Status	Beendet
Begonnen	Dienstag, 27. Mai 2025, 14:56
Abgeschlossen	Dienstag, 27. Mai 2025, 15:21
Dauer	25 Minuten
Bewertung	**9,00** von 10,00 (**90**%)

Frage 1

Richtig

Erreichte Punkte 1,00 von 1,00

Let

$$\mathbf{t:}\ \forall y \forall x((P(e,y) \wedge P(g(e), f(e,c))) \wedge P(x, f(e,c)))$$

be the starting formula of a tableau branch. Which of the following terms are suitable substitutes for the variable y in the subsequent steps of a tableau proof, when applying the corresponding quantifier rule?

Note: Multiple answers may be correct.

- [x] a
- [x] c
- [x] $f(d,a)$
- [x] $f(d,b)$

Frage 2

Richtig

Erreichte Punkte 1,00 von 1,00

In this question we consider tableau proofs with only one branch and we will represent them as a sequence. That is, the sequence $(\mathbf{t:}\ P(a), \mathbf{f:}\ \neg P(a))$ corresponds to the tableau proof:

$$\begin{array}{l}\mathbf{t:}\ P(a)\\ \mathbf{f:}\ \neg P(a)\end{array}$$

Considering this, which one of the following tableau proofs are closed? **Multiple** answers may be correct.

- [ ] a. $(\mathbf{t}: \forall x(Q(x) \to R(x)), \mathbf{f}: \exists x R(x), \mathbf{t}: Q(a), \mathbf{f}: \neg R(a), \mathbf{f}: R(a))$
- [x] b. $(\mathbf{t}: \forall x(\neg Q(x) \wedge \neg Q(x)), \mathbf{t}: \neg Q(b) \wedge \neg Q(b), \mathbf{f}: \exists x R(x), \mathbf{t}: Q(b), \mathbf{t}: \neg R(a), \mathbf{t}: \neg Q(b), \mathbf{f}: Q(b))$
- [x] c. $(\mathbf{t}: \exists x(Q(x) \wedge \neg Q(x)), \mathbf{t}: Q(b) \wedge \neg Q(b), \mathbf{f}: \exists x R(x), \mathbf{t}: Q(b), \mathbf{t}: \neg R(a), \mathbf{t}: \neg Q(b), \mathbf{f}: Q(b))$
- [ ] d. $(\mathbf{t}: \exists x(Q(x) \wedge \neg Q(x)), \mathbf{t}: Q(b) \wedge \neg Q(b), \mathbf{f}: \exists x R(x), \mathbf{t}: Q(b), \mathbf{t}: \neg R(a), \mathbf{t}: \neg Q(b), \mathbf{f}: Q(a))$

Frage 3

Richtig

Erreichte Punkte 1,00 von 1,00

Which is the formula in First-Order Logic that best captures the natural language sentence *"Abigail likes calculus but not math."*?

a. $Likes(abigail, calculus \land math)$

b. $Likes(abigail, calculus) \land \neg Likes(abigail, math)$ ✓

c. $Abigail(likes, calculus \land math)$

d. $Abigail(likes, calculus \lor math)$

Frage 4

Richtig

Erreichte Punkte 1,00 von 1,00

Let A be the $\mathcal{T}_E$-formula $a = b \land b = c \rightarrow c = a$. Which of the following statements is true?

a. A is not satisfiable in $\mathcal{T}_E$.

b. A is valid in $\mathcal{T}_E$. ✓

c. A is satisfiable but not valid in $\mathcal{T}_E$.

Frage 5

Richtig

Erreichte Punkte 1,00 von 1,00

Which one of the formulas below is a prenex normal form of $\neg\exists y((\neg\forall x Q(x, y) \lor R(y)) \rightarrow (\forall y S(y) \land P(c)))$?

a. $\exists x_0 \forall x_1 \forall x_2((Q(x_1, x_0) \land \neg R(x_0)) \lor (S(x_2) \land P(c)))$

b. $\forall x_0 \forall x_1 \exists x_2((\neg Q(x_1, x_0) \lor R(x_0)) \land (\neg S(x_2) \lor \neg P(c)))$

c. $\forall x_0 \exists x_1 \exists x_2((\neg Q(x_1, x_0) \lor R(x_0)) \lor (\neg S(x_2) \lor \neg P(c)))$

d. $\forall x_0 \exists x_1 \exists x_2((\neg Q(x_1, x_0) \lor R(x_0)) \land (\neg S(x_2) \lor \neg P(c)))$ ✓

Frage 6

Richtig

Erreichte Punkte 1,00 von 1,00

What is the first-order formula which best captures the following natural language sentence: "*If every athlete trains hard, then the coach will be satisfied.*"?

- a. $\forall x(Athlete(x) \rightarrow TrainsHard(x)) \rightarrow Satisfied(coach)$ ✓
- b. $TrainsHard(athlete) \wedge Satisfied(coach)$
- c. $\exists x(Athlete(x) \rightarrow TrainsHard(x)) \rightarrow Satisfied(coach)$
- d. $\forall x((Athlete(x) \rightarrow TrainsHard(x)) \rightarrow Satisfied(coach))$

Frage 7

Richtig

Erreichte Punkte 1,00 von 1,00

Let A be the $\mathcal{T}_E$-formula $f(a) = a \wedge f(b) = g(c) \wedge a = b$. Which are the congruence classes in the congruence closure of $=$ over A?

- a. $[[b, g(c)], [a, c], [f(a), f(b)]]$
- b. $[[c], [b, f(b), a, f(a), g(c)]]$ ✓
- c. $[[a, b, g(c), c], [f(a), f(b)]]$
- d. $[[g(c)], [b], [a, c], [f(a), f(b)]]$

Frage 8

Nicht beantwortet

Erreichbare Punkte: 1,00

Consider the formula $x - 1 > c$ to be interpreted in the standard way over integers, with x denoting a variable and c being a constant. Let I be an interpretation such that $I(x) = I(c) = 5$.

- a. $x - 1 > c$ is valid
- b. $x - 1 > c$ is unsatisfiable
- c. $x - 1 > c$ is satisfiable in I
- d. I is a model of $x - 1 > c$

Frage 9

Richtig

Erreichte Punkte 1,00 von 1,00

Which one of the following is a suitable new tableau rule that could be applied to formulas of the form $\mathbf{f:}\neg\forall x F(x)$ in tableau proofs?.

a. $\frac{\mathbf{f:}\neg\forall x F(x)}{\mathbf{f:}\neg F(c/x)}$ for c a new constant

b. $\frac{\mathbf{f:}\neg\forall x F(x)}{\mathbf{t:}\neg F(t/x)}$ for t a variable-free term

c. $\frac{\mathbf{f:}\neg\forall x F(x)}{\mathbf{f:}\neg F(t/x)}$ for t a variable-free term ✓

d. $\frac{\mathbf{f:}\neg\forall x F(x)}{\mathbf{t:}\neg F(c/x)}$ for c a new constant

Frage 10

Richtig

Erreichte Punkte 1,00 von 1,00

Let F be the formula $x = y \to y = b$, where x, y are variables and b a constant. Let α be the sort of x, y, b.

a. F is satisfiable but not valid in the class of interpretations that interpret α to be the domain $D = \{1\}$

b. F is unsatisfiable in the class of interpretations that interpret α to be the domain $D = \{1\}$

c. F is valid in the class of interpretations that interpret α to be the domain $D = \{1\}$ ✓