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ASSIGNMENT: 3

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- **APPLY Resolution for Inference :**

Problem Scenario

1. Either Alice(A), Bob(B), or charlie(c) was in the mansion(In(X)) at the time(t) of the crime(y). t1
2. If Alice was in the mansion, then she saw(y) the crime.
3. If Bob was in the mansion, then the window was open.
4. If charlie was in the mansion and the window was not open, then he committed(X) the crime(y).
5. Alice didn't see the crime.
6. The window was not open.
7. Assumption :-

   committed (c, y)

① Translate into First-Order Logic (FOL) :-

① Disjunction statement → It says at least one of them was there so;

$$In(a,t_1) \vee In(b,t_1) \vee In(c,t_1)$$

② Implication (If-then)

$In(a) \rightarrow saw(a,y)$

or $In(a,x) \rightarrow saw(a,y)$

③ $In(b) \rightarrow open$

or $In(b,x) \rightarrow open$

④ $In(c) \wedge \neg open \rightarrow committed(c,y)$

or $In(c,x) \rightarrow \neg open$

⑤ $\neg saw(A,y)$

⑥ $\neg open$

② Convert FOL into CNF (clausal form)

Remove Implications ($P \rightarrow Q \equiv \neg P \vee Q$)

① $In(a,t_1) \vee In(b,t_1) \vee In(c,t_1)$ is already in the CNF form.

② $\neg In(a,x) \vee saw(a,y)$

③ $\neg In(b,x) \vee open$

④ $\neg(In(c) \wedge \neg open) \vee committed(c,y)$

De-morgan's Law

$\neg In(c) \vee open \vee committed(c,y)$

⑤ $\neg saw(a,y)$; is already in CNF

⑥ $\neg open$ (already in CNF)

③ **Apply Resolution (Refutation)** $\neg committed(c,y)$

→ Add the negation of the query for refutation.

Available clauses :-

$[In(a,y) \vee In(b,y) \vee In(c,y)] \vee [\neg In(a,y) \vee saw(a,y)] \vee [\neg In(b,y) \vee open] \vee [\neg In(c,y) \vee open \vee committed(c,y)] \vee [\neg saw(a,y)] \vee [\neg open]$

→ Applying Resolution

$$\frac{\neg In(a,y) \vee saw(a,y) \qquad \neg saw(a,y)}{\neg In(a,y)} \quad \text{——} ①$$

$$\frac{\neg In(c) \vee open \vee committed(c,y) \qquad \neg open}{\neg In(c,y) \vee committed(c,y)} \quad \text{——} ②$$

From eq ① and ②

$In(a,y) \vee In(b,y) \vee In(c,y) \vee committed(c,y) \vee \neg In(a,y) \vee \neg In(c,y)$

committed(c,y) ∨ In(b,y) —③

¬In(b,y) ∨ open

open ∨ committed(c,y)

committed(c,y) ∨ open

¬open (can be used again)

committed(c,y)

So;

Committed(c,y) and ¬committed(c,y) Contradicts.

Hence query is proved that.

Charlie Committed the crime!!