

Exercise 4 (Problem 1)

Consider the set consisting of the following clauses:

$$\neg p_0 \vee \neg p_1 \vee \neg p_2, \quad p_0 \vee \neg p_2, \quad \neg p_0 \vee p_1, \quad p_1 \vee p_2, \quad \neg p_0 \vee \neg p_1 \vee p_2.$$

Show how GSAT can find a model of this set starting with the initial random interpretation $\{p_0 \mapsto 1, p_1 \mapsto 0, p_2 \mapsto 1\}$.

Solution

1		0		1
$\neg p_0$	\vee	$\neg p_1$	\vee	$\neg p_2$
p_0			\vee	$\neg p_2$
$\neg p_0$	\vee	p_1		
		p_1	\vee	p_2
$\neg p_0$	\vee	$\neg p_1$	\vee	p_2

flip no.	interpretation			satisfied clauses			candidates for flipping	flipped atom
	p_0	p_1	p_2	p_0	p_1	p_2		
1	1	0	1	4	4	4	$\neg p_0, p_1, p_2$	p_1
2	1	1	1	3	4	4	$\neg p_0, p_1, p_2$	p_1
3	1	0	0	4	3	4	$\neg p_0, p_2$	p_2
4	0	1	0	3	3	4	p_0, p_2	p_0

Solution

	1		0		1
	$\neg p_0$	∨	$\neg p_1$	∨	$\neg p_2$
	p_0			∨	$\neg p_2$
	$\neg p_0$	∨	p_1		
			∨	∨	p_2
	$\neg p_0$	∨	$\neg p_1$	∨	p_2

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	p_0	p_1	p_2		p_0	p_1	p_2		
1	1	0	1	4	4	4	4	p_0, p_1, p_2	p_1
2	1	1	1	4	4	4	4	p_0, p_1, p_2	p_2
3	1	1	0	4	5	3	4	p_0	p_0
	0	1	0	5					

Solution

	1		0		1
	$\neg p_0$	∨	$\neg p_1$	∨	$\neg p_2$
	p_0			∨	$\neg p_2$
	$\neg p_0$	∨	p_1		
			∨		p_2
	$\neg p_0$	∨	$\neg p_1$	∨	p_2

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3	1	1	0	4	5	3	4	p_0	p_0
	0	1	0	5					

Solution

$$\begin{array}{c}
 \begin{array}{c} 1 \\ \hline \neg p_0 \vee \neg p_1 \vee \neg p_2 \\ p_0 \vee \neg p_2 \\ \neg p_0 \vee p_1 \\ p_1 \vee p_2 \\ \neg p_0 \vee \neg p_1 \vee p_2 \end{array}
 \end{array}$$

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	0	1	0	5					

Solution

$$\begin{array}{c}
 \begin{array}{ccc}
 1 & & 1 & & 1 \\
 \hline
 \neg p_0 & \vee & \neg p_1 & \vee & \neg p_2 \\
 p_0 & & & \vee & \neg p_2 \\
 \neg p_0 & \vee & p_1 & & \\
 & & p_1 & \vee & p_2 \\
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Solution

$$\begin{array}{c}
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 1 & & 1 & & 1 \\
 \hline
 \neg p_0 & \vee & \neg p_1 & \vee & \neg p_2 \\
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3	1	1	0	4	5	3	4	p_0	p_0
	0	1	0	5					

Solution

$$\begin{array}{r}
 \begin{array}{ccc}
 1 & & 1 & & 0 \\
 \hline
 \neg p_0 & \vee & \neg p_1 & \vee & \neg p_2 \\
 p_0 & & & \vee & \neg p_2 \\
 \neg p_0 & \vee & p_1 & & \\
 & & p_1 & \vee & p_2 \\
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Solution

1	∨	1	∨	0
$\neg p_0$	∨	$\neg p_1$	∨	$\neg p_2$
p_0			∨	$\neg p_2$
$\neg p_0$	∨	p_1		
		p_1	∨	p_2
$\neg p_0$	∨	$\neg p_1$	∨	p_2

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p_0			∨	$\neg p_2$
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	0	1	0	5					

Solution

0	\vee	1	\vee	0
$\neg p_0$	\vee	$\neg p_1$	\vee	$\neg p_2$
p_0			\vee	$\neg p_2$
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Solution

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$\neg p_0$	∨	$\neg p_1$	∨	$\neg p_2$	
p_0				∨	$\neg p_2$
$\neg p_0$	∨	p_1			
		p_1	∨	p_2	
$\neg p_0$	∨	$\neg p_1$	∨	p_2	

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Typical errors

- ▶ The most common mistake is an incorrect calculation of the number of satisfied clauses.
- ▶ After flipping a variable, this variable is not put as a candidate again at the next step, even if it satisfies the maximal number of clauses.
- ▶ Flipping a variable that does not give the maximal number of satisfied clauses.
- ▶ Some answers mix GSAT with WSAT (even have steps both from GSAT and WSAT).

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