

Status Beendet**Begonnen** Freitag, 4. April 2025, 13:34**Abgeschlossen** Freitag, 4. April 2025, 14:01**Dauer** 27 Minuten 18 Sekunden**Bewertung** 9,00 von 10,00 (90%)**Frage 1**

Richtig

Erreichte Punkte 1,00 von 1,00

Given the formula $F = ((a \vee \neg b) \rightarrow \neg c) \wedge \neg b$, fill in the truth table:

a	b	c	F
0	0	0	1 ✓
0	0	1	0 ✓
0	1	0	0 ✓
0	1	1	0 ✓
1	0	0	1 ✓
1	0	1	0 ✓
1	1	0	0 ✓
1	1	1	0 ✓

☐ 0
☐ 1
Frage 2

Richtig

Erreichte Punkte 1,00 von 1,00

Given a formula $F = (b \vee a) \vee \neg b$, which of the following is true?

- ☐ a. F is satisfiable but not valid
- ☒ b. F is valid ✓
- ☐ c. F is unsatisfiable

Frage 3

Richtig

Erreichte Punkte 1,00 von 1,00

Let A be the formula $(\neg a \rightarrow \neg b) \wedge (c \wedge d)$. What is the subformula of A at position 2?

- ☐ a. b
- ☐ b. c
- ☐ c. d
- ☐ d. $(\neg a \rightarrow \neg b) \wedge (c \wedge d)$
- ☐ e. a
- ☒ f. $c \wedge d$ ✓
- ☐ g. $\neg a \rightarrow \neg b$

Frage 4

Richtig

Erreichte Punkte 1,00 von 1,00

Given the CNF $F = (a \vee \neg b \vee \neg c \vee \neg d \vee e) \wedge (\neg b \vee \neg c \vee d) \wedge (b \vee c \vee \neg e) \wedge (b \vee \neg c) \wedge (d)$, what is the result from applying unit literal propagation on F until unit propagation can no longer be applied?

*You answer should be written as a sequence of clauses separated by a ";". The clauses are written between parentheses and each literal is separated by a coma and ordered **alphabetically**. A literal is preceded by "-" if it is negative. For example, the CNF $(\neg a \vee b) \wedge (d \vee c)$ can be written as " $(-a,b);(c,d)$ " or " $(c,d);(-a,b)$ ".*

Note that you should keep the unit clauses in the set.

If the CNF can be concluded unsatisfiable with unit propagation, enter ";" instead.

The input formula can be written as " $(a,-b,-c,-d,e);(-b,-c,d);(b,c,-e);(b,-c);(d)$ "

Antwort: ✓

Frage 5

Richtig

Erreichte Punkte 1,00 von 1,00

Let A be the formula $\neg(\neg a \rightarrow b) \vee (\neg c \wedge \neg d)$. Let I be an interpretation such that $I \models \neg c$. Which of the following statements hold?

- ☐ a. $I \models A \leftrightarrow (a \rightarrow b)$
- ☒ b. $I \models A \leftrightarrow (\neg(\neg a \rightarrow b) \vee \neg d)$ ✓
- ☐ c. $I \models A \leftrightarrow ((\neg a \rightarrow b) \vee \neg d)$
- ☐ d. $I \models A \leftrightarrow ((a \rightarrow b) \vee \neg d)$
- ☐ e. $I \models A \leftrightarrow (\neg(\neg a \rightarrow b) \vee d)$

Frage 6

Richtig

Erreichte Punkte 1,00 von 1,00

Let A be the formula $\neg(\neg(a \rightarrow e) \rightarrow \neg b) \wedge (c \wedge \neg d)$. What is the polarity of the subformula at position 1?

- ☒ a. 1 ✓
- ☐ b. 0
- ☐ c. -1

Frage 7

Richtig

Erreichte Punkte 1,00 von 1,00

Let S be the CNF formula $(a \vee b) \wedge (\neg b) \wedge (\neg a \vee \neg b \vee \neg c) \wedge (\neg a \vee c) \wedge (\neg a \vee \neg c \vee d) \wedge (\neg c)$. Which of the following holds?

- ☐ a. Unit propagation can be used within S , but the satisfiability of S cannot be determined using only unit propagation
- ☒ b. Using only unit propagation exhaustively can determine that S is unsatisfiable ✓
- ☐ c. Using only unit propagation exhaustively can determine that S is satisfiable
- ☐ d. Unit propagation cannot be used within S

Frage 8

Richtig

Erreichte Punkte 1,00 von 1,00

Let F be the propositional formula $\neg((a \vee b) \wedge \neg c) \wedge (\neg c \vee a)$. Which of the following is obtained from using only one iteration the pure atom simplification?

In other words, identify all the pure atoms in F , then simplify the formula accordingly. The obtained formula is the solution, regardless of whether it has pure atoms or not.

- ☒ a. $\neg(a \wedge \neg c) \wedge (\neg c \vee a)$ ✓
- ☐ b. $\perp$
- ☐ c. c
- ☐ d. $\neg c$
- ☐ e. a
- ☐ f. $\neg a$

Frage 9

Richtig

Erreichte Punkte 1,00 von 1,00

Let S be the set of formulas $(r) \wedge (p \vee \neg q \vee \neg r) \wedge (\neg p \vee q \vee \neg r)$. Which of the following holds?

- ☐ a. Satisfiability of S can be determined using only unit propagation
- ☐ b. Unit propagation cannot be used within S
- ☒ c. Satisfiability of S cannot be determined using only unit propagation ✓

Frage 10

Falsch

Erreichte Punkte 0,00 von 1,00

Consider the formula $(a \wedge \neg b) \rightarrow \neg c$. Derive its clausal normal form using the optimized definitional clause form transformation, taking into account the polarity of its subformulas.

For this transformation consider the following constraints:

- do not introduce names for literals
- for introducing names, use the following approach to select the subformulas: *Start with the rightmost node in the tree. Then move to its left sibling, followed by their parent. From there, go to the rightmost descendant of the parent's sibling, and repeat this process until reaching the root.* For the formula $(a \vee d) \rightarrow (b \vee c)$, you would visit the tree in the following order: $c, b, b \vee c, a, d, a \vee d, (a \vee d) \rightarrow (b \vee c)$.
- use as names propositional variables of the form n_i with $i=0,1,\dots$
- the result should only contain clauses (the order of the clauses does not matter)
- the literals inside the clauses should be ordered alphabetically according to the corresponding propositional variables

Example: For the formula $a \rightarrow (b \vee c)$, your answer should look as follows: $(b,c,-n_0);(-a,n_0,-n_1);(n_1)$

Antwort:

