

A toy backtracking algorithm for SAT: an example

Here we denote variables by numbers and negation by overlining.

The model stack (the partial interpretation being explored) grows to the right.

Five clauses:

A toy backtracking algorithm for SAT: an example

Here we denote variables by numbers and negation by overlining.

The model stack (the partial interpretation being explored) grows to the right.

Five clauses:

$$\overline{1} \vee 2, \overline{3} \vee 4, \overline{4} \vee \overline{2} \vee \overline{1} \vee \overline{7}, \overline{5} \vee \overline{6}, 6 \vee \overline{5} \vee \overline{2}$$

A toy backtracking algorithm for SAT: an example

Here we denote variables by numbers and negation by overlining.

The model stack (the partial interpretation being explored) grows to the right.

Model Stack: **Five clauses:**

$\overline{1} \vee 2, \overline{3} \vee 4, \overline{4} \vee \overline{2} \vee \overline{1} \vee \overline{7}, \overline{5} \vee \overline{6}, 6 \vee \overline{5} \vee \overline{2} \Rightarrow (\text{Decide})$

1

$\overline{1} \vee 2, \overline{3} \vee 4, \overline{4} \vee \overline{2} \vee \overline{1} \vee \overline{7}, \overline{5} \vee \overline{6}, 6 \vee \overline{5} \vee \overline{2} \Rightarrow$

A toy backtracking algorithm for SAT: an example

Here we denote variables by numbers and negation by overlining.

The model stack (the partial interpretation being explored) grows to the right.

Model Stack: **Five clauses:**

	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	

A toy backtracking algorithm for SAT: an example

Here we denote variables by numbers and negation by overlining.

The model stack (the partial interpretation being explored) grows to the right.

Model Stack: **Five clauses:**

	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	

A toy backtracking algorithm for SAT: an example

Here we denote variables by numbers and negation by overlining.

The model stack (the partial interpretation being explored) grows to the right.

Model Stack: **Five clauses:**

	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	

A toy backtracking algorithm for SAT: an example

Here we denote variables by numbers and negation by overlining.

The model stack (the partial interpretation being explored) grows to the right.

Model Stack: **Five clauses:**

	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4 $\bar{7}$	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	

A toy backtracking algorithm for SAT: an example

Here we denote variables by numbers and negation by overlining.

The model stack (the partial interpretation being explored) grows to the right.

Model Stack: **Five clauses:**

	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4 $\bar{7}$	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3 4 $\bar{7}$ 5	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	

A toy backtracking algorithm for SAT: an example

Here we denote variables by numbers and negation by overlining.

The model stack (the partial interpretation being explored) grows to the right.

Model Stack: **Five clauses:**

	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4 $\bar{7}$	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3 4 $\bar{7}$ 5	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4 $\bar{7}$ 5 $\bar{6}$	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$		CONFLICT!

A toy backtracking algorithm for SAT: an example

Here we denote variables by numbers and negation by overlining.

The model stack (the partial interpretation being explored) grows to the right.

Model Stack: **Five clauses:**

	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4 $\bar{7}$	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3 4 $\bar{7}$ 5	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4 $\bar{7}$ 5 $\bar{6}$	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Backtrack)

A toy backtracking algorithm for SAT: an example

Here we denote variables by numbers and negation by overlining.

The model stack (the partial interpretation being explored) grows to the right.

Model Stack: **Five clauses:**

	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4 $\bar{7}$	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3 4 $\bar{7}$ 5	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4 $\bar{7}$ 5 $\bar{6}$	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Backtrack)
1 2 3 4 $\bar{7}$ 5	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$		

A toy backtracking algorithm for SAT: an example

Here we denote variables by numbers and negation by overlining.

The model stack (the partial interpretation being explored) grows to the right.

Model Stack: **Five clauses:**

	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4 $\bar{7}$	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3 4 $\bar{7}$ 5	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4 $\bar{7}$ 5 $\bar{6}$	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Backtrack)
1 2 3 4 $\bar{7}$ 5	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)

A toy backtracking algorithm for SAT: an example

Here we denote variables by numbers and negation by overlining.

The model stack (the partial interpretation being explored) grows to the right.

Model Stack: **Five clauses:**

	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4 $\bar{7}$	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3 4 $\bar{7}$ 5	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(UnitPropagate)
1 2 3 4 $\bar{7}$ 5 $\bar{6}$	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Backtrack)
1 2 3 4 $\bar{7}$ 5	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$	\Rightarrow	(Decide)
1 2 3 4 $\bar{7}$ 5 6	$\bar{1} \vee 2, \bar{3} \vee 4, \bar{4} \vee \bar{2} \vee \bar{1} \vee \bar{7}, \bar{5} \vee \bar{6}, 6 \vee \bar{5} \vee \bar{2}$		solution found!