Satisfiability Checking SAT-Solving Example I

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SMT-solving example

- We use enumeration and propagation in DPLL-style for the search, and CDCL-style conflict resolution for backtracking.
- We use watched literals to speed up propagation.
- We use VSIDS as variable ordering heuristics and assign the value false to decision variables.
- In VSIDS, to order variables with the same activity value, we use the lexicographic order; in our example this will be $x_1 < x_2 < x_3 < x_4$.

$$c_1: \left(\underline{x_1} \vee \underline{x_2} \vee x_4\right) \wedge c_2: \left(\underline{x_2} \vee \underline{\neg x_4}\right) \wedge c_3: \left(\underline{x_1} \vee \underline{\neg x_2} \vee x_4\right) \wedge c_4: \left(\underline{x_3} \vee \underline{\neg x_4}\right)$$

```
Watch lists: x_1: c_1, c_3 \neg x_1: x_2: c_1, c_2 \neg x_2: c_3 x_3: c_4 \neg x_3: x_4:
```

 $\neg x_4$: c_2, c_4

```
Activities Trail: (increment=1):  x_1 \quad 0 \\ x_2 \quad 0 \\ x_3 \quad 0 \\ x_4 \quad 0
```

Decide $\neg x_1$

$$c_1: (\underline{x_1} \vee \underline{x_2} \vee x_4) \wedge c_2: (\underline{x_2} \vee \underline{\neg x_4}) \wedge c_3: (\underline{x_1} \vee \underline{\neg x_2} \vee x_4) \wedge c_4: (\underline{x_3} \vee \underline{\neg x_4})$$

```
Watch lists: Acc (in x_1: c_1, c_3 \neg x_1: x_2: c_1, c_2 \neg x_2: c_3 x_3: c_4 \neg x_3: x_4: \neg x_4: c_2, c_4
```

```
Activities Trail: (increment=1): DL1: \neg x_1 : \text{NULL}
\begin{array}{ccc} x_1 & 0 \\ x_2 & 0 \\ x_3 & 0 \\ x_4 & 0 \end{array}
```

$$c_1: \left(\underline{x_1} \vee \underline{x_2} \vee x_4\right) \wedge c_2: \left(\underline{x_2} \vee \underline{\neg x_4}\right) \wedge c_3: \left(\underline{x_1} \vee \underline{\neg x_2} \vee x_4\right) \wedge c_4: \left(\underline{x_3} \vee \underline{\neg x_4}\right)$$

```
Watch lists: x_1 : c_1, c_3 \neg x_1 : x_2 : c_1, c_2 \neg x_2 : c_3 x_3 : c_4 \neg x_3 : x_4 : \neg x_4 : c_2, c_4
```

Propagate $\neg x_1$ in

```
Activities Trail: (increment=1): DL1: \neg x_1 : NULL \begin{array}{ccc} x_1 & 0 \\ x_2 & 0 \\ x_3 & 0 \\ x_4 & 0 \end{array}
```

$$c_1: \left(\underline{x_1} \vee \underline{x_2} \vee x_4\right) \wedge c_2: \left(\underline{x_2} \vee \underline{\neg x_4}\right) \wedge c_3: \left(\underline{x_1} \vee \underline{\neg x_2} \vee x_4\right) \wedge c_4: \left(\underline{x_3} \vee \underline{\neg x_4}\right)$$

```
Watch lists:
                                    Activities
                                                        Trail:
                                    (increment=1):
                                                              DL1: \neg x_1: NULL
        x_1: c_1, c_3
       \neg x_1:
                                           x_1 0
        x_2: c_1, c_2
                                          x_2 0
      \neg x_2: c_3
                                          x_3 0
       X_3: C_4
                                           XΔ
                                               0
      \neg x_3:
        X_4:
      \neg x_4: c_2, c_4
 Propagate \neg x_1 in c_1:(x_1 \lor x_2 \lor x_4)
```

$$c_1: \left(x_1 \vee \underline{x_2} \vee \underline{x_4}\right) \wedge c_2: \left(\underline{x_2} \vee \underline{\neg x_4}\right) \wedge c_3: \left(\underline{x_1} \vee \underline{\neg x_2} \vee x_4\right) \wedge c_4: \left(\underline{x_3} \vee \underline{\neg x_4}\right)$$

```
Watch lists:
                                                                  Trail:
                                          Activities
                                          (increment=1):
                                                                        DL1: \neg x_1: NULL
         x_1: \mathcal{C}_1, \mathcal{C}_3
        \neg x_1:
                                                  x_1 0
         x_2: c_1, c_2
                                                  x_2 0
        \neg x_2: c_3
                                                  x_3 0
        X_3: C_4
                                                  x<sub>4</sub> 0
        \neg x_3:
         X_4: C_1
        \neg x_4: c_2, c_4
 Propagate \neg x_1 in c_1: (x_1 \lor x_2 \lor x_4) \rightarrow (x_1 \lor x_2 \lor x_4)
```

$$c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{\neg x_4}) \wedge c_3: (\underline{x_1} \vee \underline{\neg x_2} \vee x_4) \wedge c_4: (\underline{x_3} \vee \underline{\neg x_4})$$

```
Watch lists:
                                                              Trail:
                                       Activities
                                       (increment=1):
                                                                    DL1: \neg x_1: NULL
         x_1: \mathcal{S}_1, \mathcal{C}_3
       \neg x_1:
                                               x_1 0
         x_2: c_1, c_2
                                               x_2 0
       \neg x_2: c_3
                                               x_3 0
        X_3: C_4
                                               x_4 0
       \neg x_3:
         X_4: C_1
       \neg x_4: c_2, c_4
 Propagate \neg x_1 in c_3: (x_1 \vee \neg x_2 \vee x_4)
```

$$c_1: \left(x_1 \vee \underline{x_2} \vee \underline{x_4}\right) \wedge c_2: \left(\underline{x_2} \vee \underline{\neg x_4}\right) \wedge c_3: \left(x_1 \vee \underline{\neg x_2} \vee \underline{x_4}\right) \wedge c_4: \left(\underline{x_3} \vee \underline{\neg x_4}\right)$$

```
Watch lists:
                                                                      Trail:
                                             Activities
                                             (increment=1):
                                                                            DL1: \neg x_1: NULL
          x_1: \mathcal{S}_1, \mathcal{S}_3
        \neg x_1:
                                                     x_1 0
          x_2: c_1, c_2
                                                     x_2 0
        \neg x_2: c_3
                                                     x<sub>3</sub> 0
         X_3: C_4
                                                     x<sub>4</sub> 0
        \neg x_3:
          x_4: c_1, c_3
        \neg x_4: c_2, c_4
 Propagate \neg x_1 in c_3: (x_1 \vee \neg x_2 \vee x_4) \rightarrow (x_1 \vee \neg x_2 \vee x_4)
```

Decide $\neg x_2$

$$c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{\neg x_4}) \wedge c_3: (x_1 \vee \underline{\neg x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{\neg x_4})$$

```
Watch lists:
                                    Activities
                                    (increment=1):
        X_1:
      \neg x_1:
                                           x_1 = 0
       x_2: c_1, c_2
                                           x_2 = 0
      \neg x_2: c_3
                                           x_3 0
       X3: C4
                                           X4
                                                0
      \neg x_3:
       x_4: c_1, c_3
      \neg x_4: c_2, c_4
```

```
ctivities Trail:

ncrement=1):

x_1 \quad 0
x_2 \quad 0
x_3 \quad 0
x_4 \quad 0

DL1: \neg x_1 : \text{NULL}
DL2: \neg x_2 : \text{NULL}
```

Propagate $\neg x_2$ in

$$c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{\neg x_4}) \wedge c_3: (x_1 \vee \underline{\neg x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{\neg x_4})$$

```
Watch lists:
                                    Activities
                                    (increment=1):
        X_1:
       \neg x_1:
                                           x_1 0
        x_2: c_1, c_2
                                           x_2 = 0
      \neg x_2: c_3
                                           x_3 0
       X3 : C4
                                           X4
                                                0
      \neg x_3:
       x_4: c_1, c_3
      \neg x_4: c_2, c_4
```

```
Trail:

DL1: \neg x_1: NULL

DL2: \neg x_2: NULL
```

$$c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{\neg x_4}) \wedge c_3: (x_1 \vee \underline{\neg x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{\neg x_4})$$

```
Watch lists:
                                                         Trail:
                                    Activities
                                    (increment=1):
                                                              DL1: \neg x_1: NULL
        x_1:
                                                              DL2: \neg x_2: NULL
       \neg x_1:
                                           x_1 0
        x_2: c_1, c_2
                                           x_2 = 0
      \neg x_2: c_3
                                           x_3 0
       X_3: C_4
                                                0
                                           XΔ
      \neg x_3:
        x_4: c_1, c_3
      \neg x_4: c_2, c_4
 Propagate \neg x_2 in c_1:(x_1\vee x_2\vee x_4)
```

$$c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{\neg x_4}) \wedge c_3: (x_1 \vee \underline{\neg x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{\neg x_4})$$

```
Watch lists:
                                                           Trail:
                                      Activities
                                      (increment=1):
                                                                DL1: \neg x_1: NULL
        X_1:
                                                                DL2: \neg x_2: NULL
       \neg x_1:
                                             x_1 0
        x_2: c_1, c_2
                                                                             X_4 : C_1
                                            x_2 0
       \neg x_2: c_3
                                             x_3 0
       X_3: C_4
                                            X_4
                                                  0
       \neg x_3:
        x_4: c_1, c_3
       \neg x_4: c_2, c_4
 Propagate \neg x_2 in c_1: (x_1 \lor x_2 \lor x_4) \to \mathsf{Assign}\ x_4
```

$$c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{\neg x_4}) \wedge c_3: (x_1 \vee \underline{\neg x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{\neg x_4})$$

```
Watch lists:
                                                         Trail:
                                     Activities
                                     (increment=1):
                                                               DL1: \neg x_1: NULL
        x_1:
                                                               DL2: \neg x_2: NULL
       \neg x_1:
                                           x_1 0
                                                                         X4:C_1
        x_2: c_1, c_2
                                           x_2 = 0
       \neg x_2: c_3
                                           x_3 0
       X_3: C_4
                                                0
                                           X_4
       \neg x_3:
        x_4: c_1, c_3
       \neg x_4: c_2, c_4
 Propagate \neg x_2 in c_2: (x_2 \vee \neg x_4)
```

$$c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{\neg x_4}) \wedge c_3: (x_1 \vee \underline{\neg x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{\neg x_4})$$

```
Watch lists:
                                                             Trail:
                                       Activities
                                       (increment=1):
                                                                   DL1: \neg x_1: NULL
         x_1:
                                                                   DL2: \neg x_2: NULL
       \neg x_1:
                                              x_1 0
                                                                             X4:C_1
        x_2: c_1, c_2
                                              x_2 = 0
       \neg x_2: c_3
                                              x_3 0
        X_3: C_4
                                              X_4
                                                   0
       \neg x_3:
        x_4: c_1, c_3
       \neg x_4: c_2, c_4
 Propagate \neg x_2 in c_2: (x_2 \vee \neg x_4) \rightarrow \text{$\not$$conflict!}
```

$$c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{\neg x_4}) \wedge c_3: (x_1 \vee \underline{\neg x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{\neg x_4})$$

```
Watch lists:
                                    Activities
                                                         Trail:
                                    (increment=1):
                                                              DL1: \neg x_1: NULL
        x_1:
                                                              DL2: \neg x_2: NULL
       \neg x_1:
                                           x_1 0
       x_2: c_1, c_2
                                                                        x_4 : c_1
                                           x_2 = 0
      \neg x_2: c_3
                                           x_3 0
       X_3: C_4
                                                0
                                           XΔ
      \neg x_3:
        X_4: C_1, C_3
      \neg x_4: c_2, c_4
 Conflict resolution:
```

$$c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{\neg x_4}) \wedge c_3: (x_1 \vee \underline{\neg x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{\neg x_4})$$

```
Watch lists:
                                           Activities
                                                                    Trail:
                                           (increment=1):
                                                                          DL1: \neg x_1: NULL
          X_1:
                                                                          DL2: \neg x_2: NULL
        \neg x_1:
                                                   x_1 0
         x_2: c_1, c_2
                                                                                      X_4 : C_1
                                                   x_2 = 0
        \neg x_2: c_3
                                                   x<sub>3</sub> 0
         X3: C4
                                                   X4
                                                         0
        \neg x_3:
         X_4: C_1, C_3
        \neg x_4: c_2, c_4
 Conflict resolution: \frac{(x_2 \vee \neg x_4) \quad (x_1 \vee x_2 \vee x_4)}{(x_1 \vee x_2)}
```

$$c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{-x_4}) \wedge c_3: (x_1 \vee \underline{-x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{-x_4}) \wedge c_5: (x_1 \vee x_2)$$

Watch lists:

$$x_1 : c_5$$

 $\neg x_1 : x_2 : c_1, c_2, c_5$

$$\neg x_2$$
: c_1, c_2, c_1

$$X_3$$
: C_4

$$\neg x_3$$
:

$$x_4: c_1, c_3$$

$$\neg x_4$$
: c_2, c_4

Add conflict clause

Activities (increment=1):

$$x_1$$
 1 x_2 1

$$x_3$$
 0

 x_4 1

Trail:

DL1: $\neg x_1$: NULL DL2: $\neg x_2$: NULL

 $X_4 : C_1$

```
c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{\neg x_4}) \wedge c_3: (x_1 \vee \underline{\neg x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{\neg x_4}) \wedge c_5: (x_1 \vee x_2)
```

```
Watch lists:
```

```
x_1: c_5
\neg x_1:
x_2: c_1, c_2, c_5
\neg x_2: c_3
x_3: c_4
\neg x_3:
```

Activities Trail: (increment=1): $\begin{bmatrix} x_1 & 1 \\ x_2 & 1 \end{bmatrix}$

 x_3 0

 x_4 1

DL1: $\neg x_1$: NULL

Backtrack to DL1

```
c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{-x_4}) \wedge c_3: (x_1 \vee \underline{-x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{-x_4}) \wedge c_5: (\underline{x_1} \vee \underline{x_2})
```

```
Watch lists:
```

```
X_1: c_5
\neg X_1:
X_2: c_1, c_2, c_5
\neg X_2: c_3
X_3: c_4
\neg X_3:
X_4: c_1, c_3
\neg X_4: c_2, c_4
```

Assign x_2 at DL1 by c_5

```
Activities (increment=1):  x_1 \quad 1 
 x_2 \quad 1 
 x_3 \quad 0 
 x_4 \quad 1
```

```
Trail: DL1: \neg x_1 : NULLx_2 : c_5
```

$$c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{-x_4}) \wedge c_3: (x_1 \vee \underline{-x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{-x_4}) \wedge c_5: (x_1 \vee x_2)$$

```
Watch lists:
```

```
X_1: C_5
\neg X_1:
X_2: C_1, C_2, C_5
\neg X_2: C_3
X_3: C_4
\neg X_3:
```

 $\neg x_4$: c_2, c_4 Propagate x_2 in

 $X_4: C_1, C_3$

```
Activities (increment=1):
```

 x_1 1 x_2 1

 $x_3 0 x_4 1$

Trail:

DL1: $\neg x_1 : \mathsf{NULL}$

 $x_2 : c_5$

```
c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{-x_4}) \wedge c_3: (x_1 \vee \underline{-x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{-x_4}) \wedge c_5: (x_1 \vee x_2)
```

```
Watch lists:
                                                            Trail:
                                      Activities
                                      (increment=1):
                                                                 DL1: \neg x_1: NULL
         X_1: C_5
       \neg x_1:
                                                                            X2 : C5
                                             x_1 1
        x_2: c_1, c_2, c_5
                                             x_2 1
       \neg x_2: c_3
                                             x<sub>3</sub> 0
       X_3: C_4
                                             x_4 1
       \neg x_3:
        x_4: c_1, c_3
       \neg x_4: c_2, c_4
 Propagate x_2 in c_3: (x_1 \vee \neg x_2 \vee x_4)
```

```
c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{-x_4}) \wedge c_3: (x_1 \vee \underline{-x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{-x_4}) \wedge c_5: (x_1 \vee x_2)
```

```
Watch lists:
                                       Activities
                                                             Trail:
                                       (increment=1):
                                                                   DL1: \neg x_1: NULL
         X_1: C_5
       \neg x_1:
                                                                              X2 : C5
                                              x_1 1
        x_2: c_1, c_2, c_5
                                                                              X4:C3
                                              x_2 1
       \neg x_2: c_3
                                              x<sub>3</sub> 0
        X_3: C_4
                                              x_4 1
       \neg x_3:
        x_4: c_1, c_3
       \neg x_4: c_2, c_4
 Propagate x_2 in c_3: (x_1 \vee \neg x_2 \vee x_4) \rightarrow \text{Assign } x_4
```

$$c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{-x_4}) \wedge c_3: (x_1 \vee \underline{-x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{-x_4}) \wedge c_5: (x_1 \vee x_2)$$

Watch lists:

$$x_1$$
: c_5 $\neg x_1$:

$$x_2: c_1, c_2, c_5$$

$$\neg x_2$$
: c_3

$$\neg x_3$$
:

$$x_4: c_1, c_3$$

$$\neg x_4$$
: c_2, c_4

Propagate x_4 in

Activities (increment=1): $x_1 \quad 1$ $x_2 \quad 1$

DL1: $\neg x_1 : \text{NULL}$

*x*₂ : *c*₅

 $1 X_4 : c_3$

Trail:

*x*₃ 0

 x_4 1

```
c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{-x_4}) \wedge c_3: (x_1 \vee \underline{-x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{-x_4}) \wedge c_5: (x_1 \vee x_2)
```

```
Watch lists:
                                                          Trail:
                                     Activities
                                     (increment=1):
                                                                DL1: \neg x_1: NULL
        X_1: C_5
       \neg x_1:
                                                                          X2 : C5
                                            x_1 1
        x_2: c_1, c_2, c_5
                                                                          X4 : C3
                                            x_2 1
       \neg x_2: c_3
                                            x<sub>3</sub> 0
       X_3: C_4
                                            x_4 1
       \neg x_3:
        x_4: c_1, c_3
       \neg x_4: c_2, c_4
 Propagate x_4 in c_2:(x_2\vee \neg x_4)
```

```
c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{-x_4}) \wedge c_3: (x_1 \vee \underline{-x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{-x_4}) \wedge c_5: (x_1 \vee x_2)
```

```
Watch lists:
                                                          Trail:
                                     Activities
                                     (increment=1):
                                                               DL1: \neg x_1: NULL
        X_1: C_5
       \neg x_1:
                                                                         X2 : C5
                                            x_1 1
        x_2: c_1, c_2, c_5
                                                                         X4 : C3
                                           x_2 1
       \neg x_2: c_3
                                           x<sub>3</sub> 0
       X_3: C_4
                                           x_4 1
       \neg x_3:
        x_4: c_1, c_3
       \neg x_4: c_2, c_4
 Propagate x_4 in c_2:(x_2\vee \neg x_4)\to O.K.
```

```
c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{-x_4}) \wedge c_3: (x_1 \vee \underline{-x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{-x_4}) \wedge c_5: (x_1 \vee x_2)
```

```
Watch lists:
                                                          Trail:
                                     Activities
                                     (increment=1):
                                                               DL1: \neg x_1: NULL
        X_1: C_5
       \neg x_1:
                                                                         X2 : C5
                                            x_1 1
        x_2: c_1, c_2, c_5
                                                                          X4 : C3
                                            x_2 1
       \neg x_2: c_3
                                            x<sub>3</sub> 0
       X_3: C_4
                                            x_4 1
       \neg x_3:
        x_4: c_1, c_3
       \neg x_4: c_2, c_4
 Propagate x_4 in c_4:(x_3\vee \neg x_4)
```

```
c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{-x_4}) \wedge c_3: (x_1 \vee \underline{-x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{-x_4}) \wedge c_5: (x_1 \vee x_2)
```

```
Watch lists:
                                      Activities
                                                            Trail:
                                      (increment=1):
                                                                 DL1: \neg x_1: NULL
         X_1: C_5
       \neg x_1:
                                                                           X2 : C5
                                             x_1 1
        x_2: c_1, c_2, c_5
                                                                           X4:C3
                                             x_2 1
       \neg x_2: c_3
                                                                           X_3: C_4
                                             x_3 0
        X_3: C_4
                                             x_4 1
       \neg x_3:
        x_4: c_1, c_3
       \neg x_4: c_2, c_4
 Propagate x_4 in c_4: (x_3 \vee \neg x_4) \rightarrow \mathsf{Assign}\ x_3
```

$$c_1: (x_1 \vee \underline{x_2} \vee \underline{x_4}) \wedge c_2: (\underline{x_2} \vee \underline{\neg x_4}) \wedge c_3: (x_1 \vee \underline{\neg x_2} \vee \underline{x_4}) \wedge c_4: (\underline{x_3} \vee \underline{\neg x_4}) \wedge c_5: (x_1 \vee x_2)$$

```
Watch lists:
```

$$x_1: c_5$$

 $\neg x_1:$
 $x_2: c_1, c_2, c_5$
 $\neg x_2: c_3$
 $x_3: c_4$
 $\neg x_3:$

 $X_4: C_1, C_3$ $\neg x_4$: c_2 ,

 \rightarrow SAT

```
Activities
                   Trail:
(increment=1):
                        DL1: \neg x_1: NULL
                                 X_2 : C_5
      x_1 1
                                 X_4 : C_3
      x_2 1
                                 X3 : C4
      x_3 0
      x_4 1
```