Der DPLL Algorithmus

Christoph Benzmüller
Freie Universität Berlin

Adressierte Themen:

- Wissensrepräsentation und Schließen
- Propositionale Logik und SAT Solving
- Davis-Putnam-Logemann-Loveland (DPLL) Algorithmus

Beispiel einer Erfolgsgeschichte

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Evelyn Lamb

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$n = 10$

$$3^2 + 4^2 = 5^2$$

(wähle die Farbe der anderen Zahlen beliebig)

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Verboten: nur eine Farbe!

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$n = 20$

$$3^2 + 4^2 = 5^2$$
$$5^2 + 12^2 = 13^2$$
$$8^2 + 15^2 = 17^2$$

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$n = 30$

$$3^2 + 4^2 = 5^2$$
$$5^2 + 12^2 = 13^2$$
$$8^2 + 15^2 = 17^2$$
$$7^2 + 24^2 = 25^2$$

(choose color of the other numbers arbitrarily)

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$n = 40$

$$3^2 + 4^2 = 5^2$$

$$5^2 + \boxed{12}^2 = 13^2$$

$$8^2 + 15^2 = 17^2$$

$$7^2 + 24^2 = 25^2$$

$$20^2 + 21^2 = 29^2$$

$$\boxed{12}^2 + 35^2 = 37^2$$

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(wähle die Farbe der anderen Zahlen beliebig)

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Shown by SAT-Solver:

For $n \geq 7825$ consistent bi-coloring becomes impossible.

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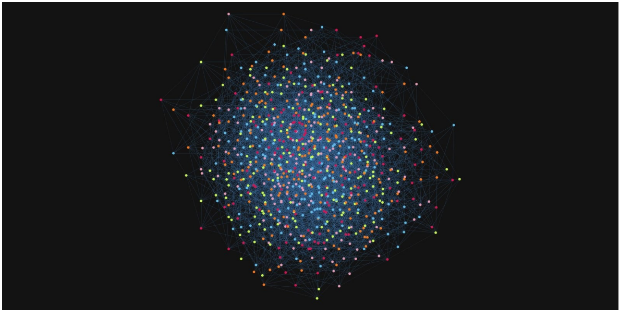
The Science of Brute Force, M.J.H. Heule, O. Kullmann, Communications of the ACM, Vol. 60 No. 8, Pages 70-79, 2017, DOI:10.1145/3107239

`https://cacm.acm.org/magazines/2017/8/219606-the-science-of-brute-force/fulltext`

Latest Results from just a Week Ago

EVELYN LAMB SCIENCE 04.30.18 09:00 AM

AN ANTI-AGING PUNDIT SOLVES A DECADES-OLD MATH PROBLEM



This 826-vertex graph requires at least five colors to ensure that no two connected vertices are the same shade. (Click here for a high-resolution version.)

OLENA SHMAHALO/QUANTA MAGAZINE; SOURCE: MARIJN HEULE

DPLL — Motivation, Grundlage, Notation

Übergeordnetes Thema: Erfüllbarkeitsproblem (SAT) der Aussagenlogik

- **P vs. NP** (1 Million Dollar Frage, Clay Mathematics Institute)
- **SAT** ist **NP-vollständig**
- **SAT-Solver** trotzdem sehr erfolgreich in der Praxis

Fokus der Vorlesung: DPLL-Algorithmus

- Intelligente Tiefensuche (Backtracking)
- Literatur
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DPLL — Motivation, Grundlage, Notation

Syntax Aussagenlogik

$$s, t ::= \top \mid \bot \mid A \mid \neg s \mid s \vee t \mid s \wedge t \mid s \rightarrow t \mid s \leftrightarrow t$$

Semantik Aussagenlogik: Abbildung nach T(rue) oder F(alse)

s	t	$\top$	$\bot$	$\neg s$	$s \vee t$	$s \wedge t$	$s \rightarrow t$	$s \leftrightarrow t$
T	T	T	F	F	T	T	T	T
T	F	T	F	F	T	F	F	F
F	T	T	F	T	T	F	T	F
F	F	T	F	T	F	F	T	T

Klauselnormalform bzw. Konjunktive Normalform (CNF)

Beispielformel: $(A \wedge \neg B) \leftrightarrow (A \vee B)$

Beispielformel in CNF: $(A \vee \neg B) \wedge (\neg A \vee \neg B) \wedge \neg B$

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Notation: Konjunktion von Klausel, Klauseln, Literale

CNF $(A \vee \neg B) \wedge (\neg A \vee \neg B) \wedge \neg B$

Notation für Klauseln $A\bar{B} \wedge \bar{A}\bar{B} \wedge \bar{B}$

Notation für Klausel-Listen $A\bar{B}, \bar{A}\bar{B}, \bar{B}$

Annahme (für Rest der Vorlesung)

Darstellung von Klauseln und Klausel-Listen: **Kommutativ und Assoziativ**

Belegungen $[\psi]$ **am Beispiel:**

$[A\bar{B}]$ repräsentiert die **Belegung** $\{A \longrightarrow \mathsf{T}, B \longrightarrow \mathsf{F}\}$

$[\bar{B}]$ ist eine **partielle Belegung** für $A\bar{B}, \bar{A}\bar{B}, \bar{B}$

$[\psi] \models s$ ist **Notation** für: Belegung $[\psi]$ erfüllt Formel s

$[\psi]$ wird dann auch als **Modell für** s bezeichnet

Regelsysteme/Transitionssysteme

Grundkenntnisse werden vorausgesetzt

Notation: Konjunktion von Klausel, Klauseln, Literale

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DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabeformel	(CNF & Initialisierung)
[]	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Schritt 1)
	...	(Schritt 2)
	...	
	...	(Schritt n)
$[\bar{B}C]$	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Solved)

Kriterium für "Solved"?

$[\bar{B}C] \quad \underbrace{A\bar{B}C}_{\checkmark}, \underbrace{\bar{B}}_{\checkmark}, \underbrace{C\bar{D}}_{\checkmark}, \underbrace{BCD}_{\checkmark}$ —alle Klauseln sind erfüllt—

(es gilt dann: $[\bar{B}C] \models$ Eingabeformel)

Solved-Regel

$[\psi] \quad \phi$ (Solved)

Bedingung: $[\psi] \models \phi$

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$[]$	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Schritt 1)
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	$\ldots$	(Schritt n)
$[\bar{B}C]$	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Solved)

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	...	
	...	(Schritt n)
$[\bar{B}C]$	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Solved)

Kriterium für "Solved"?

$[\bar{B}C] \quad \underbrace{A\bar{B}C}_{\checkmark}, \underbrace{\bar{B}}_{\checkmark}, \underbrace{C\bar{D}}_{\checkmark}, \underbrace{BCD}_{\checkmark}$ —alle Klauseln sind erfüllt—

(es gilt dann: $[\bar{B}C] \models$ Eingabeformel)

Solved-Regel

$[\psi] \quad \phi$ (Solved)

Bedingung: $[\psi] \models \phi$

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabeformel	(CNF & Initialisierung)
[]	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Schritt 1)
	$\ldots$	(Schritt 2)
	$\ldots$	
	$\ldots$	(Schritt n)
$[\bar{B}C]$	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Solved)

Kriterium für "Solved"?

$$[\bar{B}C] \quad \underbrace{A\bar{B}C}_{\checkmark}, \underbrace{\bar{B}}_{\checkmark}, \underbrace{C\bar{D}}_{\checkmark}, \underbrace{BCD}_{\checkmark}$$ —alle Klauseln sind erfüllt—

(es gilt dann: $[\bar{B}C] \models$ Eingabeformel)

Solved-Regel

$[\psi] \quad \phi \qquad$ (Solved)

Bedingung: $[\psi] \models \phi$

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabeformel	(CNF & Initialisierung)
[]	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Schritt 1)
	...	(Schritt 2)
	...	
	...	(Schritt n)
$[\bar{B}C]$	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Solved)

Kriterium für "Solved"?

$[\bar{B}C] \quad \underbrace{A\bar{B}C}_{\checkmark}, \underbrace{\bar{B}}_{\checkmark}, \underbrace{C\bar{D}}_{\checkmark}, \underbrace{BCD}_{\checkmark}$ —alle Klauseln sind erfüllt—

(es gilt dann: $[\bar{B}C] \models$ Eingabeformel)

Solved-Regel

$[\psi] \quad \phi$ (Solved)

Bedingung: $[\psi] \models \phi$

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabeformel	(CNF & Initialisierung)
[]	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Schritt 1)
	...	(Schritt 2)
	...	
	...	(Schritt n)
$[\bar{B}C]$	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Solved)

Kriterium für "Solved"?

$[\bar{B}C] \quad \underbrace{A\bar{B}C}_{\checkmark}, \underbrace{\bar{B}}_{\checkmark}, \underbrace{C\bar{D}}_{\checkmark}, \underbrace{BCD}_{\checkmark}$ —alle Klauseln sind erfüllt—

(es gilt dann: $[\bar{B}C] \models$ Eingabeformel)

Solved-Regel

$[\psi] \quad \phi$ (Solved)

Bedingung: $[\psi] \models \phi$

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabeformel	(CNF & Initialisierung)
[]	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Schritt 1)
	...	(Schritt 2)
	...	
	...	(Schritt n)
$[\bar{B}C]$	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Solved)

Kriterium für "Solved"?

$[\bar{B}C] \quad \underbrace{A\bar{B}C}_{\checkmark}, \underbrace{\bar{B}}_{\checkmark}, \underbrace{C\bar{D}}_{\checkmark}, \underbrace{BCD}_{\checkmark}$ —alle Klauseln sind erfüllt—

(es gilt dann: $[\bar{B}C] \models$ Eingabeformel)

Solved-Regel

$[\psi] \quad \phi$ (Solved)

Bedingung: $[\psi] \models \phi$

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabeformel	(CNF & Initialisierung)
[]	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Schritt 1)
	...	(Schritt 2)
	...	
	...	(Schritt n)
$[\bar{B}C]$	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Solved)

Kriterium für "Solved"?

$[\bar{B}C] \quad \underbrace{A\bar{B}C}_{\checkmark}, \underbrace{\bar{B}}_{\checkmark}, \underbrace{C\bar{D}}_{\checkmark}, \underbrace{BCD}_{\checkmark}$ —alle Klauseln sind erfüllt—

(es gilt dann: $[\bar{B}C] \models$ Eingabeformel)

Solved-Regel

$[\psi] \quad \phi$ (Solved)

Bedingung: $[\psi] \models \phi$

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabeformel	(CNF & Initialisierung)
[]	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Schritt 1)
	...	(Schritt 2)
	...	
	...	(Schritt n)
$[\bar{B}C]$	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Solved)

Kriterium für "Solved"?

$[\bar{B}C]$ $\underbrace{A\bar{B}C}_{\checkmark}, \underbrace{\bar{B}}_{\checkmark}, \underbrace{C\bar{D}}_{\checkmark}, \underbrace{BCD}_{\checkmark}$ —alle Klauseln sind erfüllt—

(es gilt dann: $[\bar{B}C] \models$ Eingabeformel)

Solved-Regel

$[\psi]$ ϕ (Solved)

Bedingung: $[\psi] \models \phi$

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabeformel	(CNF & Initialisierung)
[]	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Schritt 1)
	...	(Schritt 2)
	...	
	...	(Schritt n)
$[\bar{B}C]$	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Solved)

Kriterium für "Solved"?

$[\bar{B}C] \quad \underbrace{A\bar{B}C}_{\checkmark}, \underbrace{\bar{B}}_{\checkmark}, \underbrace{C\bar{D}}_{\checkmark}, \underbrace{BCD}_{\checkmark}$ —alle Klauseln sind erfüllt—

(es gilt dann: $[\bar{B}C] \models$ Eingabeformel)

Solved-Regel

$[\psi] \quad \phi$ (Solved)

Bedingung: $[\psi] \models \phi$

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabeformel	(CNF & Initialisierung)
[]	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Schritt 1)
	...	(Schritt 2)
	...	
	...	(Schritt n)
$[\bar{B}C]$	$A\bar{B}C, \bar{B}, C\bar{D}, BCD$	(Solved)

Kriterium für "Solved"?

$[\bar{B}C] \quad \underbrace{A\bar{B}C}_{\checkmark}, \underbrace{\bar{B}}_{\checkmark}, \underbrace{C\bar{D}}_{\checkmark}, \underbrace{BCD}_{\checkmark}$ —alle Klauseln sind erfüllt—

(es gilt dann: $[\bar{B}C] \models$ Eingabeformel)

Solved-Regel

$[\psi] \quad \phi$ (Solved)

Bedingung: $[\psi] \models \phi$

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
[]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
[$\bar{B}$]	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
[$\bar{B}\bar{D}$]	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
[$\bar{B}\bar{D}C_b$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
[$\bar{B}\bar{D}C_bF_b$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
[$\bar{B}\bar{D}C_bF_bG$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
[$\bar{B}\bar{D}C_b\bar{F}$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
[$\bar{B}\bar{D}C_b\bar{F}G$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
[]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

Unit-Propagation-Regel:

$[\psi]$ $\quad \phi, \varphi L$ $\quad$ (Unit-Propagation)

Bedingung:

$\downarrow$

$[\psi] \models \neg\varphi$

$L \notin [\psi]$

$[\psi L]$ $\quad \phi, \varphi L$ $\quad$ **Verarbeite neue Belegungsinformation**

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
[]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
[$\bar{B}$]	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
[$\bar{B}\bar{D}$]	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
[$\bar{B}\bar{D}C_b$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
[$\bar{B}\bar{D}C_bF_b$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
[$\bar{B}\bar{D}C_bF_bG$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
[$\bar{B}\bar{D}C_b\bar{F}$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
[$\bar{B}\bar{D}C_b\bar{F}G$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
[]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

Pure-Literal-Regel

$[\psi]$ $\quad \phi, \varphi L$ $\quad$ (Pure-Literal)

Bedingung:

$\downarrow$

L nur mit einheitlicher Polarität in $\phi, \varphi L$

L undefiniert in $[\psi]$

$[\psi L]$ $\quad \phi, \varphi L$ $\quad$ **Verarbeite neue Belegungsinformation**

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

Split-Regel:

$[\psi]$ $\quad \phi$ $\quad$ (Split)

Bedingung:

$\downarrow$

L und $\bar{L}$ kommen in ϕ vor

L undefiniert in $[\psi]$

$[\psi L_b]$ $\quad \phi$ $\quad$ **Verarbeite neue Belegungsinformation**

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
[]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
[$\bar{B}$]	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
[$\bar{B}\bar{D}$]	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
[$\bar{B}\bar{D}C_b$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
[$\bar{B}\bar{D}C_bF_b$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
[$\bar{B}\bar{D}C_bF_bG$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
[$\bar{B}\bar{D}C_b\bar{F}$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
[$\bar{B}\bar{D}C_b\bar{F}G$]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
[]	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
~~$[\bar{B}\bar{D}C_bF_b]$~~	~~$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$~~	~~(Unit-Propagation)~~
~~$[\bar{B}\bar{D}C_bF_bG]$~~	~~$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$~~	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

Backtrack Rule:

$[\psi L_b \psi']$	ϕ, φ	(Backtrack)
		Bedingung:
	$\downarrow$	$[\psi L_b \psi'] \models \neg\varphi$
		ψ' enhält keine mit “b” markierten Literale
$[\psi \bar{L}]$	ϕ, φ	**Verarbeite neue Belegungsinformation**

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

Solved-Regel

$[\psi] \quad \phi$ (Solved)

Bedingung: $[\psi] \models \phi$

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

Fail-Regel:

$[\psi]$ $\quad \phi, \varphi$ $\qquad$ (Split)

Bedingung:

$\downarrow$

$[\psi] \models \neg\varphi$

ψ enhält keine Backtrack-Literale

$[]$ $\quad$ **Fail**

DPLL-Algorithmus — Entwicklung am Beispiel

	Eingabe-Formel	(CNF & Initialisierung)
$[]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Pure-Literal)
$[\bar{B}\bar{D}]$	$A\bar{B}, \bar{B}, \cancel{B}CF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}FG, \cancel{\bar{C}}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Split)
$[\bar{B}\bar{D}C_bF_b]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \cancel{\bar{C}}\cancel{\bar{F}}G, \bar{D}E, \cancel{\bar{F}}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_bF_bG]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \cancel{\bar{F}}\cancel{\bar{G}}$	(Backtrack)
$[\bar{B}\bar{D}C_b\bar{F}]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \cancel{\bar{C}}\cancel{F}G, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Unit-Propagation)
$[\bar{B}\bar{D}C_b\bar{F}G]$	$A\bar{B}, \bar{B}, BCF, C\bar{G}F, \bar{C}FG, \bar{C}\bar{F}G, \bar{D}E, \bar{F}\bar{G}$	(Solved)

Abstrakter DPLL Algorithmus (Regelbasierte Darstellung)

Wende die Regeln erschöpfend an mit folgender Priorität:

1. Solved
2. Fail
3. Backtrack
4. Unit-Propagation
5. Pure-Literal
6. Split

DPLL Algorithmus am Beispiel — Kurzes Beispiel, alle Regeln

[]	an , ãn , ãñ , bn	(Pure Literal)
[b]	an , ãn , ãñ , bn	(Split)
~~[b**a**]~~	~~an , ãn , ãñ , bn~~	~~(Unit Propagation)~~
~~[b**a**n]~~	~~an , ãn , ãñ , bn~~	~~(Widerspruch: n&ñ, Backtracking)~~
[b**ã**]	an , ãn , ãñ , bn	(Unit Propagation)
[b**ã**n]	an , ãn , ãñ , bn	(Solved)

Möglichkeiten zur weiteren Verbesserung bzw. Optimierung

- Heuristiken für Split: z.B. wähle das am häufigsten vorkommende Literal (Vorheriges Beispiel: wähle F zuerst – diese Wahl verhindert Backtracking und generiert eine alternative Belegung (Übungsaufgabe))
- Nicht-chronologisches Backtracking
- Klausel-Lernen beim Backtracking
- Effiziente Datenstrukturen
- Indexing-Techniken, Watchlist
- . . .

Korrektheit und Vollständigkeit: für abstraktes System in Vorlesung

Systeme (z.B. zChaff, MiniSat, PicoSat, Limmat, Lingeling)

Anwendungsbeispiele

Satisfiability modulo Theories