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AI 3:30-5:30 PM

AI PROJECT 1

PROBLEM 1

Let: A = Alice, B = Bob, C = Carl, D = Don
I(X) means that x is innocent
F(X, D) means that X is a friend of D
L(X, D) means X liked D
Knows(X, D) means X knows D
Town(X) means X was in town on day of murder
With(X, D) means X was with D on day of murder

General Facts:

Given
1) $With(x, D) \Rightarrow Town(x)$
2) $F(x, D) \Rightarrow Knows(x, D)$
3) $L(x, D) \Rightarrow Knows(x, D)$

Alice
4) $I(A) \Rightarrow F(B, D)$
5) $I(A) \Rightarrow \neg L(C, D)$

Bob
6) $I(B) \Rightarrow \neg Town(B)$
7) $I(B) \Rightarrow \neg Knows(B, D)$

Carl
8) $I(C) \Rightarrow With(A, D)$
9) $I(C) \Rightarrow With(B, D)$

Only one guilty
10) $I(A) \vee I(B)$
11) $I(B) \vee I(C)$
12) $I(A) \vee I(C)$

Using resolution to prove Bob did it, we take negation to use resolution (so I(B))

Knowledge Base
1. $\neg With(x, D) \vee Town(x)$
2. $\neg F(x, D) \vee Knows(x, D)$
3. $\neg L(x, D) \vee Knows(x, D)$
4. $\neg I(A) \vee F(B, D)$
5. $\neg I(A) \vee \neg L(C, D)$
6. $\neg I(B) \vee \neg Town(B)$
7. $\neg I(B) \vee \neg Knows(B, D)$
8. $\neg I(C) \vee With(A, D)$
9. $\neg I(C) \vee With(B, D)$
10. $I(A) \vee I(B)$
11. $I(B) \vee I(C)$
12. $I(A) \vee I(C)$

¬S → 13. $I(B)$
If x=B, 14. $\neg I(A) \vee Knows(B, D)$ [2 & 4]
If x=B, 15. $\neg I(C) \vee Town(B)$ [1 & 9]
16. $\neg I(A) \vee \neg I(B)$ [7 & 14]
17. $\neg I(C) \vee \neg I(B)$ [6 & 15]
18. $I(C), \neg I(B)$ [12 & 16]
19. $\neg I(B)$ [17 & 18]
20. {} [13 & 19]

Empty clause, thus $KB \vdash S$ (Bob did it)

PROBLEM 2

Given:

1) $\forall c \exists x\, (Easy(c) \Rightarrow Happy(x))$
2) $\forall c \forall x\, (Final(c) \Rightarrow \neg Happy(x))$

KB:

1 simplified:

$\forall c\, (Easy(c) \Rightarrow Happy(A))$

$\equiv \neg Easy(c) \vee Happy(A)$ ①

2 simplified:

$\neg Final(c) \vee \neg Happy(x)$ ②

S simplified:

$\neg Final(c) \vee \neg Easy(c)$ ③

$\neg S$: $Final(c) \wedge Easy(c)$

Taking $KB \wedge \overline{\neg S}$

① $\neg Easy(c) \vee Happy(A)$
② $\neg Final(c) \vee \neg Happy(x)$
③ $Final(c)$
④ $Easy(c)$
⑤ $\neg Easy \vee \neg Final(c)$ [1 & 2]
⑥ $\neg Easy$ [3 & 5]
⑦ $\{\}$ [4 & 6]

Empty clause, $\Rightarrow\Leftarrow$ Therefore, if a course has a final, it is not easy.