

LU-8 : Individual Assignment : DPLL

Sayed Begam Mohamed Ikbal

12 December 2024.

$$a) \phi_1 = (\neg A \vee \neg C \vee \neg D) \wedge (A \vee B \vee \neg C \vee \neg D) \wedge (\neg A \vee \neg E) \wedge (\neg C) \wedge (A \vee D) \wedge (A \vee C \vee E) \wedge (D \vee E)$$

1) Unit clause

$$C = 0 \quad (C = \text{False})$$

$$\phi_1 = (\neg A \vee \neg D) \wedge (A \vee B \vee \neg D) \wedge (\neg A \vee \neg E) \wedge (A \vee D) \wedge (A \vee E) \wedge (D \vee E)$$

2) Pure literal

$$B = 1 \quad (B = \text{True})$$

$$\phi_1 = (\neg A \vee \neg D) \wedge (\neg A \vee \neg E) \wedge (A \vee D) \wedge (A \vee E) \wedge (D \vee E)$$

$$(A \vee B \vee \neg D) = \text{satisfied.}$$

3) Splitting rule :

$$A = 1 \quad (A = \text{True})$$

$$\phi_1 = (D \vee E)$$

$$\begin{array}{lcl} (\neg A \vee \neg D) & = & \text{satisfied} \\ (\neg A \vee \neg E) & = & \text{satisfied} \\ (A \vee D) & = & \text{satisfied} \\ (A \vee E) & = & \text{satisfied} \end{array}$$

4) Splitting rule:

$$D = 1 \quad (D = \text{True})$$

$$\phi_1 = \{\square\}$$

$$(D \vee E) = \text{satisfied}$$

$$\phi_1 = (\text{empty set})$$

ϕ_1 is satisfied.

Final answer:

$$A = 1 \quad (\text{True})$$

$$B = 1 \quad (\text{True})$$

$$C = 0 \quad (\text{False})$$

$$D = 1 \quad (\text{True})$$

$$E = 0 \quad (\text{False})$$

$$b) \phi_2 = (E \vee A) \wedge (B \vee \neg A \vee C) \wedge (E \vee \neg D) \wedge (B \vee \neg C) \wedge (\neg B \vee D) \wedge (\neg E \vee \neg A \vee \neg D \vee \neg B)$$

1) Unit Clause:

No unit clause in ϕ_2

2) Pure literals:

No pure literals in ϕ_2

3) Splitting rule:

$$A = 1$$

$$\phi_2 = (B \vee C) \wedge (E \vee \neg D) \wedge (B \vee \neg C) \wedge (\neg B \vee D) \wedge (\neg E \vee \neg D \vee \neg B)$$

(EVA) = satisfied ----- (1)

$$B = 1$$

$$\phi_2 = (E \vee \neg D) \wedge (D) \wedge (\neg E \vee \neg D) \quad \text{--- (2)}$$

(BVC) } satisfied.
(BV \neg C)

$$D = 1$$

$$\phi_2 = (E) \wedge (\neg E) \quad \text{--- (3)}$$

= contradicts

D = satisfied

B=1 leads to unsatisfiability

4) Backtracking

$$B = 0 \text{ in equ (1)}$$

$$\phi_2 = (C) \wedge (E \vee \neg D) \wedge (\neg C) \wedge (D) \wedge (\neg E \vee \neg D)$$

$$(C) \wedge (\neg C) = \text{contradicts}$$

$$A = 0$$

$$\phi_2 = E \wedge (B \vee C) \wedge (E \vee \neg D) \wedge (B \vee \neg C) \wedge (\neg B \vee D) \wedge (\neg E \vee \neg D \vee \neg B)$$

$$B = 1$$

$$\phi_2 = E \wedge (E \vee \neg D) \wedge D \wedge (\neg E \vee \neg D)$$

$$\begin{matrix} BVC \\ BV\neg C \end{matrix} \} \text{ satisfied}$$

$$D=1$$

$$\phi_2 = E \wedge E \wedge \neg E = \text{contradicts}$$

5) Backtracking $B=0$.

$$\phi_2 = E \wedge C \wedge (E \vee \neg D) \wedge (\neg C) \wedge (D) \wedge (\neg E \vee \neg D) \\ (C) \wedge (\neg C) = \text{contradicts}.$$

$A=0$; $A=1$ leads to contradiction.

$B=0$; $B=1$ leads to contradiction.

Hence we can't proceed further with variable C or D (alphabetical ordered). This ϕ_2 remains "unsatisfied" due to contradictions.