Hoang Luu

Hw3 1

Friday, October 23, 2020 5:53 PM

S_1 and S_2 is equivilent if $S_1 \leftrightarrow S_2$

Write check KB1 and KB2

true if KB1 <=> KB2

CHECK_EQUIVALENCE(KB1, KB2)

For each statement in KB1:

Check the truth values of that statement.
Check in KB2 to see if there exists a
statement that have the same truth value
as the statement in KB1
if it is not the same:
return false
if no statement in KB2 has the same truth
values as statement in KB1
return false

For each statement in KB2:

Check the truth values of that statement.
Check in KB1 to see if there exists a
statement that have the same truth value
as the statement in KB2
if it is not the same:
return false
if no statement in KB1 has the same truth
values as statement in KB2
return false

Return true

Hoang Luu

```
function check_truth value (state1, state2)
    given 2 statements
    create a truth table for all possible
    out come of both statement
    if all possible out come is the same:
        return true
    return false
```

Hw3 2

Saturday, October 24, 2020 8:50 AM

(2)

(a) $KB \models S1$

Since
S1 is True when KB is true

(b) $\neg KB \not\models \neg S1$

Since
S1 can be true even when
KB is false

Hoang Luu

Hw3 3

Saturday, October 24, 2020 8:51 AM

(3)

A, B, C, D

$A, \neg B, C, D$ = False

$\neg A, \neg B, C, \neg D$ = False

A	B	C	D	
T	T	T	T	T
T	T	T	F	T
T	T	F	T	T
T	T	F	F	T
T	F	T	T	F
T	F	T	F	T
T	F	F	T	T
T	F	F	F	T
F	T	T	T	T
F	T	T	F	T
F	T	F	T	T
F	T	F	F	T
F	F	T	T	T
F	F	T	F	F
F	F	F	T	T
F	F	F	F	T

CNF

$= \neg(A \wedge \neg B \wedge C \wedge D)$

$\wedge \neg(\neg A \wedge \neg B \wedge C \wedge \neg D)$

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

Hoang Luu

Hw3 4

Friday, October 23, 2020 10:07 AM

(4)

$A \rightarrow B$

$B \leftrightarrow C$

$D \rightarrow A$

$E \rightarrow D$

$C \wedge E \rightarrow F$

E

(a) Forward chaining

KB : E

$$\frac{E \quad E \rightarrow D}{D}$$

KB : E D

$$\frac{D \quad D \rightarrow A}{A}$$

KB : E D A

$$\frac{A \quad A \rightarrow B}{B}$$

KB : E D A B

$$\frac{B \quad B \leftrightarrow C}{C}$$

KB : E D A B C

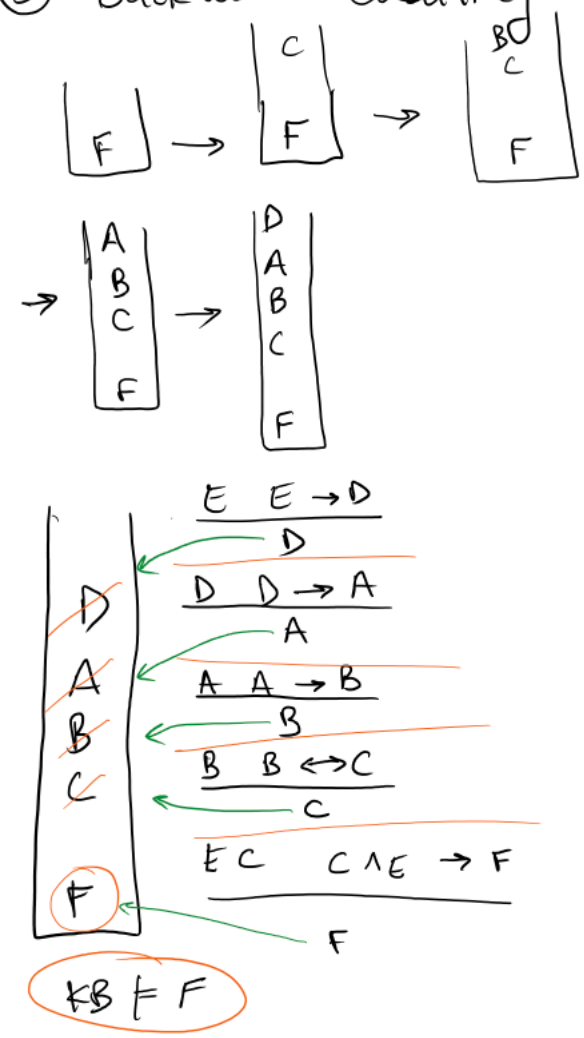
$$\frac{E \; C \quad C \wedge E \rightarrow F}{F}$$

KB : E D A B C F

KB $\models$ F

Hoang Luu

(b) Backward Chaining



Hoang Luu

(C) Resolution

$A \rightarrow B$

$B \leftrightarrow C$

$D \rightarrow A$

$E \rightarrow D$

$C \wedge E \rightarrow F$

E

Converting to CNF

$(A \rightarrow B) \wedge (B \leftrightarrow C) \wedge (D \rightarrow A)$

$\wedge (E \rightarrow D) \wedge [(C \wedge E) \rightarrow F] \wedge E \wedge \neg F$

① Convert bidirectional

$(A \rightarrow B) \wedge [(B \rightarrow C) \wedge (C \rightarrow B)]$

$\wedge (D \rightarrow A) \wedge (E \rightarrow D) \wedge [(C \wedge E) \rightarrow F]$

$\wedge E \wedge \neg F$

② convert implication

$(\neg A \vee B) \wedge [(\neg B \vee C) \wedge (\neg C \vee B)]$

$\wedge (\neg D \vee A) \wedge (\neg E \vee D) \wedge [\neg (C \wedge E) \vee F]$

$\wedge E \wedge \neg F$

③ Apply negation

$(\neg A \vee B) \wedge (\neg B \vee C) \wedge (\neg C \vee B)$

$\wedge (\neg D \vee A) \wedge (\neg E \vee D) \wedge [(\neg C \vee \neg E) \vee F]$

$\wedge E \wedge \neg F$

Hoang Luu

④ Distribute $\wedge$ and $\vee$ and simplify statement

$$(\neg A \vee B) \wedge (\neg B \vee C) \wedge (\neg C \vee B) \wedge (\neg D \vee A) \wedge (\neg E \vee D) \wedge (\neg C \vee \neg E \vee F) \wedge E \wedge \neg F$$

$$\frac{\neg C \vee \neg E \vee F \qquad \neg F}{\neg C \vee \neg E}$$

$$\frac{\neg C \vee \neg E \qquad \neg B \vee C}{\neg E \vee \neg B}$$

$$\frac{\neg E \vee \neg B \qquad E}{\neg B}$$

$$\frac{\neg B \qquad \neg A \vee B}{\neg A}$$

$$\frac{\neg A \qquad \neg D \vee A}{\neg D}$$

$$\frac{\neg D \qquad \neg E \vee D}{\neg E}$$

$$\frac{\neg E \qquad E}{\text{Empty}}$$

$KB \models F$

Hoang Luu

Hw3 5

Friday, October 23, 2020 4:47 PM

(5) John, Mary

if it rains in May, John must give Mary $10000
if John give Mary $10000, Mary must mow Lawn

Constants: John, Mary

Relation:

May(x), is the date x in May?
Rain(x), did it rain on day x?
Money(x,y), did x give y $10000?
Mow(x), did x mow the lawn?

if it rain and the date is in May, then John gives Mary $10000
if Rain(x) ∧ May(x)
then Money(John, Mary)
if John gives Mary $10000, May mow Lawn
if Money(John, Mary)
then Mow(Mary)

(a)

$$(\forall x)\left[\text{Rain}(x) \wedge \text{May}(x) \rightarrow \text{Money}(\text{John}, \text{Mary})\right]$$

$$\text{Money}(\text{John}, \text{Mary}) \rightarrow \text{Mow}(\text{Mary})$$

(b)

$$(\forall x)\left[\neg\text{Rain}(x) \wedge \text{May}(x)\right]$$

$$\text{Money}(\text{John}, \text{Mary}) \rightarrow \text{Mow}(\text{Mary})$$

Hoang Luu

(c)

Rain - Rain(x)

May - May(x)

Mow_Mary - Mow(Mary)

Mow_John - Mow(John)

Money_JJ - Money(John, John)

Money_JM - Money(John, Mary)

Money_MJ - Money(Mary, John)

Money_MM - Money(Mary, Mary)

(d)

Rain ∧ May → Money_JM

Money_JM → Mow_Mary

¬Rain ∧ May

Money_JM → Mow_Mary

(e)

it did not violate the contract

since

Money_JM → Mow_Mary

is true

and Rain ∧ May → Money_JM

is also true

$$\frac{\text{Money\_JM} \qquad \text{Money\_JM} \rightarrow \text{Mow\_Mary}}{\text{Mow\_Mary}}$$

Hoang Luu

Hw3 6

Saturday, October 24, 2020 10:52 AM

(6) Taller(x, John)
Shorter(John, Mary)
{x/Mary}

Taller(x, Mother(x))
Taller(Bob, y)
{x/Bob, y/Mother(x)}
or {x/Bob, y/Mother(Bob)}

Shorter(Bob, Mother(Bob))
Shorter(x, Mother(y))
{y/x, x/Bob} or {x/Bob, y/Bob}

Shorter(Bob, x)
Shorter(John, Mary)
Failed

Taller(x, y)
Taller(Mother(Bob), Bob)
{x/Mother(Bob), y/Bob}
or {x/Mother(y), y/Bob}