AI Problem Set 2

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1. Solution:

2. Solution:

a. $C \Rightarrow (A \Leftrightarrow E)$

Step 1: $C \Rightarrow (A \Rightarrow E \wedge E \Rightarrow A)$

Step 2: $\neg C \vee ((\neg A \vee E) \wedge (\neg E \vee A))$

Step 3: $(\neg C \vee \neg A \vee E) \wedge (\neg C \vee \neg E \vee A)$

Step 4: $\{\neg C \vee \neg A \vee E,\ \neg C \vee \neg E \vee A\}$

b. $(\neg C \vee E) \Rightarrow B$

Step 1: $\neg(\neg C \vee E) \vee B$

Step 2: $(C \wedge \neg E) \vee B$

Step 3: $(C \vee B) \wedge (\neg E \vee B)$

Step 4: $\{C \vee B,\ \neg E \vee B\}$

c. $D \Rightarrow \neg B$

Step 1: $\neg D \vee \neg B$

Step 2; $\{\neg D \vee \neg B\}$

d. $(A \wedge D) \Rightarrow \neg E$

Step 1: $\neg(A \wedge D) \vee \neg E$

Step 2: $\neg A \vee \neg D \vee \neg E$

Step 3: $\{\neg A \vee \neg D \vee \neg E\}$

e. $C \vee D \vee E$

Step 1: $\{C \vee D \vee E\}$

f. $E \Rightarrow D$

Step 1: $\neg E \vee D$

Step 2: $\{\neg E \vee D\}$

3. Solution:

Set $S_0 = \{\neg C \vee \neg A \vee E, \neg C \vee \neg E \vee A,\ C \vee B, \neg E \vee B,\ \neg D \vee \neg B,\ \neg A \vee \neg D \vee \neg E,\ C \vee D \vee E,\ \neg E \vee D\}$

Step 1:

Initial Value V_0 : All atoms Unbounded.

Step 2:

Try $V[A] = True$, V_1 is the valuation $V_1[A] = True$

$Propagate(A, S_0, V_1)$

New clauses set $S_1 = \{\neg C \vee E,\ C \vee B,\ \neg E \vee B,\ \neg D \vee \neg B,\ \neg D \vee \neg E,\ C \vee D \vee E,\ \neg E \vee D\}$

Step 3:

Try $V[B] = True$, V_2 is the valuation $V_2[A] = True,\ V_2[B] = True$

$Propagate(B, S_1, V_2)$

New clauses set $S_2 = \{\neg C \vee E,\ \neg D,\ \neg D \vee \neg E,\ C \vee D \vee E,\ \neg E \vee D\}$

Step 4:

$\neg D$ is the singleton clause in the causes set. Set $V[D] = False$.

V_3 is the valuation: $V_3[A] = True,\ V_3[B] = True,\ V_3[D] = False$

New clauses set $S_3 = \{\neg C \vee E,\ C \vee E,\ \neg E\}$

Step 5:

$\neg E$ is the singleton clause in the causes set. Set $V[E] = False$.

V_4 is the valuation: $V_4[A] = True,\ V_4[B] = True,\ V_4[D] = False,\ V_4[E] = False$

New clauses set $S_4 = \{\neg C,\ C\}$

Step 6:

$\neg C$ is the singleton clause in the causes set. Set $V[C] = False$.

V_5 is the valuation: $V_5[A] = True,\ V_5[B] = True,\ V_5[D] = False,\ V_5[E] = False,\ V_5[C] = False$

New clauses set $S_5 = \{C\}$

The remaining clause in the set is $False$, thus return NIL and go back to Step 3.

Step 7:

Try $V[B] = False$, V_6 is the valuation $V_6[A] = True,\ V_6[B] = False$

$Propagate(B, S_1, V_6)$

New clauses set $S_6 = \{\neg C \vee E,\ C,\ \neg E,\ \neg D \vee \neg E,\ C \vee D \vee E,\ \neg E \vee D\}$

Step 8:

$\neg C$ is the singleton clause in the causes set. Set $V[C] = True$.

V_7 is the valuation: $V_7[A] = True,\ V_7[B] = False,\ V_7[C] = True$

New clauses set $S_7 = \{E,\ \neg E,\ \neg D \vee \neg E,\ \neg E \vee D\}$

Step 9:

E is the singleton clause in the causes set. Set $V[E] = True$.

V_8 is the valuation: $V_8[A] = True,\ V_8[B] = False,\ V_8[C] = True,\ V_8[E] = True$

New clauses set $S_8 = \{\neg E,\ \neg D,\ D\}$

The remaining clause $\neg E$ in the set is $False$, thus return NIL and go back to Step 2

Step 10:

Try $V[A] = False$, V_9 is the valuation $V_9[A] = False$

$Propagate(A, S_0, V_9)$

New clauses set $S_9 = \{\neg C \vee \neg E,\ C \vee B,\ \neg E \vee B,\ \neg D \vee \neg B,\ C \vee D \vee E,\ \neg E \vee D\}$

Step 11:

Try $V[B] = True$, V_{10} is the valuation $V_{10}[A] = False,\ V_{10}[B] = True$

$Propagate(B, S_9, V_{10})$

New clauses set $S_{10} = \{\neg C \vee \neg E,\ \neg D,\ C \vee D \vee E,\ \neg E \vee D\}$

Step 12:

$\neg D$ is the singleton clause in the causes set. Set $V[D] = False$.

V_{11} is the valuation: $V_{11}[A] = False,\ V_{11}[B] = True,\ V_{11}[D] = False$

New clauses set $S_{11} = \{\neg C \vee \neg E,\ C \vee E,\ \neg E\}$

Step 13:

$\neg E$ is the singleton clause in the causes set. Set $V[E] = False$.

V_{12} is the valuation: $V_{12}[A] = False,\ V_{12}[B] = True,\ V_{12}[D] = False,\ V_{12}[E] = False$

New clauses set $S_{12} = \{C\}$

Step 14:

C is the singleton clause in the causes set. Set $V[C] = True$.

V_{13} is the valuation: $V_{13}[A] = False,\ V_{13}[B] = True,\ V_{13}[D] = False,\ V_{13}[E] = False,\ V_{13}[C] = True$

New clauses set is empty, return V_{13} to the top level.