ram, coal)
13) gets (ram, coal)
Hence, bad (ram) is proved.

Q.2 Differentiate between STRIPS and ADL

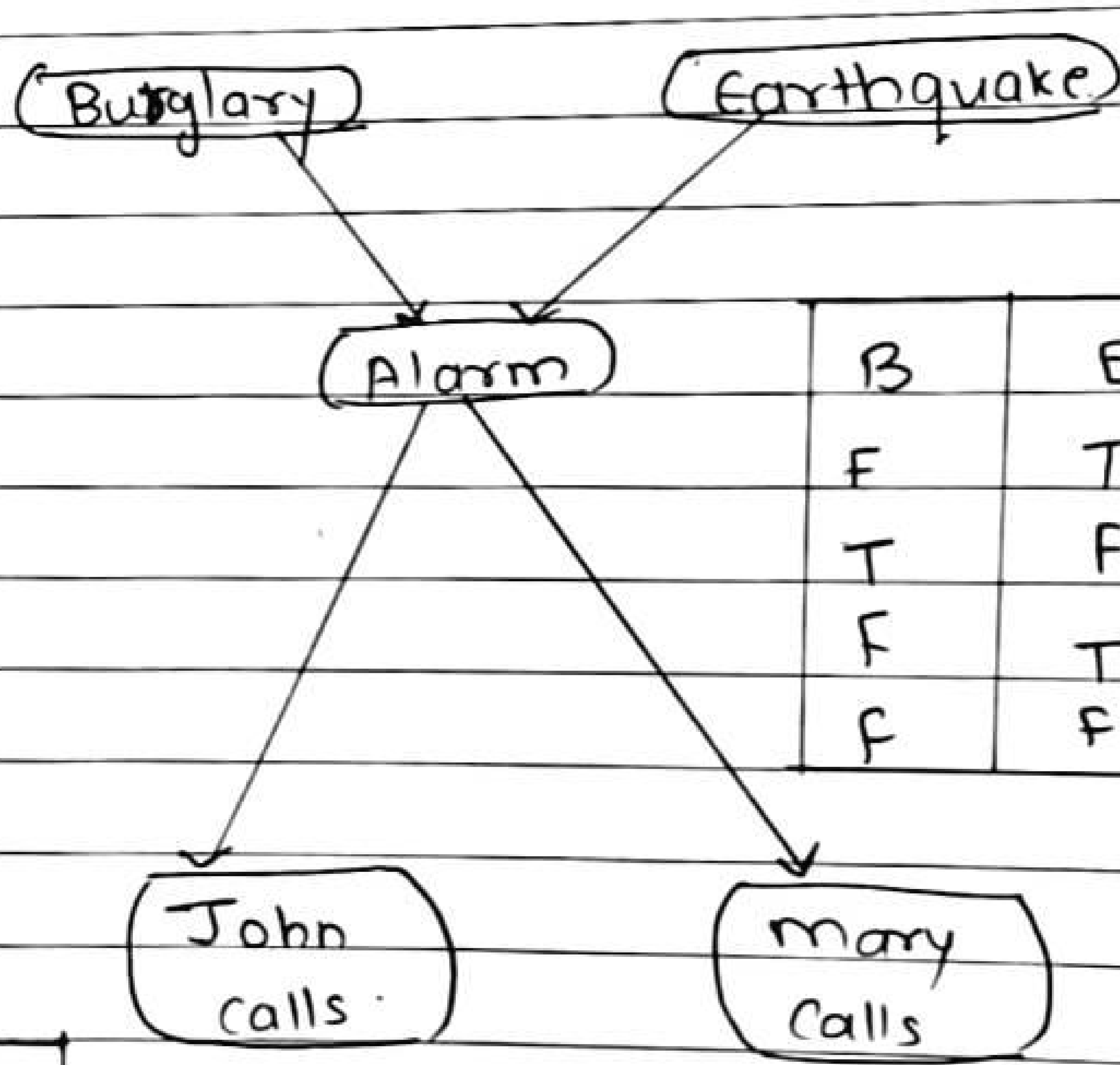
Strips Language	ADL
① Only allow positive literals in the states for eg. : A Valid sentence is STRIPS is expressed as ⇒ Intelligent ∧ Beautiful	① Can support both positive & negative literals for eg. :- Same sentence is expressed as ⇒ stupid ∧ -ugly
② STRIPS stands for standard Research Institute Problem Solver	② Stands for Actions 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 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 e.g. of blocks.
⑤ Goals are conjunctions for e.g. :- (Intelligent ∧ beautiful)	⑤ Goals may involves conjunction & disjunctions for e.g. :- (Intelligent ∧ (Beautiful ∧ Rich))

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 alarms & 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(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

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of the alarm's going off.
- wheather 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 & 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 sets of circumstances.
- The alarm might full 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 of 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 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 contains 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 $P(X_1 = x_1 \wedge \cdots \wedge X_n = x_n)$ abbreviated as $P(x_1, \cdots, x_n)$

11) The value of this entry is $P(x_1, \cdots, x_n) = \prod_{i=1,n} P(x_i \mid parents(X_i))$, where parents (x_i) denotes the specific values of the variables parents (X_i)

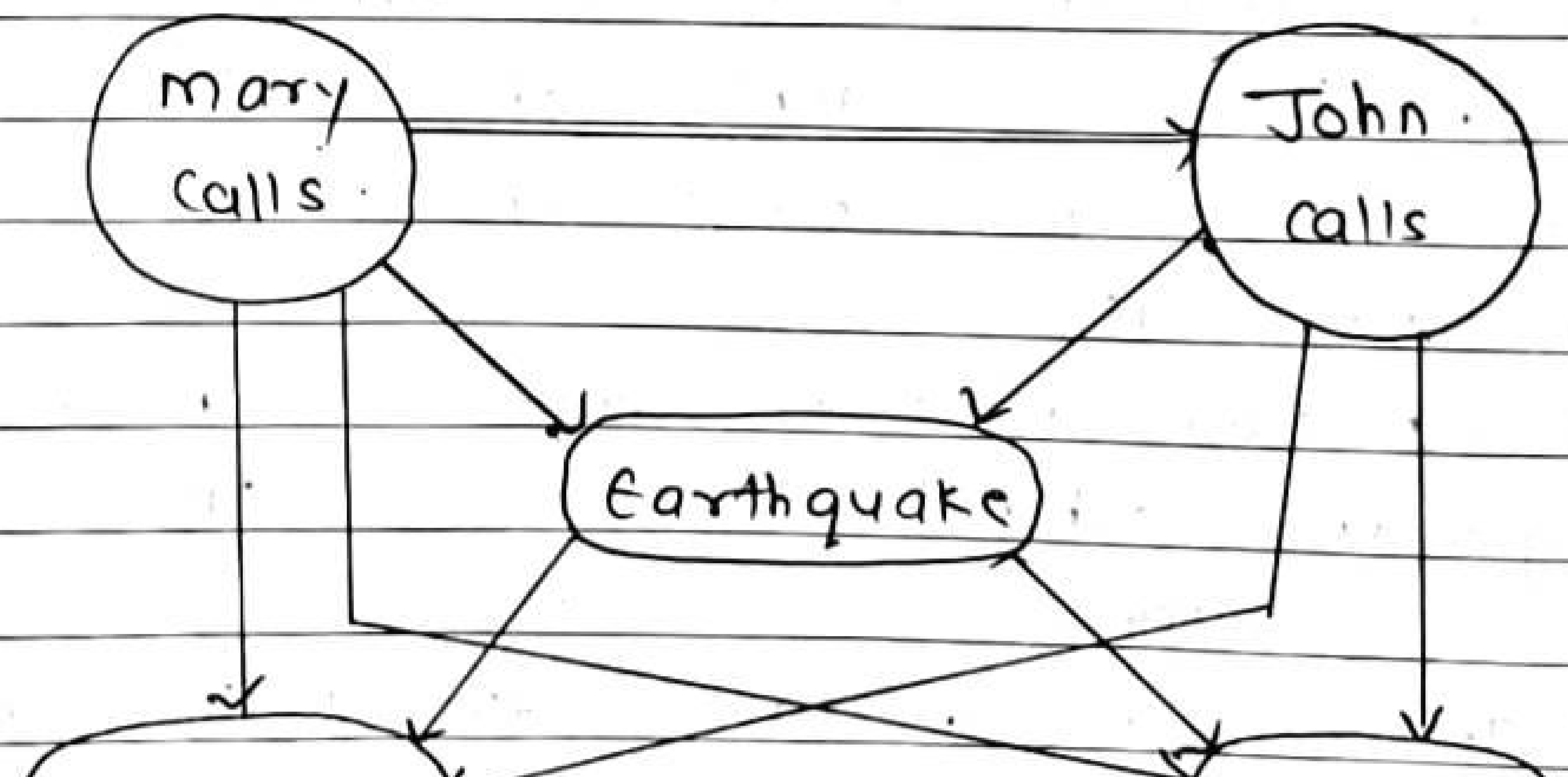
$- P(j \wedge m \wedge a \wedge \neg b \wedge \neg e)$

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

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

$= 0.000628$

12) Bayesion Network.



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