Status	Beendet
Begonnen	Montag, 26. Mai 2025, 11:09
Abgeschlossen	Montag, 26. Mai 2025, 11:25
Dauer	16 Minuten
Bewertung	**5,00** von 10,00 (**50**%)

Frage 1

Richtig

Erreichte Punkte 1,00 von 1,00

Let

$$\mathbf{f}: \forall x \exists y((P(b,y) \rightarrow Q(g(b),d)) \wedge P(f(x,y),g(y)))$$

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

Note: Multiple answers may be correct.

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

Frage 2

Falsch

Erreichte Punkte 0,00 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:

$$\mathbf{t}: P(a)$$
$$\mathbf{f}: \neg P(a)$$

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

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

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 *"James slices neither cherries nor bananas."*?

- a. $\neg Slices(slices, cherries \land bananas)$
- b. $\neg Slices(slices, cherries \lor bananas)$
- c. $\neg Slices(james, cherries) \lor \neg james(Slices, bananas)$
- d. $\neg Slices(james, cherries) \land \neg Slices(james, bananas)$ ✓

Frage 4

Richtig

Erreichte Punkte 1,00 von 1,00

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

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

Frage 5

Falsch

Erreichte Punkte -0,33 von 1,00

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

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

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 something is damaged or broken, then someone will complain."*?

- a. $\exists x(Broken(x) \lor Damaged(x)) \rightarrow \exists y Complain(y)$ ✓
- b. $\exists x(Broken(x) \lor Damaged(x) \rightarrow \forall y Complain(y))$
- c. $\exists x Broken(x) \lor (Damaged(something) \rightarrow \exists y Complain(y))$
- d. $\exists x(Broken(x) \lor Damaged(x) \rightarrow \forall y Complain(y))$

Frage 7
Richtig
Erreichte Punkte 1,00 von 1,00

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

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

Frage 8
Falsch
Erreichte Punkte -0,33 von 1,00

Consider the formula $x > c + 1$ 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 $I(x) = I(c) = 0$.

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

Frage 9
Falsch
Erreichte Punkte -0,33 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. $\frac{\mathbf{f}{:}\neg\forall x F(x)}{\mathbf{t}{:}\neg F(t/x)}$ for t a variable-free term
- b. $\frac{\mathbf{f}{:}\neg\forall x F(x)}{\mathbf{t}{:}\neg F(c/x)}$ for c a new constant
- c. $\frac{\mathbf{f}{:}\neg\forall x F(x)}{\mathbf{f}{:}\neg F(c/x)}$ for c a new constant ✗
- d. $\frac{\mathbf{f}{:}\neg\forall x F(x)}{\mathbf{f}{:}\neg F(t/x)}$ for t a variable-free term

Frage 10
Richtig
Erreichte Punkte 1,00 von 1,00

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

- a. F is unsatisfiable in the class of interpretations that interpret α to be the domain $D = \{0\}$
- b. F is valid in the class of interpretations that interpret α to be the domain $D = \{0\}$ ✓
- c. F is satisfiable but not valid in the class of interpretations that interpret α to be the domain $D = \{0\}$