

Status	Beendet
Begonnen	Mittwoch, 21. Mai 2025, 14:55
Abgeschlossen	Mittwoch, 21. Mai 2025, 15:06
Dauer	11 Minuten 9 Sekunden
Bewertung	8,67 von 10,00 (86,67%)

Frage 1

Richtig

Erreichte Punkte 1,00 von 1,00

Let

$$\mathbf{t} : \exists y \exists x (Q(f(x, y), f(d, a)) \vee P(g(x), f(d, a)))$$

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.

- ☐ $f(e, e)$
- ☐ $f(c, a)$
- ☐ $f(d, e)$
- ☒ c ✓

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

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 "Logan likes neither economics nor dancing."?

- ☐ a. $\neg Likes(logan, economics) \vee \neg Logan(Likes, dancing)$
- ☐ b. $\neg Likes(likes, economics \wedge dancing)$
- ☒ c. $\neg Likes(logan, economics) \wedge \neg Likes(logan, dancing)$ ✓
- ☐ d. $\neg Likes(likes, economics \vee dancing)$

Frage 4

Richtig

Erreichte Punkte 1,00 von 1,00

Let A be the $\mathcal{T}_E$ -formula $(a = b \wedge b = c \wedge c = d) \rightarrow a = d$. 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

Richtig

Erreichte Punkte 1,00 von 1,00

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

- ☐ a. $\exists x_0 \forall x_1 \forall x_2 ((R(x_1) \wedge P(b)) \wedge (\neg Q(x_2, x_0) \wedge \neg S(x_0)))$
- ☒ b. $\forall x_0 \forall x_1 \forall x_2 ((R(x_1) \wedge P(b)) \wedge (\neg Q(x_2, x_0) \wedge \neg S(x_0)))$ ✓
- ☐ c. $\exists x_0 \exists x_1 \exists x_2 ((\neg R(x_1) \vee \neg P(b)) \vee (Q(x_2, x_0) \vee S(x_0)))$
- ☐ d. $\forall x_0 \forall x_1 \forall x_2 ((R(x_1) \vee P(b)) \wedge (\neg Q(x_2, x_0) \wedge \neg S(x_0)))$

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 plant receives enough water, then the gardener will be pleased."?

- ☐ a. $\forall x (ReceivesEnoughWater(plant) \rightarrow Pleased(x))$
- ☐ b. $Pleased(gardener) \rightarrow \forall x (Plant(x) \rightarrow ReceivesEnoughWater(x))$
- ☒ c. $\forall x (Plant(x) \rightarrow ReceivesEnoughWater(x)) \rightarrow Pleased(gardener)$ ✓
- ☐ d. $\forall x ((Plant(x) \rightarrow ReceivesEnoughWater(x)) \rightarrow Pleased(gardener))$

Frage 7

Richtig

Erreichte Punkte 1,00 von 1,00

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

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

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 $I(x) = I(c) = 7$.

- ☐ a. $x < c - 1$ is satisfiable in I
- ☐ b. $x < c - 1$ is valid
- ☐ c. I is a model of $x < c - 1$
- ☒ d. $x < c - 1$ is unsatisfiable ✗

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 $\mathbf{t}:\neg\forall xF(x)$ in tableau proofs?

- ☐ a. $\frac{\mathbf{t}:\neg\forall xF(x)}{\mathbf{t}:\neg F(t/x)}$ for t a variable-free term
- ☒ b. $\frac{\mathbf{t}:\neg\forall xF(x)}{\mathbf{t}:\neg F(c/x)}$ for c a new constant ✓
- ☐ c. $\frac{\mathbf{t}:\neg\forall xF(x)}{\mathbf{f}:\neg F(c/x)}$ for c a new constant
- ☐ d. $\frac{\mathbf{t}:\neg\forall xF(x)}{\mathbf{f}:\neg F(t/x)}$ for t a variable-free term

Frage 10

Richtig

Erreichte Punkte 1,00 von 1,00

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

- ☒ a. F is valid in the class of interpretations that interpret α to be the domain $D = \{0\}$ ✓
- ☐ b. F is unsatisfiable 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 $D = \{0\}$