Let’s illustrate this with an example:

\[
(2 \ 3 \ 1 \ 4 \ 5) \\
(1 \ 2 \ -3) \\
(1 \ -2) \\
(-1 \ 4) \\
(-1)
\]
BCP Algorithm (2.1/8)

- Let’s illustrate this with an example:

```
\begin{array}{cccc}
2 & 3 & 1 & 4 & 5 \\
1 & 2 & -3 \\
1 & -2 \\
1 & 4 \\
-1 \\
\end{array}
```

- Conceptually, we identify the first two literals in each clause as the watched ones.
Let's illustrate this with an example:

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Changing which literals are watched is represented by reordering the literals in the clause (which comes into play later).
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Changing which literals are watched is represented by reordering the literals in the clause (which comes into play later).

Clauses of size one are a special case.
We begin by processing the assignment \( v1 = F \) (which is implied by the size one clause)

\[
\begin{pmatrix}
2 & 3 & 1 & 4 & 5 \\
1 & 2 & -3 \\
1 & -2 \\
-1 & 4
\end{pmatrix}
\]

State: \( (v1=F) \)
Pending:
We begin by processing the assignment $v_1 = F$ (which is implied by the size one clause)

To maintain our invariants, we must examine each clause where the assignment being processed has set a watched literal to $F$. 

\[
\begin{align*}
\text{State:} & (v_1=F) \quad \rightarrow \quad (1 \quad 2 \quad -3) \\
\text{Pending:} & \quad \rightarrow \quad (1 \quad -2) \\
& \quad \rightarrow \quad (-1 \quad 4)
\end{align*}
\]
BCP Algorithm (3.2/8)

- We begin by processing the assignment $v1 = F$ (which is implied by the size one clause)

$$(2, 3, 1, 4, 5)$$

State: $(v1=F)$

Pending: $$(1, 2, -3)$$ $$(1, -2)$$ $$(1, 4)$$

- To maintain our invariants, we must examine each clause where the assignment being processed has set a watched literal to $F$.
- We need not process clauses where a watched literal has been set to $T$, because the clause is now satisfied and so cannot become implied.
We begin by processing the assignment \( v_1 = F \) (which is implied by the size one clause):

\[
\begin{pmatrix}
2 & 3 & 1 & 4 & 5 \\
1 & 2 & -3 \\
1 & -2 \\
-1 & 4
\end{pmatrix}
\]

To maintain our invariants, we must examine each clause where the assignment being processed has set a watched literal to \( F \).

We need not process clauses where a watched literal has been set to \( T \), because the clause is now satisfied and so can not become implied.

We *certainly* need not process any clauses where neither watched literal changes state (in this example, where \( v_1 \) is not watched).
Now let’s actually process the second and third clauses:

\[
\begin{pmatrix}
2 & 3 & 1 & 4 & 5 \\
1 & 2 & -3 \\
1 & -2 \\
-1 & 4
\end{pmatrix}
\]

State: (v1=F)
Pending:
Now let’s actually process the second and third clauses:

State: (v1=F)
Pending:

For the second clause, we replace v1 with ¬v3 as a new watched literal. Since ¬v3 is not assigned to F, this maintains our invariants.
Now let’s actually process the second and third clauses:

For the second clause, we replace \( v_1 \) with \( \neg v_3 \) as a new watched literal. Since \( \neg v_3 \) is not assigned to \( F \), this maintains our invariants.

The third clause is implied. We record the new implication of \( \neg v_2 \), and add it to the queue of assignments to process. Since the clause cannot again become newly implied, our invariants are maintained.
Next, we process \( \neg v_2 \). We only examine the first 2 clauses.

\[
\begin{align*}
(2 & 3 & 1 & 4 & 5) \\
(-3 & 2 & 1) \\
(1 & -2) \\
(-1 & 4)
\end{align*}
\]

For the first clause, we replace \( v_2 \) with \( v_4 \) as a new watched literal. Since \( v_4 \) is not assigned to \( F \), this maintains our invariants.

The second clause is implied. We record the new implication of \( v_3 \), and add it to the queue of assignments to process. Since the clause cannot again become newly implied, our invariants are maintained.
Next, we process $\neg v_3$. We only examine the first clause.

For the first clause, we replace $v_3$ with $v_5$ as a new watched literal. Since $v_5$ is not assigned to $F$, this maintains our invariants.

Since there are no pending assignments, and no conflict, BCP terminates and we make a decision. Both $v_4$ and $v_5$ are unassigned. Let’s say we decide to assign $v_4=T$ and proceed.

Lintao Zhang
Next, we process v4. We do nothing at all.

Since there are no pending assignments, and no conflict, BCP terminates and we make a decision. Only v5 is unassigned. Let’s say we decide to assign v5=F and proceed.
Next, we process v5=F. We examine the first clause.

\[
\begin{align*}
(1 & 2 & 3) \\
(-3 & 1) \\
(1 & -2) \\
(-1 & 4)
\end{align*}
\]

The first clause is implied. However, the implication is v4=T, which is a duplicate (since v4=T already) so we ignore it.

Since there are no pending assignments, and no conflict, BCP terminates and we make a decision. No variables are unassigned, so the problem is sat, and we are done.

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