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| **Status** | Beendet |
| **Begonnen** | Dienstag, 10. Juni 2025, 17:15 |
| **Abgeschlossen** | Dienstag, 10. Juni 2025, 17:31 |
| **Dauer** | 16 Minuten 19 Sekunden |
| **Bewertung** | **8,67** von 10,00 (**86,67**%) |

**Frage 1**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the ground formula $F := f(a) = g(g(a)) \wedge f(g(a)) \neq f(f(a)) \wedge g(a) = a$ in the theory of equality $\mathcal{T}_E$. Which one of the answers below is correct?

- a. $F$ is unsatisfiable. ✓
- b. $F$ is valid.
- c. $F$ is satisfiable, but not valid.

**Frage 2**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the following formula $F := a = f(f(a)) \wedge g(g(d)) \neq f(c) \wedge f(a) = c$. Which of the following statements hold?

**Note:** More than one answer might be correct.

- a. $F \wedge (g(a) = f(a) \wedge a = c)$ is satisfiable. ✓
- b. $F \wedge (f(a) \neq f(d) \wedge f(f(f(a))) \neq c)$ is satisfiable.
- c. All formulas in the other options are unsatisfiable.
- d. $F \wedge (g(a) = f(d) \vee f(d) = f(c))$ is satisfiable. ✓

**Frage 3**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the formula $F := f(a) = f(a) \wedge c \neq f(c) \wedge p(f(a), c) \wedge q(f(a), f(b))$ in the theory $\mathcal{T}_E$ of equality and the fresh symbols $f_p$, $f_q$ and $t$. Which of the following formulas is equisatisfiable to $F$?

- a. $f(a) = f(a) \wedge c \neq f(c)$
- b. $f(a) = f(a) \wedge c \neq f(c) \wedge f_p(f(a), c) \neq t \wedge f_q(f(a), f(b)) \neq t$
- c. $f(a) = f_q(a) \wedge c \neq f_p(c) \wedge f_p(f_q(a), c) = t \wedge f_q(f_p(a), f_p(b)) = t$
- d. $f(a) = f(a) \wedge c \neq f(c) \wedge f_p(f(a), c) = t \wedge f_q(f(a), f(b)) = t$ ✓

**Frage 4**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the formula $F := read(write(A, a, c), a) = a \wedge a \neq b$ in the theory of arrays $\mathcal{T}_A$ where $a, b, c$ are constants and $A$ is an array constant. Which one of the answers below is correct?

- a. $F$ is satisfiable, but not valid. ✓
- b. $F$ is valid.
- c. $F$ is unsatisfiable.

**Frage 5**

Richtig

Erreichte Punkte 1,00 von 1,00

Which of the following formula is valid in the theory $\mathcal{T}_A$ of arrays where $a, b, c, d$ are constants and $A$ is an array constant?

- a. $read(write(A, b, a), d) = d \wedge d = d \implies c = a$
- b. $read(write(A, b, b), a) = d \wedge b = a \implies d = c$
- c. $read(write(A, b, a), d) = a \wedge d = c \implies a = b$
- d. $read(write(A, a, d), d) = b \wedge a = d \implies d = b$ ✓

**Frage 6**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the formula $F := read(write(A, a, b), d) = c$ in the theory $\mathcal{T}_A$ of arrays where $a, b, c, d$ are constants and $A$ is an array constant. Which formula is valid:

- a. $F \wedge a \neq d \implies read(A, d) = c$ ✓
- b. $F \wedge a \neq b \implies read(A, d) = c$
- c. $F \wedge a \neq c \implies read(A, d) = c$

**Frage 7**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the formula $F := read(B, b) = read(B, g(b)) \wedge c \neq f(c) \wedge a = f(c)$ in the theory $\mathcal{T}_A$ of arrays and $f_A$, $f_B$ and $t$ are fresh symbols. Which of the following formulas is equisatisfiable to $F$?

- a. $f(b) = f(g(b)) \wedge c \neq f(c) \wedge a = f(c)$
- b. $c \neq f(c) \wedge a = f(c)$
- c. $f_B(b) = f_B(g(b)) \wedge c \neq f(c) \wedge a = f(c)$ ✓
- d. $f_B(b) = t \wedge c \neq f(c) \wedge a = f(c)$

**Frage 8**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the following formula
$F := f(x) = a + 1 \vee f(a) + 1 \neq write(A, x, 1) \vee y + 2 = f(c) + 3 \vee read(write(A, x, 3), y + 1) \neq f(y)$ in the theory of equality $\mathcal{T}_E$, arrays $\mathcal{T}_A$ and linear integer arithmetic $\mathcal{T}_{\mathbb{Z}}$. Which one of the following answers is a correct Boolean abstraction of $F$?

**Note:** Use atoms to denote positive literals. For instance, the atom $p$ is the abstraction of $a = b$. Do not use $p$ as the abstraction of $a \neq b$.

a. $p_2 \vee \neg p_2 \vee p_3 \vee \neg p_4$

b. $p_1 \vee p_2 \vee p_3 \vee p_4$

c. $p_1 \wedge \neg p_2 \wedge p_3 \wedge \neg p_4$

d. $p_1 \vee \neg p_2 \vee p_3 \vee \neg p_4$ ✓

**Frage 9**

Richtig

Erreichte Punkte 1,00 von 1,00

Consider the set of formulas $\mathcal{F}$ as given below, in which the formulas might not belong to a single theory. Furthermore, let $a, b, c, d$ be constants.

$$\mathcal{F} = \{\ g(b) = a,\\ b + 1 = d + 1,\\ write(A, c, a) = b\ \}$$

Which constant symbols are shared among different theories?

**Note:** Multiple answers might be correct.

- [ ] $c$
- [ ] $d$
- [x] $b$ ✓
- [x] $a$ ✓

**Frage 10**

Falsch

Erreichte Punkte -0,33 von 1,00

Consider the set of formulas $\mathcal{F}$ as given below, in which the formulas might not belong to a single theory.

$$\mathcal{F} = \{\ h(d+5) = f(a+7) + 7,\\ (d + a \neq f(a) + 7),\\ read(A, y+7) = x)\ \}$$

Which variables and equalities need to be introduced to allow theory separation?

- $c_1 = d + 5,\ c_2 = a + 7,\ c_3 = f(a+7) + 7,\ c_4 = d + a,\ c_5 = f(a) + 7,\ c_6 = y + 7$
- $c_1 = d + 5,\ c_2 = a + 7,\ c_3 = f(a+7) + 7,\ c_4 = d + a,\ c_5 = f(a) + 7$
- $c_1 = d + 5,\ c_2 = a + 7,\ c_3 = f(c_2),\ c_4 = c_3 + 7,\ c_5 = d + a,\ c_6 = f(a),\ c_7 = c_6 + 7,\ c_8 = y + 7$
- $c_1 = d + 5,\ c_2 = a + 7,\ c_3 = f(c_2) + 7,\ c_4 = d + a,\ c_5 = f(a) + 7,\ c_6 = y + 7$ ⊗