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INST0072 Logic and Knowledge Representation

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Assessment 1

Find cnf ¬[(¬gamble ∧ work) → happy]

¬[(¬gamble ∧ work) → happy]

≡ ¬ [¬ (¬gamble ∧ work) ∨ happy] **implication**

≡ ¬¬ (¬gamble ∧ work) ∧ ¬happy **de Morgan**

≡ ¬gamble ∧ work ∧ ¬happy **Cancellation**

cnfset ¬[(¬gamble ∧ work) → happy]= **{¬gamble, work, ¬happy}**

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Show that KB ⊨ (¬gamble ∧ work) → happy

By the Resolution Soundness and Completeness theorem it is sufficient to show that:

KB ∪ cnfset ¬[(¬gamble ∧ work) → happy] $\vdash_{res}$ ⊥

A derivation of this is as follows:

(1) (¬rich ∨ ¬healthy ∨ happy), by assumption from KB ∪ {¬[(¬gamble ∧ work) → happy] }

(2) (stressed ∨ healthy), by assumption from KB ∪ {¬ [(¬gamble ∧ work) → happy]}

(3) (gamble ∨¬stressed), by assumption from KB ∪ {¬[(¬gamble ∧ work) → happy] }

(4) (¬work ∨ gamble ∨ rich), by assumption from KB ∪ {¬[(¬gamble ∧ work) → happy] }

(5) (¬gamble) by assumption from KB ∪ {¬[(¬gamble ∧ work) → happy] }

(6) (work) by assumption from KB ∪ {¬[(¬gamble ∧ work) → happy] }

(7) (¬happy) by assumption from KB ∪ {¬[(¬gamble ∧ work) → happy] }

(8) (healthy ∨ gamble) by (2), (3), resolution

(9) (healthy) by (5), (8), resolution

(10) (¬rich ∨ healthy) by (7), (1), resolution

THIS SHOULD BE ¬healthy

(11) (¬stressed) by (5), (3), resolution

(12) (gamble ∧ rich) by (6), (4), resolution

(13) (¬rich) by (12), (5), resolution

THIS SHOULD BE rich

(14) (¬work ∧ gamble) by (13), (4), resolution

(15) (gamble) by (14), (6), resolution

(16) ⊥ by(15), (5), resolution

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THE RIGHT IDEA, BUT BE CAREFUL WITH "¬" ON INDIVIDUAL PROPOSITIONS

Using the domain of discourse D = {A,B,C,D,E} and signature ⟨{ }, { }, {admiral/1, boat/1, captain/2, boss/2}⟩

Give one interpretation I + that satisfies and another interpretation I – that does not satisfy the following sentence:

$\forall x.[admiral(x) \rightarrow \forall y.(boat(y) \rightarrow \exists z.[captain(z, y) \wedge boss(x, z)])]$

THIS NEEDS TO BE "B" BECAUSE "C" NEEDS TO BE CAPTAIN OF THE BOAT

$\|\|^+$ that satisfies	**$\|\|^-$ that does not satisfy**
$\|\|^+$ (admiral) = (A) ✓	$\|\|^-$ (admiral) = (A) ✓
$\|\|^+$ (boat) = (B) ✓	$\|\|^-$ (boat) = (B) ✓
$\|\|^+$ (captain) = {(C,D)}	$\|\|^-$ (captain) = {(C,B)} ✓
$\|\|^+$ (boss) = {(A,C)} ✓	$\|\|^-$(boss) = {(A,E)} ✓

✗

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Convert the sentence $\forall x.[admiral(x) \rightarrow \forall y.(boat(y) \rightarrow \exists z. [captain (z, y) \wedge boss (x, z)])]$

into prenex normal form:

$\forall x. [\neg admiral(x) \vee \forall y (\neg boat(y) \vee \exists z. [captain(z, y) \wedge boss(x, z)])$ ✓ **Eliminating →**

$\forall x \forall y \exists z.[\neg admiral(x) \vee \neg boat(y) \vee [captain (z, y) \wedge boss(x, z)])$ ✓ **Moving Quantifiers Out**

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6
3 +
4
5

TOTAL: $\frac{18}{25}$ = 72%

GOOD WORK ON THE WHOLE, WITH JUST ONE OR TWO ERRORS – SEE ME IF YOU NEED MORE EXPLANATION.