Status	Beendet
Begonnen	Montag, 26. Mai 2025, 15:27
Abgeschlossen	Montag, 26. Mai 2025, 15:41
Dauer	14 Minuten 7 Sekunden
Bewertung	**10,00** von 10,00 (**100**%)

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

Let

$$\mathbf{t}: \forall x \exists y (P(x, g(y)) \vee Q(g(x), f(c, b)))$$

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

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:

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

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

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

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 *"Liam teaches civics and geography."*?

- (•) a. $Teaches(liam, civics) \wedge Teaches(liam, geography)$ ✓
- ( ) b. $Liam(teaches, civics \wedge geography)$
- ( ) c. $Liam(teaches, civics) \wedge Liam(teaches, geography)$
- ( ) d. $Teaches(teaches, civics \wedge geography)$

Frage 4
Richtig
Erreichte Punkte 1,00 von 1,00

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

- ( ) a. A is satisfiable but not valid in $\mathcal{T}_E$.
- (•) b. A is valid in $\mathcal{T}_E$. ✓
- ( ) c. A is not satisfiable 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 $\neg\exists y((\forall y R(y) \land P(b)) \rightarrow (\exists x P(x, y) \lor \neg R(y)))$?

a. \(\forall x_0 \forall x_1 \forall x_2 ((R(x_1) \lor P(b)) \land (\neg P(x_2, x_0) \land R(x_0)))\)

b. \(\exists x_0 \forall x_1 \forall x_2 ((R(x_1) \land P(b)) \land (\neg P(x_2, x_0) \land R(x_0)))\)

c. \(\forall x_0 \forall x_1 \forall x_2 ((R(x_1) \land P(b)) \land (\neg P(x_2, x_0) \land R(x_0)))\)

d. \(\exists x_0 \exists x_1 \exists x_2 ((\neg R(x_1) \lor \neg P(b)) \lor (P(x_2, x_0) \lor \neg R(x_0)))\)

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 there is a dog that barks loudly, then the neighbor will be annoyed."*?

a. \(\forall x (Dog(x) \land BarksLoudly(x) \rightarrow Annoyed(neighbor))\)

b. \(\exists x (Dog(x) \land BarksLoudly(x)) \rightarrow Annoyed(neighbor)\)

c. \(Annoyed(neighbor) \rightarrow \exists x (Dog(x) \land BarksLoudly(x))\)

d. \(\exists x (Dog(x) \land BarksLoudly(x) \rightarrow Annoyed(neighbor))\)

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

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

a. \([[a], [f(b), f(a), b]]\)

b. \([[a, b], [f(b), f(a)]]\)

c. \([[a], [b], [f(b), f(a)]]\)

d. \([[a, f(b), f(a), b]]\)

Frage 8
Richtig
Erreichte Punkte 1,00 von 1,00

Consider the formula \(x \lt c - 1\) 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. \(I\) is a model of \(x \lt c - 1\)

b. \(x \lt c - 1\) is satisfiable in \(I\)

c. \(x \lt c - 1\) is unsatisfiable

d. \(x \lt c - 1\) is valid

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 \(\textbf{f:}\neg \exists x \neg F(x)\) in tableau proofs?.

a. \(\frac{\textbf{f:}\neg \exists x \neg F(x)}{\textbf{f:} F(c/x) } ~ \text{for } c \text{ a new constant}\)

b. \(\frac{\textbf{f:}\neg \exists x \neg F(x)}{\textbf{t:} F(c/x) }~ \text{for } c \text{ a new constant}\)

c. \(\frac{\textbf{f:}\neg \exists x \neg F(x)}{\textbf{t:} F(t/x) }~ \text{for } t \text{ a variable-free term}\)

d. \(\frac{\textbf{f:}\neg \exists x \neg F(x)}{\textbf{f:} F(t/x) }~ \text{for } t \text{ a variable-free term}\)

Frage 10

Richtig

Erreichte Punkte 1,00 von 1,00

Let F be the formula \(x \neq y \to y=x\), where \(x, y\) are variables. Let \(\alpha\) be the sort of \(x, y \).

- a. \(F\) is valid in the class of interpretations that interpret \(\alpha\) to be the domain \(D=\{1\}\) ✓
- b. \(F\) is unsatisfiable in the class of interpretations that interpret \(\alpha\) to be the domain \(D=\{1\}\)
- c. \(F\) is satisfiable but not valid in the class of interpretations that interpret \(\alpha\) to be the domain \(D=\{1\}\)